Studies in Farmer Decision Making and Innovation

Success Factors in New Land-based Industries

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Contents

List of Tables

Preface

Part of the changing structure of New Zealand agriculture and horticulture includes a move from traditional land uses to new land uses. Not all new land uses, however, become established industries. The research objective of this study was to focus on a wide range of new land-based industries and address the question of why some new industries succeed and why others do not. The research also introduces a relatively new method, the Qualitative Comparative Analysis method, which identifies critical factors in industry success in a way that combines the richness of case studies with the rigour of comparative analysis. Results will be of interest to primary producers seeking to learn from recent experience of new industries, and to policy-makers interested in promoting new land-based industries.

The research for this report began in 1998 with support from Lincoln University's New Development Fund. That support resulted in an internal report entitled "Success factors in New Land-based Industries: Literature Review and the QCA method" (Fairweather, Skoko, and Curtis, 1999). The literature review is included in this final report, as is an updated introduction to the QCA method.

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Summary

Conclusions

- A comparative case study analysis of new land-based industries successfully worked and showed how success was achieved.
- There were common factors and combinations of factors associated with success and non-success.
- Emerging new industries can develop by targeting the attributes of successful industries.
- Government can play an important role in assisting development from loose associations to professional councils.

Background

- There has been growth in new, innovative land uses beyond traditional farming activities since 1984.
- New animal based industries include: deer, goats, salmon, emus, ostriches, alpacas, and llamas. New horticultural crops include: tamarillos, passionfruit, olives, persimmons, walnuts, hazelnuts, and chestnuts.
- Some new land uses have yet to achieve industry levels (for example: sphagnum moss, echanacea, essential oils, medicinal herbs, ginseng, ginger and truffles).
- Our research question was: why do some new industries succeed?

Research Objectives

- To identify key factors in either the success or non-success of new land-based industries.
- To assist emerging new industries in establishing strategies for success.
- To compare industries using the Qualitative Comparative Analysis (QCA) method and assess the method's utility.

Definition of New Land-based Industries

- Products new to New Zealand and /or new to domestic production.
- Includes agriculture, horticulture and aquacultural products.
- Successful industries are those with over 50 producers and over $1.0m in total sales.
- Non-successful industries includes some that may be successful in future.

Method

- 22 land-based industries were selected as case studies, including eight new animal industries, five fruits, five vegetables, and four tree crops, to representative a wide range of new land uses.
- Seven new industries were judged as successful.
- Formal industry organisations and published sources provided case information.
- Industry experts, employees, growers, consultants, and scientists provided key information.

New Industries Studied (shading indicates success)

Alpacas and Llamas	Deer	Goat Meat	Onions	Salmon
Asparagus	Emus	Hazelnuts	Ostriches	Tamarillos
Babaco	Feijoas	Mussels	Passionfruit	Walnuts
Buttercup Squash	Garlic	Olives	Persimmons	Wasabi
Chestnuts	Goat Fibre			

Results

- New industries with a formal industry council (or similar organisation) with extensive functions and interactions with exogenous groups are most likely to succeed.
- New industries with a grower association with limited functions and a low level of co-operation with exogenous groups are least likely to succeed.
- Secondary factors for success include limited initial problems, export markets, extensive initiation of research and development, multiple quality controls, and high current finance of the industry organisation.
- Secondary factors for non-success include an old product source that is only new to New Zealand, limited marketing techniques, low producer input into and satisfaction with industry organisation, limited initiation of research and development, and low current finance.
- Results can by synthesised to show profiles of successful and non-successful new industries (see below).

Profile of a Successful New Industry	**Profile of a Non-Successful New Industry**
Industry Council (or Equivalent) Professional, full-time, paid employees	**Grower Association** Amateur, part-time, unpaid volunteers
With Extensive Functions Undertakes a wide range of functions	**With Limited Functions** Undertakes a narrow range of functions
And Exogenous Interactions Extensively involved with outside groups	**And Low Exogenous Co-operation** Low co-operation with outside groups
Limited Initial Problems	**Old Source, New to New Zealand**
Export Market	**Low Producer Input and Satisfaction**
Multiple Quality Controls	**Limited Marketing Techniques**
Extensive R&D Initiation	**Limited R&D Initiation**
High Current Finance	**Low Current Finance**

Chapter 1
Introduction: Definitions and Research Objectives

New Zealand's land-based industries have changed considerably since 1984. While a certain degree of innovation in New Zealand agriculture and horticulture has always been present, it appears that the level of innovation increased after the reforms introduced in 1984 as primary producers sought to pursue alternatives to the predominant pastoral production. Hence, as sheep and beef numbers declined, deer and other animal numbers increased, while the area in forestry and horticulture also expanded (Fairweather, 1997). Among these land use changes some completely new land uses have arisen, such as raising emus and ostriches, of which a few have become, or are becoming, established as new industries.

The meaning of 'new' in new industry needs some explanation. For the purposes of this study we define 'new industries' as those that involve the production by farmers and growers of something that has not been commercially produced in New Zealand before, and at a scale that involves a number of people, however limited in size. Examples include mohair, blackcurrants, venison, wine, salmon, sphagnum and, more recently, nuts, emus, wasabi, echanacea, ginseng, ginger and truffles. This definition acknowledges that some products may have been produced privately at some time, but not at a level that constitutes a commercial industry - the so-called 'cottage industries'. It also excludes alternative land uses such as farm-based tourism (Fairburn, 1994) or other on-farm businesses (Little and Taylor, 1997).

What is new can also be qualified by acknowledging that a new product in New Zealand may not be new in the world. In many cases a new product is produced elsewhere and the task for developers is to enable it to be produced under New Zealand conditions. Occasionally, a new product may be unique to New Zealand, for example manuka honey for medicinal purposes. Thus a product may be genuinely new, or an 'old' or existing product that is being produced commercially in New Zealand for the first time. Wood et al. (1994) note that newness can also apply to the time of year, new varieties (e.g., stringless celery) and new technology (different ways of producing the same product).

Furthermore, any product, either old or new, may be put to a new use or an old use. For example, sunflower oil (old product) may be used for fuel oil (new use) or, alternatively, jojoba oil (new product) may be used for fine oil (new use). Another dimension relevant to newness is the source of the product. There may be an existing source from which a new product is derived. For example, milk may be used as a source of chemicals. Alternatively, a new source may provide a new or old product, such as a native plant that provides new or existing oils. Table 1 shows a classification of land-based products by source, newness and use to illustrate how new products can be conceptualised.

The table shows that some sources may be used for a number of products and these may be for different uses. For example, deer may provide venison (old use) or velvet (new use to New Zealand), and milk may provide new biopharmaceuticals (new use) or goat milk products (old use). The table also shows that many new industries are based on existing sources and old products used for old purposes, with their newness coming from their newness to New Zealand. There may be some debate whether a product is new or old. For example, New Zealand wine is an age-old product (qua wine) but may also be distinctive to New Zealand and therefore seen as a new product. For our purposes wine is an existing product with an old use.

Table 1: Classification of Selected Land-based Products by Source, Newness and Use

Source	Product	New Use	Old Use
New	**New**	Jojoba oil for fine oil Velvet beans for L-dopa Emu oil for medicinal use Essential oils from native plants Mint oil	Jojoba for sperm whale oil Sphagnum moss for potting mixes Triticale for food Kiwifruit Emu meat or cooking oil Paua for pearls
New	**Old**		Guyale for rubber, Green lipped mussels for food Paua for food
Existing	**New**	Manuka honey as anti-bacteria Pea starch for printer ink Lucerne for feed pellets Milk biopharmaceuticals Blackcurrant beverage Kiwifruit wine Deer velvet for medicinal use Yams for oestrogen	Canola oil for cooking Sunflower oil for diesel engines Milking sheep for cheese Goat milk products Organic sweetcorn for food
Existing	**Old**		Mohair Buttercup Squash Venison Asparagus Wasabi Sweetcorn Salmon Maize for Corn Chips Truffles Wine Grapes Ginseng Blueberries Ginger Sugarbeet

The focus of this study is on products that are new to New Zealand and/or are new to domestic commercial production here. This definition identifies new products that require considerable research to establish how to successfully grow the product and considerable innovation by producers. The definition excludes products that, while new to a farmer or grower, only require modification of an existing production system. Thus, while innovations within an established farming system can be challenging, they are not as challenging as producing something outside the scope of usual production activities. Our definition excludes organic products although a case could be made that organic products, in some cases, are outside the scope of usual production activities.

The term ‘land-based’ is defined to include industries from a variety of sectors. These include agricultural, horticultural and marine industries. We have included two examples from the marine sector (mussels and salmon) because they are similar to the other new industries in that they involve intensive management rather than fishing using vessels of some sort. Alternative terms such as ‘new agricultural industries’ or ‘new crop industries’ are too narrow even though they are widely used in the relevant literature. Hence ‘land-based’ is a broader, umbrella term which includes all of these new industry possibilities.

An industry occurs when there is relatively easy entry for new producers. The new producers do face costs for land and labour but these are not prohibitive. Consequently, there are large numbers of producers rather than a few.

Casual observation of recent changes in primary production shows that some new industries are successful while others are not so successful. There are, of course, different degrees of both ‘success’ and ‘failure’ and we do not wish to characterise any new land-based industries as abject ‘failures’. The fact that a new industry is present is in some way success in itself. Moreover, we do not wish to run the risk of circumventing a possible future revitalisation of an unsuccessful new industry by labelling it a ‘failure’ here. Non-successful industries could perhaps be seen as ‘not yet

successful'. Thus 'success' is best conceptualised as a continuum from less successful to more successful and not as a simple dichotomy of success or failure.

A successful new industry is defined as one that achieves a size sufficient for it to be identified as an industry, with more than about 50 producers. The industry is not just the preserve of a few producers, regardless of the value of their sales, and over time increases in size albeit with occasional setbacks. This definition excludes processor-driven new developments, like organic peas, where growers are contracted to supply product. In these cases, the processor brings larger than usual capital and marketing resources to the new activity, which while it has an industrial nature, is not characteristic of an industry as we have defined it here. The definition also excludes new activities which are dominated by a few key growers, for example capsicum exports, which do not have the character of an industry. In terms of value of sales, we have used an arbitrary limit of approximately $1.0m in annual sales to characterise success. The new industry may sell its product(s) on the domestic market and/or to export markets. Our definition would exclude the salmon industry, which has fewer than 50 producers, but it is included because of the high value of its exports and to give two marine industries.

The main research objective was to identify key factors of success (and non-success) in new land-based industries. This research employs eleven categories of factors to achieve this primary research objective. An important point with regard to this primary research objective is that in analysing 'success' we acknowledge that there is a crucial temporal dimension to new industry success, that is, a new industry's success or non-success is in part a function of its age. It is likely that some degree of success is needed before an industry can mature and develop. Therefore, the key factors identified for success or non-success in fulfilment of this first research objective are *associated* with either outcome, rather than being direct *causes* of success or non-success.

A second research objective was to assess how well the research method employed in this project, that of the Qualitative Comparative Analysis method, works in its application to new land-based industries. The importance of the temporal dimension is also important here, because it qualifies the application of the QCA method, which normally seeks to identify causal relationships rather than associations or correlations between inputs and outcomes. However, QCA remains an appropriate and rigorous method, as shall be demonstrated later in this report.

This report is structured as follows. Chapter 2 reviews literature on success factors in new land-based industries. Chapter 3 provides a detailed account of the Qualitative Comparative Analysis method and describes its application to this study of new land-based industries. Both of these chapters are detailed and play an important part in the research, however readers more interested in the results of this study may omit them and move directly to Chapter 4. That chapter presents the substantive results derived from analysing success and non-success for eleven categories of industry characteristics. Chapter 5 integrates those results and identifies the most relevant key factors. Chapter 6 concludes this report by discussing its implications for theory, policy, and future research.

Chapter 2
Literature on New Land-based Industries: Theoretical Perspectives and Success Factors

2.1 Introduction

This literature review on success factors in new land-based industries is divided into two parts. The first part is an overview of different theoretical perspectives on new land-based industry development. The second part is a selective review of the empirical research that identifies factors accounting for the successful development of new land-based industries. This literature is comprehensive and provides an excellent base from which to identify key success factors. In effect, this review draws on the findings of earlier studies in a number of countries to identify success factors. This chapter concludes with a summary table that lists the key success factors drawn from the literature and ranks these in order of frequency.

2.2 Theoretical Perspectives on New Land-based Industries

The current review of the relevant literature has failed to uncover a body of work that might, at least directly, provide a template for general case studies of success factors in new land-based industries. Specifically, a template that includes a social science approach to success factors is missing. Given this apparent gap in the literature it seems useful to try and extrapolate from what is available. Certainly there is a multitude of case studies from which to draw. Unfortunately, these look mainly at agriculture in the Third World (Freivalds, 1985) or have a focus which is not open to accounting for success factors in terms of industry structures. Within the remaining literature there are two broad approaches: economic and sociological. There is considerable contestability between the logic of these two approaches (Hirsch et al. 1990). The key distinction between them is that of ascribing primacy to either economic rationality or to the workings of social processes.

In our opinion, neither approach by itself is relevant to the complex issues associated with new land-based industries that inevitably involve economic, social, political, and production issues. The following literature illustrates well how complex issues (a system) have been analysed. There is literature that tries to span the divide, however, which at its broadest could be called ‘economic sociology’ (Fligstein, 1996; Granovetter and McGuire, 1998). Granovetter and McGuire (1998), for example, argue that a new industry develops not only out of technical and/or economic factors, but may also be socially constructed by the mobilisation of resources and the existence of social networks. Accordingly, Granovetter and McGuire stress a variety of factors such as a web of friendships, shared experience, social connections, forms of organisation and governance, relations between firms and public authorities, and also the engagement of research centres, and the role of associations, clubs, and journalists in determining the outcomes of new industry development.

Little has been written, however, on new industry success factors within economic sociology. An exception is the ethnic entrepreneurship literature that includes land-based industries in analysing the viability of new industries emerging from, within and supporting ethnic populations (Waldinger et al., 1990). In analysing factors important for the successful development of new industries the literature focuses on both resources and the actor approach. Accordingly, the literature stresses the role of ethnic resources, such as ingrained ethnic knowledge, cultural values, attitudes, religion, shared information, and the social structure along which these resources are mobilised.
While we have identified two broad approaches to the study of new land-based industries, there is a need to focus on specific approaches within these broad approaches because it is at that level that

success factors are discussed or at least can potentially be discussed. These are: (1) Diffusion Theory; (2) Evolutionary Theories; (3) the Commodity System Approach (CSA); (4) a decision matrix approach involving a Production, Marketing and Consumption (PMC) approach; (5) the Farming System Research (FSR) approach; and (6) the Actor Network Theory (ANT) approach. The first two approaches are least relevant to our research objectives. The other approaches all focus on complex systems involved in new land-based industries (see below for a brief account of their problems), but each has a different emphasis. CSA and FSR embrace all aspects of the system but to date have been applied only to established industries. PMC embraces all aspects but tends to be descriptive while ANT goes further and provides a better understanding and interpretation of why a new industry develops. Each approach is now reviewed.

(1) Diffusion Theory. Research by Rogers (1983) on the diffusion of innovation has been of groundbreaking importance to discussions of technology transfer and rapid rural appraisal. Rogers (1983:15) argues that innovation involves the social system, change agents and the nature of the innovation, hence,

> "the characteristics of an innovation, as perceived by the members of a social system, determine its rate of adoption. Five attributes of innovation are (1) relative advantage, (2) compatibility, (3) complexity, (4) trialability, and (5) observability".

The reduction, however, of the success factors in new land-based industries to issues of innovation tends, like all behavioural accounts, to obliterate issues of context and environment. Some issues that can be drawn from the discussion of innovation relate to the assessment of the worth of the 'innovation' to producers, processors and marketers. It must be noted, however, that a method for measuring this type of assessment is unclear. Furthermore, a favourable assessment of, for example, the potential of a new product does not immediately translate into the uptake of that product by producers. What needs to be evaluated is the assessment of the other actors (e.g. financiers, input suppliers) who form the constellation of decision-makers. An extension of the diffusion theory by including context, social relations and the nature itself in the diffusion process has been developed by proponents of the Actor Network Theory (see below).

(2) Evolutionary Theory. Wollin (1997), who developed a new model based on the punctuated-equilibrium theory of discontinuous change, proposes an evolutionary theory approach to the new industry systems. The model draws on four case studies of new rural industries. In explaining success or failures in the development of a new industry, Wollin considers a rather complex and interdependent interplay between the industry system's deep structure (defined by the already accumulated resources and existed power relations between economic actors), the industry system's environment (natural, economic and social environment), and purposeful action of the economic actors (including producers' decisions to introduce innovation and to form cooperative or competitive relations within industry groups).

A high level of abstraction in presenting the model limits an identification of success factors that are in common for the case studies analysed. Factors noted in Wollin (1997:90-91), however, could be proposed as principles in explaining an outcome of new industry development. These are: (1) the prior experience of the producers; (2) the existence of cooperative relations within the industry; (3) the early success of the industry; and (4) its favourable treatment from an external source, such as a government.

(3) Commodity System Approach. The CSA approach emerged in the 1980s (Friedland, 1984) and recognises the complex nature of the production of a given commodity. CSA views agricultural commodity production as a system that incorporates technical and labour inputs, and also articulates

with distribution and marketing systems. There are five major foci that should be included in any Commodity System analysis: (1) the nature of the production process; (2) the economic and social organisation of growers; (3) the use and management of labour; (4) science production and application; and (5) marketing and distribution networks (Friedland, 1984). Friedland illustrates CSA in the case of three commodities: processing tomatoes, iceberg lettuce and grapes. Although CSA primarily refers to existing and developed production systems, its analytic approach and points of focus may be valuable as a conceptual tool for analysing a new industry development. To date, the CSA approach has evidently not been applied to new land-based industries.

(4) Production, Marketing and Consumption Approach. The PMC approach has been used in a series of US Department of Agriculture and other US initiatives on new industries. PMC is a systems approach that examines the critical factors affecting new industry development, and uses a decision matrix approach to problem identification (as reviewed in Wood et al., 1994). Essentially, a decision matrix considers forty components divided into production, marketing and consumption fields. Each component is analysed with respect to its physical possibility, economic feasibility and institutional permissibility (*Ibidem*, p. 12). Constraints of each component to the development of the new industries are further examined by a numeric rating system. Once formed, the matrix can be modified in the course of technical and economic changes. Moreover, the matrix can also be designed for a simultaneous assessment of different new industries.

Jolliff and Snapp (1988) present a brief account of the use of the data matrix in the context of decisions made by producers in Oregon's Willamette Valley in producing meadowfoam. The authors use a modified decision matrix that identifies three sets of resources available to decision makers (producers): (1) production resources; (2) processing and marketing resources; and (3) plant characteristics. Each of these sets of resources is further sub-divided to create categories (e.g. land resources, organisation, processing facilities, product versatility). For each category or row in the matrix there are two columns. These gauge conditions of 'physical presence' and 'economic climate'. Unfortunately the application of these physical and economic aspects and a numerical rating system are not presented in detail.

(5) Farming System Research Approach. Cornish and Kelleher (1997) consider the FSR approach as relevant to an analysis of new industries. Essentially, FSR recognises that development relies on the conjunction between an ecosystem (soil, climate, water, biodiversity) and a human management system (family unit, markets, processing, transport, financial resources). The focus of FSR is the question of how to incorporate new products into existing farming systems and accordingly the models and simulations play a key role in evaluating changes caused by the introduction of new products. No case studies of applying FSR to new industry development however, have been reported.

(6) Actor Network Theory. The ANT approach, as derived from new sociological interpretations of science (Callon, 1991; Kloppenburg, 1991), has been recently introduced into the studies of the development of two new industries, rapeseed (Juska and Busch, 1994) and soybeans (de Sousa and Busch, 1998). The proponents of ANT argue that the introduction of a new land-based industry is best understood as the result of construction of specific networks of people and things. Accordingly, an introduction of a new industry will be effective only if it succeeds in building networks that include both non-human actors such as plants, land resources, roads, port facilities, and human actors such as producers, cooperatives, consumers, processors, extension officers, manufacturers, retailers, scientists and technologists, and government representatives. The analysis of introducing soybean production in Brazil (de Sousa and Busch, 1998), for example, revealed the complex relationships formed by human and non-human actors present in a soybean network. The creation of such networks required the enrolment of scientific agricultural research, the introduction of a new product, credit institutions, state policy, the construction of processing plants, and the development

of new food products. The ANT approach is new, with only these two above case studies in agriculture, but it appears to have potential because of its comprehensive approach.

To summarise, theoretical perspectives on the development of new land-based industries offer different approaches in framing key success factors. Predominantly, these approaches are system oriented, as they focus on the conjunction of factors such as nature and society, the actors and resources. These approaches are typically formulated at a high level of abstraction, however, and also have not always been rigorously assessed by a number of case studies. Thus, this review turns to the empirical analyses of success factors carried out in the context of new land-based industries. Meanwhile, the Production, Marketing, and Consumption approach and Actor Network Theory appear to be the most valuable for examining new land-based industries, because they are both holistic and addressed to new products.

2.3 Empirical Research on Success Factors in New Land-based Industries

This section outlines the findings of the studies and reports relevant to understanding new industry success factors in New Zealand. The section starts with a series of studies on development of new land-based industries in Australia, undertaken by the Rural Industries Research and Development Corporation (RIRDC). This section also reviews the proceedings from international symposiums on new product development (Janick and Simon, 1988; Janick, 1996; Wickens et al. 1989), an Organisation for Economic Co-operation and Development (OECD) report on developing a new industry, and concludes with an overview of the New Zealand literature.

The Rural Industries Research and Development Corporation has taken an intense interest in the development of new rural industries. The RIRDC has published several reports and handbooks for these industries, organised the First Australian New Crops Conference (Imrie et al., 1997), and presented two comprehensive analyses of the case studies identifying the factors considered to be important for successful development of ten new rural industries (Wood et al., 1994; Hyde, 1998).

The report by Wood et al. (1994) is, as Jolliff (1997, p. 8) explicitly notes, “perhaps the most thoughtful, comprehensive, and well-written treatment of new crops development experience available”. This two-volume report analyses the development of 35 new land-based industries since the 1950s. The objective was to identify the factors that contribute to, or constrain, the growth and development of these new industries. Volume One presents empirical analysis of associations between the success of the new industries (measured by current gross value as well as the rate of growth) and the factors viewed as important influences on industry growth and development. The statistical analysis of significance between these associations resulted in a list of five factors considered to have significant negative or positive influences on the success of the new rural industries. Volume Two outlines the case studies and provides a detailed account of factors identified by respondents as crucial to the success or otherwise of new industries.

The main success factors identified by this statistical analysis in Wood et al. (1994) were classified into five groups: production, processing, marketing, government, and research and development factors. The most important factors identified in the case studies were related to production and marketing. Factors relating to processing were not as clearly correlated with success measures as production and marketing factors. There were also relatively few success factors relating to government involvement, other than government contributions to research and development. Production factors significantly associated with success include: (1) use of overseas technology; (2) compatibility of new product with farming system; and (3) developments in pest control. The processing factor (4) ‘establishment of processing facilities’ was the only such factor analysed that was associated with successful industries. Marketing factors identified as significant included: (5) increasing demand relative to supply; (6) market development and promotion; and (7) quality

breakthroughs. Significant government factors included: (8) industry regulations (quality standards and marketing legislation), while the most important among research and development factors was: (9) plant improvement and cultural practice.

The experience accumulated from the RIRDC's involvement in the development of new rural industries was also summarised in an introductory chapter in a handbook on new industries (Hyde, 1998). Drawing upon various reports, Hyde compiled a list of key success factors that have been noted as important in the development of new industries. These include: (1) the industry champion; (2) market focus of the new industries; (3) location in terms of climate, soil, topography and water access; (4) transferable technology; (5) financial resources; (6) *modus operandi* of new industries; and (7) the role of government in fostering new industries through research and development activities and a favourable economic environment. The procedure for selecting key factors, however, was not grounded in a statistical analysis as was provided by Wood et al. (1994), so the importance of the factors relative to each other is unknown.

Also referring to the Australian experience, Hodges (1997) suggests that: (1) the market-led assessment of crop development; (2) the presence of a strong industry champion; (3) an involvement of multi disciplinary research and development teams relying upon; (4) effective government and private collaboration in providing seed funding; and (5) agronomic suitability were of critical importance in developing the poppy and pyrethrum industry in Tasmania. Hodges also recognised, however, that these factors should not be considered in isolation but brought together in a strategic and holistic manner. Similarly, Wood (1982) proposes a systems approach in conceptualising successful new crop development. Wood illustrates that a whole system of production, processing, marketing and consumption had to be developed for a particular new crop, with close coordination and co-operation between the various groups involved in all facets of the new industry.

The RIRDC report that examines why some firms successfully export processed food and beverages (Philp, 1997) is of limited interest. The report focuses on the characteristics of the management of firms that export. Measures of managerial attitudes were subjected to regression analysis to model the main factors of export firms. These factors centred on (1) attitudinal commitment to export; (2) commitment to allocate resources; (3) recognition of importance of price; and (4) the presence of experienced and trained managers. Unfortunately, this study shows 'everything and nothing' about firms. The account is purely internal to the firm (endogenous), while ignoring all contextual (exogenous) aspects. In terms of the typology developed by Coombes et al. (1987) this report belongs to the tradition of neo-classical and behavioural theories. At the same time, the report is clearly conceived as a justification for the activities of the RIRDC; that is, the subtext to all its recommendations is the fostering of research and development programmes.

More important findings from the RIRDC studies were that government and corporate interventions and especially the value of research and development programmes are important success factors. The Centre for International Economics (1994) examines this issue, arguing for government involvement in new industry development, particularly in production, where market failure prevails. The Centre also recognises that the specific role of the government is in the direct funding and the establishment of research and development infrastructure in new industries.

The strong government role as an imperative for the success of new industry development was also anticipated in the proceedings on research, development and economics of new industries, organised by the US Department of Agriculture (USDA) and various academic research centres (Janick and Simon, 1990; Janick, 1996). In general, these US sources consider public funding as necessary for the research and development activities in new industry development and suggest that

the government should have a strong role in the sphere of technology transfer, loans, tax incentives and in supporting extension services.

In addition to justifying the stronger role of the federal government, some USDA proceeding papers also listed factors or constraints considered of importance in the development of a particular new industry. A necessity for political constituency amongst the actors involved in a new industry was emphasised in Felker (1996:110), who quoted a Californian governor as saying, "The problem with new crop development is that you don't have a political constituency". Thus, similar to the associations within the major, conventional farming sectors, subjects/actors within a new industry complex should be organised into a constituency group or a professional association. As the cases of two new industries (cactus and mesquite) show, a constituency group included not only academic and research centres, but also actors from the commercial sectors such as growers, bankers, national brokers, agricultural equipment manufacturers, institutions in charge of pesticide registration and use, food editors, and even chefs promoting the specific products for food. Consequently, such constituency groups or professional associations may become powerful in making their interests known, and can increase the visibility and demand for new products through various channels of market promotion.

Bordelon et al. (1996) introduce the Indiana grape and wine industry as a successful new land-based industry. Key success factors are the co-operation between producers and marketers in developing and promoting the product and educational programmes that focus on commercial growers and winemakers on the one side and potential consumers on the other. Education was considered as crucial because few producers entered this industry with any academic or professional training in grape growing and wine making. Purdue University consolidated such educational programs through workshops, private consultations, and newsletters, tailored for both commercial growers and winemakers. The University also organised "a wine appreciation class" (Bordelon et al. 1996:139) that focused on students as future consumers.

Waters (1990) synthesises experiences of the University of Minnesota in new industry development and lists six success factors including, most importantly, the role of industry champion(s), noting that without leadership, vision and simple persistence from individuals dedicated to a new crop, new industry development is unlikely to be successful. Other secondary factors considered to be important included: (1) the commitment of time by many individuals; (2) industry interest; (3) academic priority; (4) political priority; and (5) financial support.

Selected papers of the international symposium edited by Wickens et al. (1989) on "New Crops for Food and Industry" outlined requirements for successful new crops development as noted world-wide. Muchaili (1989) and von Maydell (1989) review the introduction of tea, fruit, and palm trees as new industries in Africa. Both authors recognise the importance of production systems involved and underline the following factors: (1) available inputs; (2) disease control; (3) legal restrictions to seed or plant import; (4) farmers' experience and knowledge; and (5) compatibility with existing farming systems. Muchaili, however, also stresses inadequate market analyses and the lack of financial resources and proper extension services as the causes of failures in new industry development. The necessity for adequate market systems was also underlined as a requirement for the development of new essential oil, spice and plant extractive industries, as found in many country studies (Green, 1989).

Finally, Lazaroff (1989) makes some observations on new industry development based on the US experience with winged beans. The factors considered critical for the development of new industries include: (1) agronomic and processing requirements; (2) developed marketing structure; (3) extension systems; (4) the successful incorporation of the new crops into the existing farming and

marketing systems; (5) the flow of relevant information; and (6) industry champions who may have substantive role in transferring knowledge and in promoting the new industry.

The Organisation for Economic Co-operation and Development report (OECD, 1989) on developing a new industry reviews factors considered to be essential in the development of aquaculture as an emerging industry in the 1980s. The design of the research, however, was different to the studies discussed above. The latter examines success factors within a multiple industry - one country research design, while the OECD examines 21 countries involved in the development of a single industry. After excluding some technical issues specific to aquaculture (the biological requirements and cultural practice) some of the findings may be relevant to other new industries. Thus, according to the OECD report, three groups of factors may be considered as important in successful development of a new industry. These factors were classified as (1) production; (2) marketing; and (3) administration. Production factors include a range of technical advancements, technology, and disease control, while marketing factors include the size of the markets, trade barriers, and international collaborations in setting standards (quality, labelling, and packaging). Administrative factors and factors stemming from the range of government regulations related to the legal and institutional arrangements (import regulation, disease control, environment issues) were also considered to be of importance.

Finally, within the New Zealand literature items on restructuring are particularly relevant for the development of new land-based industries. The majority of accounts of New Zealand agriculture in the last decade focus on facets of restructuring through reduced intervention in the economy by and a redefined role of the state (e.g., removal of tax incentives, elimination of production and price subsidies, dismantling of producer boards). As such, a literature on 'restructuring' views different rural processing and marketing structures as different forms of organisation. In terms of the debate on the structure of these, Hussey (1992:229-230) designates economic disciplinary forms of knowledge as 'the Coase model'. The more 'sociological' and diffuse approach is designated as 'the political economy model'. This approach recognises the 'political marketplace' (Hussey, 1992:230), and as applied to agricultural marketing issues insists on a social system approach involving the interaction of social units (single producers, local groups, cooperatives, firms).

Hussey (1992) generates an account that favours restructuring and emphasises the minimisation of transaction costs as the rationale for the formation and operation of firms and industries (see also Martin and Zwart, 1986; Savage, 1990; and Sandrey and Reynolds, 1990). From the other side of the divide, Moran et al. (1996) stress the political and institutional elements of agriculture (see also Britton et al., 1992). Neither wing of the restructuring debate, however, deals with the operation of markets and institutions at a low enough level of abstraction to be amenable to the study of success factors. In part, this limitation is because the debate deals with established rather than new industries.

What can be taken from the restructuring debate is the need to contextualize the choices that producers, processors, marketers and other interested parties make in the establishment of a new industry. Furthermore, the interrogation of these issues must be pitched in concrete terms in order to make comparative analysis feasible. Some issues that can be drawn from the restructuring debate relate to the role of government involvement in industry and whether or not innovations are the result of 'market-led' or 'production-push' decision making.

A market-led approach it also emphasised in a series of papers by Douglas (1992; 1993; 1997) that reviews the experience of the New Zealand Institute for Crop & Food Research in the last decade, with particular regard to the development of a variety of new products, such as traditional Japanese vegetables, medicinal and culinary herbs, essential oils, edible fungi, new fruit, nuts and ornamentals. The approach taken within Crop and Food covers: (1) identifying the market

opportunity; (2) producing the marketable product; and (3) servicing the market. The primary task was to identify products with defined international market opportunities, and thereafter to achieve the adaptability and productivity of crops selected. Clearly, the new products programme was built around identifying the demands of the markets in terms of type, quality and services required. Afterwards, Crop and Food's involvement was to establish the feasibility of production, and essentially to conduct research on all aspects of production, processing and post-harvest handling. The aim was to achieve efficient production and high quality products. Once production systems were known the focus was again directed towards supplying and servicing the markets to ensure that the product meets market specifications. Douglas (1997:74) considers that industry development of new crops requires establishment of the whole commercial linkage from growers to exporters, and organisational requirements and integration within an industry are "of equal importance to producing the (product) to market specification". Therefore, sound new industry development is dependent on industry-based groups from every sector to coordinate all areas of operations.

A paper by Wynn-Williams and Logan (1985) is probably the most comprehensive New Zealand study on key success factors in new land-based industries. The authors' empirically analyse problems encountered in the development of 23 arable crops in New Zealand between the 1960s and the 1980s. Their resulting list of factors limiting the development of these new crops include: (1) climatic suitability; (2) agronomic performance; (3) market factors (such as internal or external demand); (4) commercial interest of the growers; and (5) availability of special processing plants. Wynn-Williams and Logan also argue that all these factors, taken together, are required for the successful development of a new crop. These two authors also attempt to isolate single success factors and accordingly consider two commercial factors, market and finance, and three agronomic factors, yield, disease and quality. In these findings they report that agronomic problems such as poor and variable yields (relevant for ten crops) and market factors (relevant for eight crops) appear to be dominant factors limiting expansion of the products examined. In addition, the research notes that the enthusiasm and role of innovative farmers were essential at an early stage of product development. The paper does not, however, cover the methods of assessing each of the case studies or how the conclusions were reached, omissions that weaken those very conclusions.

2.4 Conclusion

The above empirical studies identify different success factors in new land-based industries. These success factors may also be grouped by their frequencies in the studies reviewed. Thus, content analysis of all factors listed in this literature review has been used to produce Table 2. Marketing and production factors, encompassing a variety of agronomic and technological features, occur with high frequency of success factors. In many of the empirical studies, research and development factors were not listed separately, although these were considered as the *sine qua non* condition for the development of new industries. Occurring with medium frequency were government, processing, and industry champion factors. Finally, appearing with a low frequency only were association or industry factors and a number of other factors that are all beyond the industry itself and relate to the context of its operation.

The empirical research also indicates that success factors should be examined holistically and that there are multiple patterns of factors leading towards the success of new industry development. That is, there are no single factors or even group of factors to which the development of new industries can be attributed, and clearly success factors have to be considered in combination with each other. The complex nature of new industry development also indicates that different patterns of successful development may exist in different situations.

Table 2: The Frequency of Success Factors Identified in the Literature

Frequency	Success factors
High (10-13)	Marketing factors Production and agronomic factors
Medium (5-9)	The role of government (other than research and development support) Processing factors; The existence of an industry champion
Low (0-4)	Associations / industry groups Availability of financial resources; Existence of extension services; Education; Flow of information

As a general observation, then, most empirical studies to date would appear to fit under the Production, Marketing, and Consumption (PMC) approach described earlier because marketing and production factors have been consistently highlighted as key success factors. The low frequency success factors do, however, illustrate Actor Network Theory (ANT) approaches that acknowledge a broader system within which the new industry is located. In fact, some of the US research, by emphasising political constituency and the role of professional associations, appears to be ANT research, even if not explicitly couched in such terms. Thus, there are degrees of integration of success factors involved in new industries: PMC approaches integrate many factors but those are largely confined to products and markets and reflect their economic parentage, while ANT approaches consider a broader range of factors and reflect their sociological origins.

Beyond theoretical approaches, this literature review illustrates research design and approaches used to date. Most studies adopt the single or multiple industries within one country design rather than the more demanding one industry in many countries design. The latter approach helps identify factors relating to the industry regardless of the context, while the former approach helps identify factors relevant to a particular country or setting. A major weakness in the above case studies is in their research design. First, many review a small number of cases and little review many cases. The RIRDC study using 35 cases is impressive. Frequently, however, the analysis of key factors is unsystematic and therefore reliant on the researcher to deduce the relevant success factors rather than using a method designed to highlight the causal factors in an independent and rigorous fashion.

This research attempts to move from unsystematic study of success factors to a systematic study by using the Qualitative Comparative Analysis (QCA) method. The application of the QCA method will identify causal factors consistently associated with success and non-success. QCA is essentially a case-oriented approach that identifies the combinations of causal factors (for instance, success factors) across a moderate number of cases (5-30). Accordingly, the method is appropriate for carrying out a multiple case study project. Furthermore, the complex and holistic nature of new industry development, emphasised by the proponents of the PMC approach (Joliff and Snapp, 1988:85), should be amenable to analysis by QCA. The method can provide complex causal explanations by combining various success factors in a systematic way into a comprehensive, deterministic formulation of the causes related to the success of new industries. QCA also embraces a holistic approach in analysing case studies. Thus, in applying QCA to an analysis of new land-based industries, each case should remain contextualised. This means that the impact of each causal or success factor is not taken out of context, but instead depends upon the presence or absence of other causal factors. To put it simply, QCA can potentially unfold the complex patterns of causal variables rather than a simple list of factors.

Chapter 3
Research Methods: Qualitative Comparative Analysis and Application to New Land-based Industries

3.1 Introduction

The literature reviewed in Chapter 3 shows that a variety of methods has been used to study new land-based industries. The methods range from case studies of a few industries or even just one industry through to quantitative studies of many industries. The former provide compelling evidence based on the richness of the data from each case but they tend to emphasise diverse factors and the findings lack generality. The latter provide compelling evidence for new industries as a whole but the results appear to be very general and focus on relatively few variables. Regression analysis in quantitative studies is attractive and can be very useful but it is possible that key variables are unwittingly omitted or that the process of operationalising variables distracts from the subtleties of how key factors lead to success or non success in new land-based industries. There have been no rigorous comparative studies of new land-based industries to date. Such studies are well suited to developing new theories or understandings of success factors and they draw on the richness of case study material but examine a number of cases in order to develop generalisable conclusions. One such approach is the Qualitative Comparative method.

The first section of this chapter outlines the Qualitative Comparative Analysis research method that provides the analytical framework of this project on success factors in new land-based industries in New Zealand. This explanation is necessary because the Qualitative Comparative Analysis (QCA) method is not widely known. The second section provides a reasonably detailed account of the questionnaire design, data gathering, and preliminary analysis phases of this research project. This section also explains the reasoning behind certain research decisions. The third section bridges the preceding data gathering stage and the data presentation of the next chapter by discussing the specific application of the QCA method in this research project. This section also includes notes on the problems encountered in applying the QCA method and the solutions employed to overcome these. The fourth and concluding section of this chapter provides a critique, based on this experience, of the QCA method.

3.2 The Qualitative Comparative Analysis Method

Qualitative Comparative Analysis is a relatively new research method in social science that attempts to bridge the gap between qualitative and quantitative research methods (Ragin 1987, 1989, 1994a; Ragin and Hein 1993; Griffin and Ragin 1994). The method is designed to overcome the limitations of qualitative research techniques that often use only a single case study but without resorting to quantitative research techniques that include multiple cases. QCA attempts to achieve this compromise by treading a middle road between qualitative ‘narrow depth’ and quantitative ‘shallow breadth’ by including holistic information on a moderate number of cases. The QCA method attempts to maintain both the case-oriented approach of qualitative techniques and the variable-oriented approach of quantitative techniques by gathering multi-case information on a wide range of selected variables and transforming this into nominal data using a yes/no or presence/absence binary code dichotomy.

Selecting the variables to be included in a QCA research project is the critical starting point of the method’s implementation and should be guided by the literature on the topic and supplemented by considerable forethought. The literature shows four approaches to the selection of variables. First, a

comprehensive approach includes all the existing theoretical perspectives on the subject at hand (Wickham-Crowley, 1991). Second, a perspective approach would limit the variables included by using only the main theoretical approaches found in the literature (Ragin, 1987). Third, a significance approach includes only those variables that proved significant in already completed statistical analyses (Amenta et al., 1992). Finally, a "second look" approach also includes insignificant variables from previous analyses (Griffin et al., 1991).

The binary data coding step constructs 'data tables' that present each case's combination of yes/presence and no/absence responses, coded '1' on the former and '0' on the latter, to the selected variables. Each case is then given an overall rating, also coded according to the presence (1) or absence (0) of the particular outcome under investigation, in this example the success of new industries in New Zealand. The selected variables used to characterise each case are therefore 'independent variables', while the overall rating for each case is the 'dependent variable'. The binary codes for the independent variables are hereafter referred to as 'input values' and the binary code of the dependent variable is hereafter referred to as the 'output value' (note that the former is plural and the latter is singular).

Regardless of which of the four means of selecting the independent variables described above is used, a general problem still exists of how to code both the input values and output value. Decisions on how to transform the probably substantial information on each independent and dependent variable into binary form is a major requirement of the QCA method, because in doing so some degree of case information detail will undoubtedly be lost. Moreover, the transformation of variables with different types of data measurement into the universal form of binary dichotomies means that some advanced coding procedures have been developed (Ragin, 1994b; Hollingsworth et al., 1996). Very clear criteria, therefore, are needed at this data reduction point of the QCA method in order to determine the actual data coding procedure. This coding system should be explained, where necessary, as part of the detailing of the method implementation in each research project. Thus the QCA method forces the researcher to give serious consideration to the selection of the independent variables and how these will be coded as input values. The researcher is also required to have a sound understanding of the general features of each case included in the comparative analysis before gathering detailed information that responds to each of the independent variables.

The next stage of the QCA method employs Boolean algebraic analysis as the analytical tool to identify critical configurations of input values associated with particular output values. The preparatory step for this operation involves converting the input values on the data tables into algebraic form, whereby each independent variable is given a letter code and presence (1) is signified by the upper case and absence (0) is signified by the lower case. Each case's letter codes for all independent variables are then amalgamated into a Boolean algebraic code comprising as many letters (in either upper or lower case, depending on the presence/absence binary code for each independent variable) as there are independent variables. These initial Boolean codes are known as 'primitive expressions'.

The amalgamation of all the letter codes into a primitive expression uses Boolean multiplication, which "differs substantially from normal multiplication" (Ragin 1987:91). Boolean multiplication represents logical AND, which means that if an output value, S, is associated with the primitive expression 'Abc', then this does not represent A x b x c, but the presence of variable A in combination with the absence of variable b in combination with the absence of variable c. In other words, S occurs when A is present AND b is absent AND c is absent, expressed as S = Abc. In instances where an output value has more than one primitive expression, these are linked by Boolean addition, which represents logical OR. For example, if S also occurs when a is absent, B is

present, c is absent, and D is present, then S will occur with Abc OR aBcD, and its equation of primitive expressions will read S = Abc + aBcD.

An output value's primitive expression(s) are then used to construct a 'truth table', where identical primitive expressions are grouped together and the number of each identical primitive expression is entered alongside. The truth table also records the frequency of the presence and/or absence of each primitive expression's output value. Some groups of primitive expressions may be homogenous in that all cases have the same input values and output value, whereas other groups may be contradictory in that while all cases have the same input values there is difference on output value. These contradictory groups can be dealt with in a number of ways, which are discussed in detail in Section 3.3 below.

Thereafter, the minimal number (i.e., a number smaller than the total number of cases, as a primitive expression that is common to two or more cases is only included once on the truth table) of primitive expressions on the truth table are then subjected to the Boolean algebraic analysis proper. The first step in this analysis is a procedure known as Boolean algebraic minimisation, which involves comparing the input values of primitive expressions that have the same output value. Primitive expressions that differ only on the presence and absence of only one and the same variable (i.e., the upper and lower case of a particular letter code) are simplified by eliminating the corresponding letter code altogether. This omission is justified by Boolean logic, which holds that in such instances the presence or absence of that particular letter code does not affect the output value, and therefore it is irrelevant as a possible cause of that specific outcome. These minimised primitive expressions are known as 'prime implicants', for they contain only those upper or lower case letter codes that cover all critical causal combinations that result in each output value.

The second step of Boolean minimisation is to reduce these prime implicants to 'essential prime implicants'. This reduction is achieved by constructing 'essential prime implicant charts', which include the original primitive expressions and the list of prime implicants. The Boolean logic of this exercise is that two or more primitive expressions may form a subset of the same prime implicant, therefore rendering a second prime implicant unnecessary. This procedure is necessary because the first step of Boolean minimisation does not enable the identification of those prime implicants that form a superset incorporating two or more primitive expressions. In other words, some prime implicants are more important than others, hence the nomenclature of essential prime implicants. The objective of these two steps of Boolean minimisation is to reach a logically minimal number of essential prime implicants that incorporate or 'cover' all the original primitive expressions.

Such parsimony eases the final stage of the Boolean algebraic analysis, which seeks to (a) identify similarities in input values between cases with the same output value and (b) differences in input values between cases with different output values. These similarities and differences will pinpoint the critical independent variables, now referred to as causal conditions, that are associated with a particular output value, in this case the success (or, equally as important, the non-success) of new land-based industries in New Zealand. The QCA method recognises, however, that causal conditions are more likely to operate in combination with others, either their presence or absence, and therefore the impact of a causal condition should be discussed in the context of the presence or absence of other conditions. QCA also allows for the probability that any output value may have more than one essential prime implicant; that is, this method acknowledges that a number of different combinations of independent variables may generate the same dependent variable. Indeed, in advanced studies with large numbers of independent variables the expectation should be of multiple causes of the same effect.

After this last step in the Boolean algebraic analysis all independent variables will fall into one of four categories. The first group includes those independent variables that are not closely associated

with any output value; that is, they are not causal conditions on their own or in any particular combination with other independent variables. These independent variables are known as neither 'necessary', because they are not present in all of an output value's essential prime implicants, nor 'sufficient', because in no output value's essential prime implicant(s) does one independent variable appear by itself. An independent variable is 'necessary', therefore, only if it appears in all of an output value's essential prime implicants, for in no instances without this critical causal condition (in either its presence or absence form) does the dependent variable occur. Alternatively, an independent variable is 'sufficient' if it appears by itself in one of an output value's essential prime implicants. For in such instances this critical causal condition (in either its presence or absence form) is enough to precipitate the dependent variable of its own accord. The fourth and final category includes those independent variables that are both 'necessary' AND 'sufficient', a rare occurrence where just ONE independent variable appears by itself in an output value's ONLY essential prime implicant. Such independent variables are especially critical as causal conditions, for in no other circumstances, either in combination with other independent variables or by other individual independent variables, does that particular output value occur.

This identification of necessary and/or sufficient conditions offers deterministic causal explanations for the presence or absence of a particular output value. It is probable that in sophisticated, multi-variate applications of the QCA method (such as the one that follows here) combinations of critical causal conditions will be prominent, rather than individual independent variables. As a consequence it is likely that all critical causal conditions will be necessary rather than sufficient, nor will they be necessary and sufficient.

Boolean algebraic analysis includes one last minimisation step to simplify, as much as possible, the essential prime implicants of any particular output value. This step is Boolean factoring, which contrary to Boolean multiplication, "does not differ dramatically from standard algebraic factoring" (Ragin 1987:100), and can help to identify necessary conditions and those that are causally equivalent. As Ragin goes on to explain, if $S = AB + AC + AD$, then these essential prime implicants for S can be factored to produce $S = A(B + C + D)$, which shows that A is a necessary condition and B, C, and D are causally equivalent with regard to outcome S. Boolean factoring, therefore, may not necessarily simplify a set of essential prime implicants, but it may ease the identification of necessary causal conditions.

Finally, the QCA method also enables the analysis of the causes of 'absent' or 'negative' output values, which in this research project constitute the non-successful new land-based industries in New Zealand. This identification of critical causal conditions of non-success can be achieved by two means. First, and most in keeping with QCA, is the application of de Morgan's Law to the critical causal conditions resulting from the Boolean algebraic analysis of 'present' or 'positive' output values. In essence this technique simply inverts the presence or absence of critical causal conditions for success to provide a 'mirror image' of critical causal conditions for non-success. Second, it is also possible to analyse critical causal conditions for 'absent' or 'negative' output values in conjunction with the analysis for 'present' or 'positive' output values. This technique treats both 'success' and 'non-success' equally, and looks to the essential prime implicants of the latter for critical causal conditions, rather than merely inverting the results for the former. Again, in complex, diverse variable analyses this second means of determining the critical causal conditions for 'absent' or 'negative' output values appears as though it will yield stronger results of more utility.

The key steps of the Qualitative Comparative Analysis method can be summarised as follows:

1. Select and code independent variables (input values) associated with the dependent variable (output value) to prepare data tables

2. Convert data tables to algebraic form using Boolean codes to generate primitive expressions and then construct the truth tables
3. Analyse the truth tables using Boolean algebraic minimisation to identify prime implicants and then reduce these further to essential prime implicants
4. Examine essential prime implicants to find critical causal conditions and combinations thereof that correlate with a particular output value, identifying either necessary and/or sufficient conditions

This overview of the Qualitative Comparative Analysis method has highlighted the key general points as expressed by Ragin and other authors in the literature. This discussion now moves on to the specific, and examines the application of the QCA method in this particular research project on new land-based industries in New Zealand.

3.3 Application of QCA to New Land-based Industries

In beginning the process of selecting new industries as cases, several broad parameters were identified to guide the sampling. First, it was realised that, according to the literature (Ragin 1987, 1994; Skoko 1999; and Fairweather et al. 1999), the QCA method works best with an intermediate number of cases of between five and thirty. Within this broad range, resource constraints meant that a number in the low to mid-twenties was probably the practical maximum. It was also decided early in the selection process to avoid including too many of the cases covered in a similar project being conducted in the AERU At the same time. As a consequence, new land uses such as avocados, blackcurrants, free-range eggs, capsicum, mandarins, organic meat and organic fresh vegetables were omitted. Some overlap did occur with cut flowers, essential oils, olives, ostriches, persimmons, and truffles included on our initial list. However, cut flowers, essential oils, and truffles were eventually excluded from this study, leaving only the three matching cases of olives, ostriches, and persimmons.

Thus with a target case study number of 25, the selection process was further refined with the recognition that a range of new products was desirable so as not to skew the results to any one particular type of new product. The QCA method is like qualitative research in general, where diverse theoretical samples are used to ensure that a variety of cases are studied. For this reason, cases were included from ‘fruit’, ‘vegetable’, ‘tree crop’ and ‘animal’ groupings across the new product spectrum.

During the initial investigation into potential cases it emerged that it was possible to make a *prima facie* judgement about the success or otherwise of those new industries encountered. As a consequence it was possible to include a range of success levels of new industries according to this initial perception, again in order to avoid skewing the results towards ‘successful’ or ‘non-successful’ cases. Recognising that this nomenclature was to be an initial perception only, cases were assigned to one of five categories, including ‘glamour’, ‘successful’, ‘struggling’, ‘premature’, and ‘failed’. As noted towards the end of the introduction, however, the success or otherwise of new industries may be dependent, to at least some degree, on their duration of existence. That is, older cases may have been able to establish themselves better than younger cases, and therefore qualify as a successful new industry over others simply on the grounds of age. This selection of older cases may have introduced bias at this stage. Cases of various ages, therefore, were included in the sample, ranging from new industries that began emerging as long ago as the 1960s (e.g., deer) and others that have come into existence only in the 1990s (e.g., olives). The four categories used to describe this variation in age were ‘deceased’, ‘mature’, middle age’, and ‘young’.

With these parameters helping to refine the selection method for cases a final list of 22 new industries was compiled and is presented in Table 3. By new industry type, this list included eight animals, five fruits, four tree crops, and five vegetables. With little variation in the numbers of cases by type, it was decided these did indeed meet the demand for a wide range of different new products. As noted above, the cases were categorised in two additional ways, by success and by age.

On the initial success rating, these 22 new industries were divided into two glamour, five successful, ten struggling, three premature, and two failed industries, as presented in Table 3. Although there is wide variation in the frequency of products by rating, this was not considered an immediate problem, for two reasons. First, this was very much a *prima facie* analysis and specific ratings were recognised as likely, indeed probable, to change as more information was gathered on each case. Second, and as a consequence of the data gathering process, it was recognised that the evaluating criteria would be refined and thus a more sophisticated rating system would be developed. That improved system was indeed developed and used to determine a final success rating which appears in the right hand column of Table 3. The main criterion used here was value of sales with the criterion for success set at higher than $1.0m. Such a stringent success criterion was necessary in order to have some cases of success and some cases of non-success – a necessary requirement for any comparison of success and non-success. A less stringent criterion, such as mere

Table 3: New Land-based Industry Cases by Type and by Age Group, Initial and Final Success Rating

Cases by Type	Age Group	Initial Success Rating	Final Success Rating
New Animal Products (8)			
Alpacas and Llamas	Middle aged	Struggling	Non-successful
Deer	Mature	Glamour	Successful
Emus	Middle aged	Struggling	Non-successful
Goat Meat	Middle aged	Successful	Successful
Goat Fibre	Middle aged	Struggling	Non-successful
Mussels	Mature	Glamour	Successful
Ostriches	Middle aged	Struggling	Non-successful
Salmon	Mature	Failed	Non-successful
New Fruits (5)			
Babaco	Deceased	Failed	Non-successful
Passionfruit	Middle aged	Struggling	Non-successful
Feijoas	Middle aged	Struggling	Non-successful
Persimmons	Middle aged	Successful	Successful
New Tree Crops (4)			
Chestnuts	Young	Struggling	Non-successful
Olives	Young	Struggling	Non-successful
Walnuts	Young	Premature	Non-successful
Hazelnuts	Young	Premature	Non-successful
New Vegetables (5)			
Buttercup Squash	Middle aged	Successful	Successful
Asparagus	Middle aged	Successful	Successful
Garlic	Middle aged	Struggling	Non-successful
Onions	Mature	Successful	Successful
Wasabi	Young	Premature	Non-successful

presence indicating success, would have given no cases of non-success. The research results will reflect this use of a stringent criterion and means that the study focuses on an end point of a high degree of success. Some degree of economic success must have been achieved on the way to the level we have used in our criterion. The use of this stringent criterion means that an emerging new industry may be classified as non-successful even though it is possible that the industry may not yet be successful. Thus some new industries may be partially successful at present.

This table also shows an assessment of industry age, including one deceased, five mature, 12 middle age, and five young cases. This distribution well reflects expectations from the total population of new industries, with limited numbers at both the deceased and young extremes and the highest proportion in the central middle age category. Overall, then, the selected cases presented in Table 4 illustrate a reasonably unbiased sample in terms of the three variables of new industry type, age group, and initial and final success ratings. Thus, this table illustrates the diversity of the sample, and therefore its strength.

Having compiled this final list of 22 new industry cases to be included in this research, the next stage was to formulate a series of variables with which to analyse each new industry. For this process the literature review included in Chapter 2 was used as an initial guide. The review showed an array of potential variables of analytical interest derived from various sources. This tactic reflects the first comprehensive approach of the four literature-derived approaches to variable selection. The variables were then grouped corresponding to stages in the production process. The sequence of categories was from planting, through growing, harvesting, transporting, processing, marketing, and finally to selling. This 'industry timeline' was further expanded after a number of brainstorming sessions that added other important categories, such as industry organisation, financial resources, regulatory framework, and research and development. Within each category, key variables were identified from the literature and further substantiated by these brainstorming sessions. The final result was an 11 category analytical framework incorporating a total of 86 variables. The categories included:

1. Origins and History of Industry
2. Product Characteristics and Environmental Requirements
3. Industry Organisation and Co-operation
4. Production Inputs and Capital Investments
5. Marketing and Market Development
6. Financial Resources
7. Research and Development
8. Government Regulations and Controls
9. Processing and Transport
10. Satisfying the Markets
11. Current and Future Issues.

These 11 categories, with their 86 variables, were then transformed into a questionnaire that would be used as the basis for data collection for each of the 22 cases. For each of these 86 questions a total of 369 'possible responses' were used to assist data evaluation and coding. Of the 86 questions, 57 were mutually exclusive, in that only one possible response was required. The questionnaire included the provision for more responses to be added should – or rather, when – the empirical data produced common themes not thought of in this preparatory phase. Conversely, it was recognised that some of the possible responses would later be omitted, as the empirical data would undoubtedly prove some of these to be irrelevant. With this questionnaire in hand, therefore, the project entered the initial data collection phase.

The first step in the data collection process was to contact obvious industry organisations to request preliminary information that would answer basic questions, for example, on the new product's characteristics, industry structure, organisational membership, marketing, and research and development activities. A considerable amount of very useful information was obtained, in the form of annual reports, industry profiles, and marketing strategy documents. These inquiries also helped extend the 'contact tree' with initial contacts leading to other industry figures - either through direct advice or via the information they supplied. Folders holding all information and contact names and details were established for each of the 22 new industries under initial consideration.

These cases were augmented by material gleaned from industry newspapers, magazines, and serials. For example, *The Deer Farmer*, *The Orchardist*, *New Zealand Farmer*, *Horticulture News*, and *New Zealand Growing Today* and other such sources (see Bibliography for the complete list) all provided valuable information. As these sources tend to focus on the technical details of production, which is beyond the purview of this study, our focus was on articles that discussed broader industry issues. Items on industry structure and organisation, marketing and market development, research and development initiatives, and export sales activities, for example, were found to give a good account of significant events in the emergence (or otherwise) of these new industries. Some industries, of course, were better documented than others, certainly those which were successful enough to support their own publication (e.g., *The Deer Farmer*) were well covered, while there was a paucity of information on the struggling, pre-mature, young or simply non-successful industries (e.g., babaco). This extensive search provided much valuable background information and outlined a timeline of important events in the history of the selected new industries. This preparation was a considerable benefit inasmuch as it provided the field researcher some background knowledge before interviewing industry experts.

From here, the next step was to interview leading growers, industry experts, and industry organisation members and employees to compile the specific, detailed data corresponding to the 11 category, 86 variable questionnaire. A three-stage fieldwork exercise covered a data collection period of two weeks. The first stage was a three-day trip to the Waikato - Bay of Plenty area, followed by another three-day trip to the Nelson - Marlborough region. The third and final phase incorporated a number of interviews in the Canterbury region. This exercise included 22 interviews and covered 19 new industries, with some respondents having knowledge of more than one industry and some industries being covered by more than one interview.

With a substantial amount of empirical information gathered in this initial data collection phase a preliminary analysis was necessary in order to assess the quality of both the questionnaire and the data obtained. With the objective of improving the questionnaire, a 'trial' Qualitative Comparative Analysis of the new industry data was undertaken. This test revealed a number of irrelevant variables that were not present in any of the 15 new industries evaluated at this stage and whose absence did not appear to be significant. These variables were consequently deleted from the questionnaire. Conversely, the initial interviews identified a small number of potentially important variables not included in the questionnaire and these were subsequently added in a revised version.

As a consequence of these subtractions and additions, the questionnaire was reduced by a net total of 16 variables, down from 86 to 70 variables. Through this net deletion of these 16 variables, and the refinement of others, 120 of the original 369 possible responses were also eliminated, thus reducing these to 249. The number of mutually exclusive questions was reduced by 12, from 57 down to 45, but the proportion of such questions remained fairly constant at approximately two-thirds. The result was a refined and therefore much improved questionnaire (see Appendix 1 for this final version).

For the purpose of trialing the Qualitative Comparative Analysis (QCA) method, information from the 15 industries evaluated at this stage was entered into the 'data table' for the first "Origins and History of Industry" category of the questionnaire, and the corresponding 'truth table' was derived. The resulting Boolean codes, or primitive expressions, were then subjected to algebraic analysis, as the next step of the QCA method. The results of this analysis were, unfortunately, less than encouraging, in terms of both identifying success factors and the usefulness of the QCA method. This process was therefore repeated, this time using the primitive expressions of the second category, namely "Product Characteristics and Environmental Requirements". Again, the results of this analysis were disappointing.

At this point, however, it was recognised that it was possible that these weak results were not indicating serious problems with the information and/or the QCA method, but actually a useful 'no-result' result. The hypothesis was that factors of "Origins and History of Industry" and "Product Characteristics and Environmental Requirements" were not critical enough, in their presence, absence, or combinations thereof, to effect the output value – success or otherwise – for each new industry. This line of thought was tested by moving to the seventh questionnaire category, that of "Research and Development", and subjecting this to Boolean algebraic analysis. "Research and Development" was chosen because the impression gained at this point of the research process was that this was a vital category, and therefore should yield stronger results. And this was indeed the case, with "Research and Development" variables providing a much clearer correlation between presence and success on the one hand and absence and non-success on the other. It was therefore recognised that both the information being gathered and the QCA method itself were proving themselves to be satisfactory.

At this preliminary analysis stage it was recognised that two of the 11 categories needed changes to their titles. First, it had become clear by this stage that transport factors were irrelevant, thus category nine was reduced to just "Processing". Similarly, the final category was reduced to just "Current Issues" as it had become clear that future issues, even if they have been identified as posing a threat, clearly did not effect the success or otherwise of the new industries thus far. Therefore, having used the information from the 15 cases evaluated so far to refine both the number of cases and the questionnaire, the research entered a second data collection phase.

A second phase of data collection was deemed necessary to not only cover the seven cases not yet studied, but also to substantiate information gained from the initial interviews and to validate the data gained from them. That is, since an average of only one interview per industry had by this time been conducted, this was a serious limitation on the quality of data collected in phase one. Thus, a second and sometimes third interview was arranged to substantiate and verify information gathered in the first interview. Where possible, this second or third interview was with a person whose role is different from that of the initial interviewee. Thus, interviews for each new industry covered any combination of growers, processors, administrators, marketeers, exporters, and scientists. Some interviewees, of course, fulfil more than one of these roles.

For this second phase of data collection another three-day trip to the Bay of Plenty, Auckland, and Northland was undertaken. This incorporated a further nine interviews and specifically covered eight industries. Two of the interviewees, however, were long-time horticulturalists who have significant experience in new industries as a whole, thus their knowledge was not necessarily specific to any one industry but rather generic to this whole phenomena. Their insights into the broader context of the emergence of new industries in New Zealand, and indeed the factors for success or non-success, were therefore invaluable.

Interviewing knowledgeable people was continued upon the return to Canterbury, with a number of interviews being conducted with scientists in the Lincoln University community. Each scientist has

specific knowledge of a particular new industry but also broad experience of new industries in general. These interviews also proved to be invaluable, as all the scientists concurred with or in their own way expanded our empirical impressions formulated from the preceding data collection activities that were raised with them.

The next step in this second phase of data collection was a series of four interviews in Canterbury, which covered three new industries. The completion of these interviews signified the end of the data collection for the project. The only activities in this vein undertaken after this point were phone calls to interviewees to clarify or augment points from either interview notes or printed primary information sources. Other than these steps to fill 'gaps' in the industry information, the research process now entered the data analysis stage.

3.4 Research Method: Applying Boolean Algebraic Analysis

The first step in the application of the Qualitative Comparative Analysis method is to prepare 'data tables' upon which information from each case study on all independent variables is entered as a binary code, where '0' denotes absence and '1' denotes presence. These data tables are presented in Appendix 2, with the names of the new industries removed in order to protect the confidentiality of some of the information provided by some of the interviewees, as per their requests. Eleven data tables, corresponding to the 11 categories of the questionnaire, were developed and updated in conjunction with changes to that framework, as outlined above. It was decided to keep the data tables as eleven separate entities, rather than amalgamate them into one 'super' data table, for two reasons. First, it was realised that such a 'super' data table would include 70 variables and 249 possible responses, which would be unmanageable as this research project is reliant on manual data processing and does not extend to computer programmes, although such software has been developed by Drass and Ragin (see below). Second, it was also realised that having 11 category data tables would lead to more specific, and therefore more useful, results after the Boolean algebraic analysis. That is, success and non-success factors would be identified more easily and related more specifically to the independent variables included in each of the 11 categories in the questionnaire. From these 11 separate data tables it would be possible to construct an overall picture of success or non-success factors in new land-based industries.

Before then, however, it was necessary to process the information on each new industry and code the data tables using the binary presence or absence system. Thus, a comprehensive review of all information gathered on each new industry - including primary material from industry organisations, printed news media articles, published statistics, and interview responses - was undertaken, which also included cross-verification and/or further clarification where and when required, as noted above. This review was an exacting and time-consuming process as assigning a presence or an absence value for all independent variables is a crucial component of QCA.

During this review process it was recognised that a number of the possible responses required specific criteria to ensure consistency of coding across cases. For example, assessing the 'flow of information' possible response (within the 'industry functions' independent variable) involved consideration of approximately six items. Using a 50 per cent threshold, it was decided that to be coded present on this possible response an industry organisation needed to incorporate at least four of these six items. Industry organisations undertaking less than half of these activities, therefore, were considered to have an insufficient 'flow of information' to be coded present, hence they would be coded absent (see Hollingsworth et al. 1996 for comparable dating coding techniques). Although the possible responses of only nine independent variables were so affected, all are noted with the superscript number '1' and explained throughout the questionnaire included in Appendix 1. This development of coding criteria and its detailing at the appropriate independent variables in the

questionnaire fulfils the requirements of the QCA method noted earlier, that the researcher gives serious consideration to how each independent variable is coded and explains such coding criteria.

An important realisation occurred while preparing the primitive expressions from the data tables. It became evident that another multifaceted process of refinement was possible that would simplify the primitive expressions and the resultant truth tables. The first step of this fine-tuning process was to reduce the dichotomous, mutually exclusive independent variables to just one letter, rather than using two, because in such variables the presence of one response automatically implies the absence of the other response, and vice versa. A second letter code was therefore superfluous, as these variables can be assigned a one-letter code where the upper case represents presence and the lower case represents absence. For example, the 'initial problems' independent variable included the two mutually exclusive possible responses of 'minimal problems' and 'significant problems'. As any response can only be one of these options and not both, a two-letter code is unnecessary. Thus the Boolean code for this variable was reduced to one letter, D, which indicates significant initial problems, while d indicates minimal initial problems. The 20 such dichotomous mutually exclusive variables reduced the total number of possible responses by the same amount. All of these variables are marked with the superscript number '2' in the questionnaire included in Appendix 1.

Another step of this refinement process used an extension of this same logic to reduce mutually exclusive independent variables with three or four possible responses. These variables could also be reduced to a one-letter code because, again, in such variables the presence of one possible response automatically signifies the absence of the others, and so on. Hence, such multi-response variables were also reduced to a one-letter code, using the presence code and omitting the absence codes as a 'preliminary step' prior to the Boolean algebraic analysis. As a consequence, otherwise inconveniently long primitive expressions were further refined to a more manageable level, remembering the constraint of manual data processing on this research project.

Unlike the reduction of dichotomous mutually exclusive independent variables, the reduction of the variables with three or four possible responses had an important implication for the Boolean algebraic minimisation to follow. This effect was reasonably complex, but was dealt with by simply extending the same Boolean logic that governs the elimination of a letter code when the only difference between two primitive expressions is that one contains the present code and the other contains the absent code of that letter. That is, this application now requires that three or four primitive expressions, depending on the number of possible responses for a particular variable, diverge only on that variable AND include all three or four present codes, before those primitive expressions could be reduced according to Boolean minimisation. Thus, instead of comparing just two primitive expressions on the presence and absence of one letter code, this application of Boolean minimisation now compares three or four primitive expressions on the presence of three or four letter codes that relate to the same variable. For example, the 'pest and disease impact' independent variable included three mutually exclusive possible responses, 'minor', 'medium' and 'major'. For the impact of pests and diseases to be eliminated as a critical causal condition, therefore, three primitive expressions had to vary only on this letter code, but include all three present code options, the letters F, G, and H (respective to the three possible responses). This extension of Boolean logic ensures that the minimisation process continues to adhere to the rules of the QCA method, while allowing for such idiosyncrasies of this application of this technique.

A related step of this process of refinement reduced those mutually exclusive independent variables with five or more possible responses into dichotomous variables. This reduction was achieved by merging the multi-responses into two groups and appropriately re-naming these two new categories, for example, as 'limited' and 'extensive' or 'narrow' and 'broad'. The 50 per cent threshold was then employed again and a presence or absence code was assigned depending on whether or not each case fulfils half of the original options. For example, the 'marketing problems' independent

variable, which initially had eight possible responses, was reduced to just the two re-named responses of 'limited problems' and 'extensive problems'. Cases which have encountered four or less of the original eight marketing problems were then coded absent on extensive problems, y (in effect, the presence of limited problems), while those cases that have experienced five or more of the original eight marketing problems were coded present, Y, on extensive problems. Such multi-response independent variables therefore became dichotomous, mutually exclusive independent variables, and were consequently treated in the same manner as above. Thus, initially complex independent variables were also reduced to a one-letter code, using the present and absent codes to distinguish between the two sides of the dichotomy, and consequently also helped to simplify the primitive expressions. There were ten complex independent variables in the questionnaire, the reduction of which eliminated a further 39 possible responses between the questionnaire and the data tables. These ten variables are all marked with the superscript number '3' in the questionnaire in Appendix 1. Note that there is some overlap between those variables with superscript numbers 2 and 3, as those variables that were reduced to a dichotomous, mutually exclusive variable (3) were then able to be further reduced to just one letter code on the data tables (2).

In addition to these major steps of refinement, four additional, minor steps were also possible. First, two independent variables did not receive any positive responses, even after the first round of refinements, and were consequently not included in any form on the data tables. For example, there were no 'current targets' of investment enticements. The omission of these two independent variables resulted in the loss of five possible responses. The superscript number '4' in the questionnaire denotes these refinements in Appendix 1. Second, three independent variables in the industry questionnaire were merged with other variables, as distinguishing between them became pointless. For example, the 'driving force(s)' and 'industry initiators' independent variables were merged because there was no discernible difference between them. Six such amalgamations occurred, resulting in the loss of three independent variables and 11 possible responses. The superscript number '5' in the questionnaire in Appendix 1 denotes these refinements.
The final two types of secondary refinements at this stage included, respectively, the elimination of those possible responses that proved irrelevant in that they received no positive response across the 22 cases and the merging of 'no' and 'low' possible responses on a number of independent variables. In the first instance, for example, no government agencies were identified as a 'funding source', so this possible response was omitted. Five variables were affected by this particular refinement, resulting in the omission of nine possible responses. In the second case in point, for example, the 'no' and 'low' possible responses for producer input into the industry organisation were merged together. There were nine such variables, leading to the loss of the same number of possible responses. The superscript numbers '6' and '7' identify these last two refinement steps, respectively, in the industry questionnaire in Appendix 1.

Overall, this second round of 32 refinements resulted in the loss of five independent variables and 73 possible responses. This process of refinement accounts for the large variation between the number of independent variables and possible responses in the questionnaire (70 and 249, respectively) compared to the data tables (65 and 176, respectively). Furthermore, the presence of the 20 dichotomous mutually exclusive variables in the data tables means that the number of Boolean letter codes used is 20 less than the number of possible responses, or 156. As a consequence of all these refinements, the primitive expressions derived from these significantly reduced data tables are substantially simplified from what they would have otherwise been, with the downstream benefit being that the Boolean algebraic analysis will be considerably eased.

After assigning presence and absence codes on the 65 independent variables that include the 176 possible responses, each case was then classed as successful or non-successful; that is, given a final, overall dependent variable rating, or output value. This step is difficult and critical. The main difficulty is that the binary coding system means that a case study must be classed as either

successful or non-successful: there is no in-between or third option. This dichotomy proved especially problematic for those new industries that are simply too young to be fairly classed as either successful or non-successful (e.g., wasabi). A related problem concerns those industries which have been through a boom and bust period, and who are now in the (often slow and laborious) process of re-establishing themselves (e.g., goat fibre). QCA demands that a classification is made, however, and it is a crucial designation as it essentially determines the very outcome of the analysis.

One possible solution was seriously considered in an attempt to overcome this problem of assigning one or the other output value. This potential resolution involved the use of two thresholds of success, a high and a low limit, and to conduct the Boolean algebraic analysis twice, in accordance with these two thresholds. Thus in the proposed first QCA analysis, a high threshold of success would be employed, reasoning that problematic, premature or rebuilding new industries were significantly less successful than other clearly successful cases. Hence the former cases would be considered as being below this high success threshold and consequently classed as non-successful.

Conversely, the second proposed QCA analysis would use a low success threshold and classify as successful those problematic cases, this time by reasoning that a new industry's very existence now – even if premature or rebuilding – is in itself a sign of success. The cases that would be classed as non-successful on this low threshold analysis were to be those new industries whose level of activity did not warrant 'industry' status or which had simply not been successful. It was recognised that some of the new industries would not change categories according to what line of reasoning and consequent analysis was employed; they were either successful or non-successful, regardless of threshold. There would, however, be a significant change in the overall distribution between successful and non-successful new industries from the high to low success threshold.

While this proposed solution had very definite possibilities, further thinking and some preliminary analysis led to the idea being discounted. It was realised that conducting the Boolean algebraic analysis twice would be too time consuming and would distract both researcher and reader from the main research objectives. Moreover, some preliminary tests, in the same vein as those conducted after phase one of the data collection, using the low threshold produced only weak results of limited usefulness. These inconclusive initial findings confirmed our thinking that a second Boolean algebraic analysis would merely distract us from the primary task at hand and cloud the eventual results. It was therefore decided to use only the high success threshold and accordingly conduct the Boolean algebraic analysis just once. This decision also reflected our desire for the subsequent QCA results to be as accurate, succinct, and as rigorous as possible. The consequence of using this high threshold is that only seven of the 22 cases qualify as successful new industries, with the remaining 15 classified as non-successful (see Table 3 above).

Another important problem emerged during this preparatory stage to the data analysis. This obstacle was that of contradictory groups, where cases with the same input values have different output values. That is, when constructing the truth tables from the initial lists of primitive expressions (derived from the data tables) for successful and non-successful new industries, it was found that some primitive expressions appeared on both lists. This duality is problematic because each group of identical primitive expressions (i.e., those cases with the same input values) can only be assigned one (i.e., the same) output value. The problem of contradictory output values, therefore, is a serious one and requires much thought to resolve.

This difficulty, however, is not unforeseen, and Ragin's (1987) theoretical QCA method literature offers considerable guidance on this issue. Ragin's (1987:113) most preferred solution is to return to the theoretical framework and/or empirical information and "examine the troublesome cases in greater detail and attempt to identify omitted causal (independent) variables". Thus, he advises

(1987:113) that the researcher must treat the primitive expressions derived from the initial data tables as "tentative" and they should "use theoretical and substantive knowledge to achieve a proper specification of causal conditions before reducing the truth table".

While this expansion of the range of independent variables seems a logical, obvious solution to the problem of contradictory primitive expressions, it was rejected as inappropriate for this research project, for a number of reasons. First, it was simply impossible, given our time and financial constraints, to gather more information on each case. Undoubtedly this is the best solution, but it is perhaps one that exists in an ideal world and not one bound by practical limitations. Second, even if it had been possible to undertake a third round of information gathering, the range of independent variables was sufficiently refined enough after the first phase of data collection that we could justifiably claim that this step had already been taken. Indeed, the number of independent variables already included in the questionnaire, in each of the eleven categories and in total, was more than sufficient and clearly indicated that the Boolean algebraic analysis would be complicated enough without adding yet more variables. Moreover, there is no guarantee that more independent variables means better independent variables that would simply eliminate all contradictory groups of primitive expressions. The danger that this step may have had to be repeated *ad infinitum* was very real; hence this solution was impractical to say the least.

The search for a solution to the problem of contradictory primitive expressions therefore moved to Ragin's (1987) four secondary, and less preferred, options. First amongst these possibilities is to assign the contradictory group(s) a new output value according to the majority of initial successful or non-successful cases within each specific group. Thus, three cases with the same primitive expression, two of which are successful while the other is non-successful, would be assigned an overall successful output value; majority rules. While this re-classification may seem reasonable, it is actually of limited utility given that, in this hypothetical example, this would 'contaminate' the results by including the minority non-successful single case in the analysis of the majority of the two successful cases. Furthermore, this solution would obviously only work for odd-numbered groups where a majority would eventuate. In an even-numbered and evenly divided group, this solution would clearly fall over, as any re-assigning of an output value would then become totally arbitrary.

A second option exists to re-classify all the contradictory groups as non-successful, on the argument

> …that if no clear tendency is apparent among the cases conforming to a certain causal combination, then the output should be coded conservatively. Thus, the analysis would show which causal combinations are unambiguously associated with the outcome (i.e., success; Ragin 1987:116).

The problem with this approach, and the reason it is discounted here, is that it would incorporate instances of success in the analysis of non-successful new industries, which is clearly contradictory and therefore unsatisfactory. A third and opposite alternative is to re-classify contradictory groups as successful, on the reasoning "that a wide net should be cast so that all possible combinations of causes…are captured by the equation (resulting from the Boolean algebraic analysis)" (Ragin 1987:116). As the approach is the direct opposite to the previous option, so too is the problem, as here it would include non-successful cases into the analysis of successful new industries. Again, this consequence is clearly contradictory, totally unsatisfactory, and therefore this option is also eliminated.

Amenta et al. (1992) and Amenta and Poulsen (1996) also faced this difficulty of contradictory groups, and used these solutions to guide their search for "certain", "possible", and "likely" outcomes. This technique, however, was discounted as an option here because it would mean

undertaking the Boolean algebraic analysis twice, or even thrice, with no perceivable gain in the quality of the results obtained. In effect, the Amenta et al. and Amenta and Poulsen approach was the same as the above consideration of using two classifications for success and non-success and conducting the Boolean algebraic analysis twice, and was therefore dismissed as possibilities for the same reasons: conducting the Boolean algebraic analysis more than once would be too time consuming and would distract both researcher and reader from the main research objectives by clouding the eventual results themselves.

Fortunately, Ragin's fourth secondary option offers much more promise, and is in fact chosen as the way to overcome this problem of contradictory codes. This fourth approach treads a middle path between the previous two extremes, and simply omits, or re-classifies as non-existent, group(s) with contradictory primitive expressions. Thus, such primitive expressions are not able to 'contaminate' the Boolean algebraic analysis of either successful or non-successful new industries. The argument here is simple but compelling: as contradictory groups show no clear tendency towards either success or non-success, they cannot be reasonably assigned to either category. The decision was taken, therefore, that where contradictory primitive expressions were encountered (marked with a question mark on the truth tables in Appendix 3), we would heed Ragin's (1987:116) advice and treat these particular combinations "as though they do not exist". Perhaps not a perfect solution to the problem of contradictory primitive expressions, but it is by far the best of the available options within the Qualitative Comparative Analysis method, because it offers the greatest potential to enhance the rigour of the results.

There were a number of other problems with later stages of applying the QCA method. Another effect of the complexity of the primitive expressions concerns the minimisation step that reduces prime implicants to essential prime implicants. This effect was total, in that in constructing the essential prime implicant charts - the means for conducting this step - in all 11 categories for both the success and non-success prime implicants, NO refinements were possible. Although in two instances one primitive expression was covered by two prime implicants, in neither case did this lead to the omission of either of those prime implicants, because both prime implicants also 'cover' another but different primitive expression, thus both prime implicants were still required. Because no refinements resulted from this step, the essential prime implicant charts are not presented in the following analysis chapter but included only in Appendix 3, with these two 'near-misses' explained.

A second group of problems emerged after 'trialing' the Boolean algebraic minimisation in preparation for the final data analysis. First, it became apparent that the complexity of the primitive expressions, a result of the large number of independent variables, would severely limit the number of necessary and/or sufficient conditions identified by the analysis, thus placing a fairly major constraint on the utility of the results. Indeed, the complexity of the primitive expressions, in all 11 categories, emphatically indicated even before commencing the minimisation process that in all cases the identification of a sufficient condition - a causal condition that appears by itself in any of an output value's essential prime implicant - was a practical impossibility. It was also, therefore, beyond the realms of possibility that a necessary AND sufficient condition - a causal condition that appears on its own in an output value's only essential prime implicant - would be identified. The effect of these two impossibilities was the realisation that our Boolean algebraic analysis would only identify causal conditions that were (a) neither necessary nor sufficient or (b) necessary only. Those causal conditions in the former category would not, by definition, be closely associated with success or non-success of new industries and could be consequently disregarded as unimportant. On the other hand, those causal conditions in the latter group, because by definition such necessary conditions are present in all of an output value's essential prime implicants, would be closely associated with success or non-success and would consequently be the focus of our results.

The search was on, therefore, for necessary causal conditions as the key factors in the success and non-success of new land based industries in New Zealand. Another problem was encountered, however, immediately this pursuit began. In undertaking the Boolean algebraic minimisation, another effect of the complexity of the primitive expressions became obvious, namely that very few minimisation steps could be made. This limited minimisation meant that the final lists of essential prime implicants differed little from the original primitive expressions. Consequently, the likelihood that any particular causal condition, even if strongly associated with a specific output value, would appear in all essential prime implicants within each of the 11 categories was significantly reduced. Indeed, this reduced probability significantly limited the number of necessary conditions identified by an initial analysis. The search for key success and non-success factors stalled, therefore, while this problem of minimal necessary conditions - and more importantly its possible solution - was given further thought.

On closer evaluation of the essential prime implicants it was realised that the definition of a necessary condition, that it must be present in ALL of an output value's essential prime implicants, was the rather arbitrary cause of this problem. Arbitrary, because this omnipresence requirement meant that otherwise necessary conditions present, for example, in all but one of the essential prime implicants would have to be eliminated as its association with that output value is not, according to this standard, sufficiently strong enough. Such strict reasoning is nonsensical, for a hypothetical causal condition present in six out of seven essential prime implicants clearly correlates well with that output value. By this reasoning high frequency thresholds, rather than omnipresence, of any causal condition within an output value's essential prime implicants were used here to determine the necessary conditions associated with success or non-success in new industries.

A frequency threshold for necessary conditions of less than one hundred per cent, therefore, needed to be developed for use in the Boolean algebraic analysis. While omnipresence was seen as too strict a standard, it was recognised that to avoid widening the net too far and capturing too many necessary conditions the frequency threshold should not be lowered unreasonably. In determining its level, it was recognised that more than one frequency threshold was needed, because necessary conditions can only be whole numbers (i.e., actual cases), so the percentage of essential prime implicants containing a particular causal condition would vary according to the number of essential prime implicants. The guiding low threshold of three-quarters, or 75 per cent, was used for establishing these frequency thresholds. Consequently, for output values with three or less essential prime implicants the omnipresence standard would have to be employed, as the whole number restriction meant that the 75 per cent threshold was impractical: none out of one is zero per cent, one out of two is only 50 per cent, and two out of three is only 67 per cent.

In instances with four essential prime implicants, however, a condition's presence in three, or 75 per cent, was sufficient for that condition to qualify as necessary, and so on as the number of essential prime implicants increased. Causal conditions were therefore classed as necessary if they were present in: four out of five essential prime implicants (80 per cent); five out of six (83 per cent); six out of seven (86 per cent); six out of eight (75 per cent); seven out of nine (78 per cent); eight out of ten (80 per cent); nine out of 11 (82 per cent); nine out of 12 (75 per cent); 10 out of 13 (77 per cent); 11 out of 14 (79 per cent); and 12 out of 15 (80 per cent). The frequency qualification of each necessary condition is noted in parentheses in Chapter 4. While this 'loosening' of the criteria for necessary conditions seemingly runs counter to the strict rules of Boolean algebraic analysis, it is a step by no means incompatible with the QCA method. For Ragin (1987:152) acknowledges the use of many minor steps, such as our thresholds, to allow for the problem of frequency at various stages of the analysis process, what he refers to in one such instance as "substantive importance".

The employment of frequency threshold criteria for identifying critical causal conditions did have the side effect of increasing the number of necessary conditions that appeared on both success and

non-success lists. This contradiction, however, was more easily dealt with, by dismissing these two-faced necessary conditions as clearly not indicating a strong tendency to either success or non-success. The focus of our results, therefore, became those necessary conditions that appeared on one or the other list of critical success or non-success causal conditions.

Finally, it is important to note two last points with regard to the new industry data analysis. First, the decision was taken not to apply de Morgan's Law, which in this case would invert the necessary conditions that result from the analysis of successful essential prime implicants, in order to create an opposing set of critical causal conditions for non-successful new industries. This step is perceived to be unnecessary in this situation, for here the Boolean minimisation is a double-edged sword that will analyse success and non-success simultaneously. Our understanding of the non-successful new industries, therefore, will be based on the necessary conditions derived from those essential prime implicants, rather than just the algebraic inverse of the necessary conditions for success. We believe this to be a much better and more grounded analysis than one algebraically derived from the application of de Morgan's Law.

Second, Boolean factoring is also not applied to the final 22 groups of essential prime implicants. The reason for this omission is twofold. First, the presence of mutually exclusive independent variables and consequent use of frequency thresholds means that the identification of necessary conditions is straightforward enough and factoring will not make this task any easier. Second, the complexity of some groups of essential prime implicants – those with a large number of independent variables – is such that Boolean factoring would be a time consuming but pointless task, as it would not advance the analysis in a significantly meaningful way. Thus, Boolean factoring, which may have been appropriate in some instances, is not utilised in this application of the QCA method.

This section has detailed the specific application of Boolean algebraic analysis in this research project that is presented in the following chapter. The discussion has chronicled the problems encountered and the reasoning behind the solutions employed to overcome these. While these solutions have modified Ragin's theoretical model of the QCA method to some degree, such modifications have only been made where absolutely necessary, are negligible in their effect, and in many ways have added to, rather than detracted from, the ideal form. The omission of unnecessary letter codes of mutually exclusive variables from primitive expressions is but one example of how practice has expanded theory. While our application of the Qualitative Comparative Analysis method may differ from Ragin's pure intentions, therefore, this is purely out of necessity, limited in deviation, and enables the theoretical model to be critically examined from the viewpoint of empirical experience.

3.5 Method Critique

Several criticisms of the Qualitative Comparative Analysis method are implicit in the above discussion. This section presents these criticisms here as an explicit, constructive critique of Ragin's (1987, 1994) little known QCA method. The discussion does not proffer solutions to these problems with the intention that these should become permanent changes to the QCA method, but simply alerts the reader and, perhaps more specifically, other potential users of the QCA method to its limitations as encountered in this research project.

The first and most striking criticism is that although the QCA method is intended to bridge the gap between qualitative and quantitative research techniques, it maintains one of the major limitations of the latter approach. Namely, the QCA method can force the researcher to reduce an enormous

amount of qualitative case information into a limited number of quantitative independent variables, especially in situations where there is a large number of apparently important variables. Undoubtedly, a considerable amount of the complexity and idiosyncrasies of each case is lost in this reduction, a cost almost anathema to qualitative research. This loss is also rather ironic, given that Ragin (1987) emphasises the need for QCA researchers to adhere to what he calls "the case oriented approach".

The second main criticism is related to and in effect exacerbates this first problem of a significant, almost intolerable, level of data reduction. This second concern is the few steps possible in the Boolean algebraic minimisation process in this project, a direct consequence of the large number of independent variables included. As discussed earlier, the resulting complexity of the original primitive expressions has had four negative effects on this application of the QCA method. First, the complexity of the primitive expressions forced the additional process of reducing, as much as possible, the number of letter codes included in each primitive expression. Second, the complexity of the primitive expressions rendered the essential prime implicant charts completely ineffectual as they did not produce any useable refinements whatsoever. Third, the complexity of the primitive expressions excluded necessary and sufficient and sufficient causal conditions as possible results of the Boolean algebraic analysis. Finally, and as a consequence of these three preceding effects, the complexity of the primitive expressions kept to an absolute minimum the number of Boolean minimisation steps that eventuated, meaning that there was often little difference between the original primitive expressions and the resulting essential prime implicants.

The implication, therefore, seems to be that Boolean algebraic analysis is best suited to only a very minimal number of independent variables. For as the number of independent variables (and therefore the complexity of primitive expressions) increases, the likelihood of two primitive expressions differing on only one variable or letter code decreases. The number of possible minimisation steps is consequently reduced, which Ragin (1987:104) notes "places severe constraints on possibilities for testing causal arguments", or in our terminology limits the identification of critical causal conditions via the Boolean algebraic analysis. Hence two primitive expressions that differ on only one variable become the exception rather than the rule.

Indeed, this inference that the QCA method works best only with a minimal number of independent variables is so strong that Ragin's (1987) illustrative examples may not, in fact, be far from the practical maximum for Boolean algebraic analysis. A small number of variables will certainly increase the number of minimisation steps possible and almost inevitably result in parsimonious essential prime implicants and succinct necessary, sufficient, and/or necessary and sufficient causal conditions. For qualitative researchers with an acute awareness of the implicit but substantial reduction in the quality of case information through such considerable data reduction, however, such concise results are perhaps just a little too simplistic.

The possibility arises, however, that this research project may have included substantially more independent variables than what Ragin proposes for such analyses. If there are more variables than he intends, however, this requirement is not explicit in Ragin's theoretical QCA method literature, and therein lies the exacerbating effect of the first criticism above. For if the number of independent variables in any QCA study is to be kept to an absolute minimum, then the required level of data reduction will be increased accordingly, perhaps to the point where it becomes extreme. In effect, this simplification would potentially tilt the QCA method too far to the latter for it to be considered a serious attempt to bridge the qualitative – quantitative divide. In this project, for example, we have already stripped an enormous amount of case information almost to its barest essentials; to be required to reduce this data even further would surely take us to the point of no return as far as the QCA method is concerned.

The means to overcome this double-edged sword of too many independent variables does exist, of course, in the form of computer programmes designed to run complex algorithms and undertake the Boolean algebraic analysis. This solution, however, is itself a limitation on the utility of the QCA method, for even in this technological era there are still some practical constraints on research, as this project experienced with its restriction to manual processing. Indeed, if QCA researchers want to minimise the damage done to their case information by the process of reducing this down to data tables and primitive expressions, then computer programmes become a necessity for using the QCA method, placing another limitation on its utility.

Drass and Ragin, at the Centre of Urban Affairs and Policy Research at Northwestern University, have developed computer software for use in applications of the QCA method. While this software is user friendly in that it runs on all MS-DOS computers with a minimum of 640 kilobytes of memory, it is limited because its purpose is to create truth tables, not to undertake the far more complex Boolean algebraic analysis (see Hanneman 1994 for one such application). Far more sophisticated software, therefore, was required for the Boolean minimisation in this project, but this remained beyond the resources of this research.

Despite these two related and considerable problems of significant data reduction and limited minimisation steps, the QCA method did enable necessary causal conditions to be identified at the end of the Boolean minimisation, thus demonstrating its strength in the face of such obstacles. The pinpointing of these necessary conditions was undoubtedly the most valuable aspect of the QCA method, as it highlights the critical causal conditions for success and non-success in new industries. In turn, these key factors provide the crucial discussion points, elaborated in Chapter 5, in response to this project's research problem, namely to identify key success factors in new land-based industries. Before then, however, the results of the Boolean algebraic analysis that led to this endpoint of critical causal conditions are presented in Chapter 4.

3.6 Conclusion

The first section of this chapter introduced the Qualitative Comparative Analysis method as the broad analytical framework of this research project. The next section presented an in-depth chronicle of the selection of cases and independent variables, the two-phase data gathering process and the preliminary analysis. The third section detailed the application of the QCA method in this investigation into success factors in new industries. Finally, the fourth section identified the two main problems encountered in this specific application of the QCA method, but concluded by emphasising the strength of the critical causal conditions identified by the Boolean algebraic analysis.

Chapter 4
Results Derived Using Boolean Algebraic Analysis

4.1 Introduction

This chapter presents the outcomes of the Boolean algebraic analysis component of the Qualitative Comparative Analysis method, the detailed steps of which are included in Appendix 3. The presentation is divided into eleven sections, in accordance with the eleven categories of the industry questionnaire. Each category is introduced by explaining the reasoning behind the inclusion of the independent variables. The essential prime implicants (taken from the essential prime implicant charts in Appendix 3) from each category are then presented, followed by a list identifying the necessary conditions for success and non-success from these essential prime implicants. The frequency threshold qualification for each necessary condition is given in parentheses, while those necessary conditions that appear on only the success or non-success list, and are therefore more strongly associated with one or the other output value, are given in bold type. This list is followed by a results paragraph that summarises these specific necessary conditions for success or non success. These initial results of the Boolean algebraic analysis from this chapter are then expanded in Chapter 5 with a full discussion of necessary conditions for success and non-success in new land-based industries.

4.2 Boolean Algebraic Analysis for Success and Non-Success by Category

4.2.1 Origins and History of Industry

The reasons behind the emergence of a new industry as a commercial proposition was identified as the first possible factor in determining the success or otherwise of a new industry. Closely related to this recognition was the idea that the roles or occupations of the people involved in leading the new industry's development could also be an important factor in determining success. These two initial variables were so closely related, in fact, that there was no practical difference, so they were merged into a single 'Origins' variable of 'force(s)/initiator(s)'. On the other hand, it was recognised that the breadth of 'initial problems' and the type of 'initial growth' could also be influential factors at the outset of a new industry, thus these were included as the 'History' variables. This category therefore includes a refined number of three independent variables and nine possible responses.

Success

Essential Prime Implicants	=	ABCdH + AbdE + AbCdG
Necessary Conditions	=	A (3/3) Producer diversification
	=	**d (3/3) Limited initial problems**

Non-Success

Essential Prime Implicants	=	ABCdE + AcdF + AcDE + ABCDH + ABcdH + AbcdG
Necessary Conditions	=	A (6/6) Producer diversification
	=	**B (3/4) Improved financial returns**

The Boolean algebraic analysis of the case information for this "Origins and History of Industry" category shows one necessary condition for success, one necessary condition for non-success, and one contradictory necessary condition. The necessary condition for success is the presence of only 'limited initial problems' (actually the absence of 'extensive initial problems') for a new industry. The necessary condition for non-success is the perception amongst producers at the outset of a new industry that the new product will provide significantly 'improved financial returns'. The contradictory necessary condition of 'producer diversification', by definition, can be disregarded as a critical causal condition as it has no clear correlation with either success or non-success.

4.2.2 Product Characteristics and Environmental Requirements

It seems intuitively obvious that a new product's characteristics and environmental requirements are related to its chances of success, so this category was identified as being potentially critical. As each product's character and quality is closely related to its environmental conditions and susceptibility to pests and diseases, these two broad topics were combined. In terms of a new product's characteristics, the reason why it is a new product was seen as the first significant variable. Is a particular new product 'new' because it is an existing product being produced in New Zealand for the first time, or is it something completely new on the global scale? Hence the 'old/new product' variable was included. Second, the 'end use' of each product was seen as having a potential impact on its success, as was its 'temporal availability'. As for a new product's environmental requirements, the first measure was to assess its 'geographic location' within New Zealand, to see if a broad production base is more important than a narrow one, or whether particular parts of New Zealand are more amenable to successful new products than others. Closely associated with this spatial variable, through climate, is a new product's particular 'environmental requirements'. Thus, limited environmental requirements means that the new product can occur widely in New Zealand. Similarly, each product will have its own particular pest and diseases, a function of both the product characteristics and the environmental conditions in which it is grown. The severity of those pests and diseases was seen as a potentially critical factor in the life or death of a new industry, hence the 'pest and disease impact' variable. This category therefore includes six independent variables and a refined number of 13 possible responses.

Success

Essential Prime Implicants	=	aBCeG + ABceF
Necessary Conditions	=	B (2/2) New product is a food
	=	**e (2/2) Limited environmental requirements**

Non-Success

Essential Prime Implicants	=	abdeF + aBCDH + aBCdEF + aBCDEG
Necessary Conditions	=	**a (4/4) Old source, but new to New Zealand**
	=	B (3/4) New product is a food

The Boolean algebraic analysis of the case information for this "Product Characteristics and Environmental Requirements" category shows one necessary condition for success, one necessary condition for non-success, and one contradictory necessary conditions. The necessary condition for success is the presence of only 'limited environmental requirements' (actually the absence of 'extensive environmental requirements') for a new industry. The necessary condition for non-success is that the new product comes from an 'old source, but new to New Zealand'. The contradictory necessary condition that the 'new product is a food', by definition, can be disregarded as a critical causal condition as it has no clear correlation with either success or non-success.

4.2.3 Industry Organisation and Co-operation

The structure and range of interaction of a new industry's formal organisation was perceived to be a potentially vital ingredient in its emergence or demise. The first variable assessed what type of body the 'industry organisation' was. Is it merely a grower association or a more formal industry council? Secondly, is the industry organisation involved in a narrow or broad range of 'organisation functions'? Externally, the range of other bodies that an industry organisation interacts with was considered to be of possible significance, hence the amount of 'exogenous interaction' was measured. Related to this was the actual 'level of co-operation', or how well the industry organisation actually co-operates with other organisations it consistently deals with. Another facet of industry organisation considered to be of importance was its 'funding' sources, which turned out to be exclusively from membership subscriptions and/or production levies, although two

organisations did not receive even this minimal level of income. A related variable considered whether 'membership' of the industry organisation was compulsory or voluntary for growers or producers and/or processors. Finally, two variables were included that measured 'producer input' into the policy decision making process of the industry organisation, and the level of 'producer satisfaction' with the performance of the industry organisation. This category therefore included eight independent variables and a refined number of 19 possible responses.

Success

Essential Prime Implicants	=	ACFGhKN + ABCFGKN + ABCFGhKO + AbCEGhKN + aBCEGhKN
Necessary Conditions	=	**A (4/5) Industry council**
	=	**B (3/4) Extensive functions**
	=	**C (5/5) Extensive exogenous interactions**
	=	E (2/2) Medium exogenous co-operation
	=	F (3/3) High exogenous co-operation
	=	G (5/5) Subscription and/or levy funding
	=	h (4/4)Voluntary membership
	=	K (5/5) High producer input
	=	N (4/4) Low producer satisfaction
	=	O (1/1) High producer satisfaction

Non-Success

Essential Prime Implicants	=	abCEghJN + abcEGhIN + abcDghIM + abCDGhKO + aBCEGhKO + abcDGhIL + abcFGhKN + abcEGhJO + aBCFGhJN + abcDghKM + abEGhJM + ABCEGhJN
Necessary Conditions	=	**a (11/12) Grower association**
	=	**b (9/12) Limited functions**
	=	**D (4/4) Low exogenous co-operation**
	=	E (6/6) Medium exogenous co-operation
	=	F (2/2) High exogenous co-operation
	=	G (9/12) Subscription and/or levy funding
	=	h (12/12) Voluntary membership
	=	**I (3/3) Low producer input**
	=	**J (5/5) Medium producer input**
	=	K (4/4) High producer input
	=	**L (1/1) Low producer dissatisfaction**
	=	**M (3/3) Ambivalent producer dis/satisfaction**
	=	N (5/5) Low producer satisfaction
	=	O (3/3) High producer satisfaction

The Boolean algebraic analysis of the case information for this "Industry Organisation and Co-operation" category shows three necessary conditions for success, seven necessary conditions for non success, and seven contradictory necessary conditions. The three necessary conditions for success include the presence of an 'industry council', an industry organisation with 'extensive functions', or an industry organisation with 'extensive exogenous interactions' with outside groups. The first three necessary conditions for non-success include the presence of a 'grower association', an industry organisation with 'limited functions', or an industry organisation with a 'low level of exogenous co-operation' with outside groups. The four remaining necessary conditions for non-success can be paired, the first couple being 'low' or 'medium producer input' into the industry organisation and the second couple being 'low dissatisfaction' or 'ambivalence amongst producers' with the performance of the industry organisation. The seven contradictory necessary conditions of 'medium' or 'high exogenous co-operation', 'subscription and/or levy funding', 'voluntary

membership', 'high producer input', or 'low' or 'high producer satisfaction', by definition, can all be disregarded as critical causal conditions as none have a clear correlation with either success or non-success.

4.2.4 Production Inputs and Capital Investments

The fourth category addressed the issue of how amenable (or otherwise), from a financial viewpoint, a new industry is to potential producers. Thus, the first variable measured the 'investment level' required to become a new producer. Secondly, the presence or absence of 'pre-production activities', such as pilot schemes and environmental assessments, at the outset of the new industry was recorded. Similarly, the existence or non-existence of 'government enticements', in the form of financial or tax incentives, to potential producers during the embryonic phase was the third variable. Finally, this section evaluated the 'level of technology' in the production process as one measure of the difficulty of producing each new product. This category therefore included four independent variables and a refined number of nine possible responses.

Success

Essential Prime Implicants	=	BDeFG + CDeFH + BdeH + BdEFG
Necessary Conditions	=	B (3/3) Medium capital investment
	=	C (1/1) High capital investment
	=	e (3/4) No environmental assessments
	=	**F (3/3) Government enticements**
	=	G (2/2) Low production technology
	=	H (2/2) Medium production technology

Non-Success

Essential Prime Implicants	=	CdEfG + BefG +CDefH + BdeFG + CDefI + AdefG
Necessary Conditions	=	B (2/2) Medium capital investment
	=	C (3/3) High capital investment
	=	e (5/6) No environmental assessments
	=	**f (5/6) No government enticements**
	=	G (4/4) Low production technology
	=	H (1/1) Medium production technology
	=	**I (1/1) High production technology**

The Boolean algebraic analysis of the case information for this "Production Inputs and Capital Investments" category shows one necessary condition for success, two necessary conditions for non-success, and five contradictory necessary conditions. The necessary condition for success is the presence of 'government enticements' in the form of financial incentives and/or tax breaks (this applies only to industries that started before 1984). The two necessary conditions for non-success include the absence of such 'government enticements' or a 'high level of technology' used at the production stage. The five contradictory necessary conditions of 'medium' or 'high capital investment', the absence of 'environmental assessments' (prior to the first commercial operations), or a 'low' or 'medium level of production technology' are, by definition, disregarded as critical causal conditions as none have a clear correlation with either success or non-success.

4.2.5 Marketing and Market Development

The potential markets and promotion of new products was identified as likely to be a critical facet in the success or non-success of new industries. As such, the first variable was to record whom is undertaking the 'current marketing' of the new product. A related question was to identify the 'markets supplied', either domestic and/or process and/or export markets. The export market was acknowledged as being the most critical of these three, so this second variable was followed by a third that sought to identify particular geographic 'export markets' that are current clients of each

new industry. To narrow the buyers even further, the fourth variable identifies the actual purchasers or the 'market clients' of the new product, as it was thought that to whom one sells may be of some salience. Domestically, the sources of 'marketing funding', 'levels of expenditure', and the 'change in marketing' levels were also seen as potentially important factors. Finally, the breadth of 'marketing techniques' and the range of 'marketing problems' were included to round out one of the more comprehensive categories of this study. This category therefore included nine independent variables and a refined number of 27 possible responses.

Success

Essential Prime Implicants	=	abCDEFGHijklMnOpQTUxy + aBCdEfGHijklMnOPQSVXy + AbCdEfGhIjKlMnOPQTVXy + abcDEfghIjKlmnOpQRVxy + AbCdEfGHIjKLMnOPQTVXy + aBCdEfGHIjklMnOpQSVxY + AbcDEfGHIjklMnOPQSVXy
Necessary Conditions	=	E (7/7) Domestic market
	=	**f (6/7) No process market**
	=	**G (6/7) Export market**
	=	j (7/7) No Africa / Middle East export markets
	=	**l (6/7) No restaurants or cafes market clients**
	=	**M (6/7) Food retail market clients**
	=	**n (7/7) No health or souvenir retail market clients**
	=	**O (7/7) Wholesalers and/or importers market clients**
	=	Q (7/7) Private companies funding marketing
	=	R (1/1) Low marketing expenditure
	=	S (3/3) Medium marketing expenditure
	=	**T (3/3) High marketing expenditure**
	=	U (1/1) Decreasing marketing expenditure
	=	V (6/6) No change in marketing expenditure

Non-Success

Essential Prime Implicants	=	aBcdEfghijklmNopQRVxy + aBcdefghijklmnopqRVxY + AbCdEfGHijklmnOPQRVxy + aBCdEFghijkLMnopQRVxY + AbcDEFGHijKlMnOpQRVxy + aBCdEfGHIjkLmnOpQRUxY + abCdEfGHIjklmNOpQRVxY + abCdEFghijkLMNopQRWxy + aBCdEFGhijKLMNopQRWXy + aBCdEfghijkLmnopQRWxY + abcDEfGHijKlMnOPQRVxy + abCdEfGHijkLMnOpQRVxY + AbcDEfGHijKlMnOPQSUxY + AbCdEfghijkLMNoPQRVxy + abcDEfGHijklMNOpQRVxy
Necessary Conditions	=	E (14/15) Domestic market
	=	**i (13/15) No European export markets**
	=	j (15/15) No Africa / Middle East export markets
	=	Q (14/15) Private companies funding marketing
	=	R (14/14) Low marketing expenditure
	=	S (1/1) Medium marketing expenditure
	=	U (2/2) Decreasing marketing expenditure
	=	V (10/10) No change in marketing expenditure
	=	**W (3/3) Increasing marketing expenditure**
	=	**x (14/15) Limited marketing techniques**

The Boolean algebraic analysis of the case information for this "Marketing and Market Development" category shows seven necessary conditions for success, three necessary conditions for non-success, and seven contradictory necessary conditions. The seven necessary conditions for success include the absence of a 'process market', the presence of an 'export market', the absence

of ‘restaurants or cafes’ or ‘health or souvenir retail’ market clients, the presence of ‘food retail’ or ‘wholesalers and/or importers’ as market clients, or a ‘high level of marketing expenditure’. The three necessary conditions for non-success include the absence of ‘European export markets’, ‘increasing marketing expenditure’, or only ‘limited marketing techniques’. The seven contradictory necessary conditions of the presence of a ‘domestic market’, the absence of ‘African or Middle Eastern’ export markets, ‘private company’ funding of marketing, ‘low’ or ‘medium marketing expenditure’, or a ‘decreasing’ or ‘no change marketing expenditure’ are, by definition, disregarded as critical causal conditions as none have a clear correlation with either success or non-success.

4.2.6 Financial Resources

A general evaluation of the financial situation of an industry’s formal organisation was undertaken, in the belief that the monetary resources of an industry body could well determine the future of a new land use. The financial status of the industry organisation was seen to be especially critical at start-up, so the first variable rated the ‘initial finance’ of the industry organisation, followed by the ‘initial impact’ of that status on the industry. The ‘change in finance’ since that period of time was then evaluated, which then resulted in logically consistent ‘current status’ and ‘current impact’ of those financial circumstances on the industry. This category therefore included five independent variables and a refined number of 15 possible responses. Because one new industry did not have a formal industry organisation this category was inappropriate, while a second new industry declined to disclose information on financial resources. There are, therefore, only 20 new industries analysed in this category, with six successful and 14 non-successful.

Success

Essential Prime Implicants	=	CFGKN + AEILO + BFILO + ADILO + BEHKO + ADIKO
Necessary Conditions	=	A (3/3) Low initial finance
	=	B (2/2) Medium initial finance
	=	**C (1/1) High initial finance**
	=	D (2/2) Negative impact initial finance
	=	E (2/2) No impact initial finance
	=	**F (2/2) Positive impact initial finance**
	=	G (1/1) Decrease in financial status
	=	H (1/1) No change in financial status
	=	I (4/4) Increase in financial status
	=	K (3/3) Medium current finance
	=	**L (3/3) High current finance**
	=	N (1/1) No impact current finance
	=	O (5/5) Positive impact current finance

Non-Success

Essential Prime Implicants	=	AEIJN + ADHJM + ADHJN + AEHJN + BEGJM + AEIKO
Necessary Conditions	=	A (5/5) Low initial finance
	=	B (1/1) Medium initial finance
	=	D (2/2) Negative initial financial impact
	=	E (4/4) No impact initial finance
	=	G (1/1) Decrease in financial status
	=	H (3/3) No change in financial status
	=	I (2/2) Increase in financial status
	=	**J (5/5) Low current finance**
	=	K (1/1) Medium current finance
	=	**M (2/2) Negative impact current finance**
	=	N (3/3) No impact current finance
	=	O (1/1) Positive impact current finance

The Boolean algebraic analysis of the case information for this "Financial Resources" category shows three necessary conditions for success, two necessary conditions for non-success, and ten contradictory necessary conditions. The three necessary conditions for success include an industry organisation with a 'high level of initial finance', a 'positive initial financial impact', or a 'high current financial status'. The two necessary conditions for non-success include a 'low level of current finance' for the industry organisation and a 'negative current financial impact'. The ten contradictory necessary conditions of 'low' or 'medium initial finance', 'negative' or 'no impact initial finance', a 'decrease', 'no change', or 'increase in financial status', 'medium current finance', or 'no impact' or 'positive current financial impact' are, by definition, disregarded as critical causal conditions as none have a clear correlation with either success or non-success.

4.2.7 Research and Development

The role of research and development in the progression of new industries was identified as a probable key facet very early in the research project. The 'status of research and development', whether it is being conducted at all, and if so whether it is a spasmodic or continual process, was seen as the first and most critical variable of the research and development category. The extent of involvement amongst industry people and/or organisations of different roles in initiating research and development were seen as a second important variable, so these were recorded and then merged into 'research and development initiation', which comprised two responses, narrow and broad. The 'cost level' of an industry's research and development and the 'impact' of that cost on the industry organisation and/or the industry as a whole was also seen as a variable of potentially great significance. The 'levels of genetic engineering' and the 'levels of pest and disease control' were included to obtain some idea of the substance of an industry's research and development programme. Finally, the overall perception of the 'contribution' of an industry's research and development programme was recorded. This category therefore included seven variables and a refined number of 19 responses.

Success

Essential Prime Implicants	=	AbEHINQ + abCGILQ + ABDHINQ + aBCGILP + ABDHILQ + aBCFKNQ
Necessary Conditions	=	**B (4/6) Extensive initiation**
	=	C (3/3) Low cost level
	=	D (2/2) Medium cost level
	=	E (1/1) High cost level
	=	F (1/1) Negative cost impact
	=	G (2/2) No cost impact
	=	**H (3/3) Positive cost impact**
	=	I (5/5) No or low genetic engineering
	=	**K (1/1) High genetic engineering**
	=	L (3/3) No or low pest and disease control
	=	N (3/3) High pest and disease control
	=	P (1/1) No impact contribution
	=	Q (5/5) Positive contribution

Non-Success

Essential Prime Implicants	=	abCFILP + bCFILO + abEFILQ + abDFILO + AbCGINQ + AbDFJNP + ABCGIMQ + AbDGILP
Necessary Conditions	=	**b (7/8) No or limited initiation**
	=	C (4/4) Low cost level
	=	D (3/3) Medium cost level
	=	E (1/1) High cost level
	=	F (5/5) Negative cost impact
	=	G (3/3) No cost impact

= I (7/7) No or low genetic engineering
= **J (1/1) Medium genetic engineering**
= L (5/5) No or low pest and disease control
= **M (1/1) Medium pest and disease control**
= N (2/2) High pest and disease control
= **O (2/2) Negative contribution**
= P (3/3) No impact contribution
= Q (3/3) Positive contribution

The Boolean algebraic analysis of the case information for this "Research and Development" category shows three necessary conditions for success, four necessary conditions for non-success, and ten contradictory necessary conditions. The three necessary conditions for success include 'extensive initiation' of a new industry's research and development programme, a 'positive research and development cost impact', or a 'high level of genetic engineering' in an industry's research and development programme. The four necessary conditions for non-success include 'no or limited initiation' of a new industry's research and development programme, a 'medium level of genetic engineering', a 'medium level of pest and disease control' research, or a 'negative overall contribution' from research and development to the industry. The ten contradictory necessary conditions of 'low', 'medium', or 'high research and development cost level', a 'negative' or 'no impact research and development cost level', 'no or low genetic engineering', 'no or low' or 'high pest and disease research', or 'no impact' or 'positive contribution' from research and development are, by definition, disregarded as critical causal conditions as none have a clear correlation with either success or non-success.

4.2.8 Government Regulations and Controls

If, at its conception, a new industry must operate under a strict regulatory regime, this was seen as a potential limiting or constraining factor on its development. Alternatively, a new industry not restrained by central government regulations and controls was hypothesised to be more likely to flourish in its early years. Thus, the level of 'initial regulations' and their 'initial impact' on a new industry was recorded. Moreover, the 'change in regulations' was also seen as an important variable, as prolonged existence under a tight regulatory regime may, hypothetically, be fatal to an emergent venture. The analysis of change in regulations was brought up to date by recording the level of 'current regulations' and their 'current impact'. Finally, as a measure of an industry's attempts to and success in changing its regulatory regime, the sixth and seventh variables respectively identified the industry's perception of the level of 'government responsiveness' and its 'level of satisfaction' with that responsiveness. This category therefore included seven independent variables and a refined number of 23 possible responses.

Success

Essential Prime Implicants = BDGJNPS + BDGJOQT + BDGJNPU + CDGJNQT + AEIKMRW

Necessary Conditions
= A (1/1) No or low initial government regulations
= B (3/3) Medium initial government regulations
= **C (1/1) High initial government regulations**
= D (4/4) Negative initial impact
= E (1/1) No initial impact
= G (4/4) Decrease in regulations
= I (1/1) Increase in regulations
= J (4/4) No or low current regulations
= K (1/1) Medium current regulations
= M (1/1) Negative current impact
= N (3/3) No current impact

= **O (1/1) Positive current impact**
= P (2/2) Low government responsiveness
= Q (2/2) Medium government responsiveness
= R (1/1) High government responsiveness
= S (1/1) High industry dissatisfaction
= T (2/2) Mild industry dissatisfaction
= U (1/1) Ambivalent industry dis/satisfaction
= W (1/1) High industry satisfaction

Non-Success

Essential Prime Implicants = BEGKNQV + AEHJNPU + BDHKMPS + BDHKNPU + BDGJNPT + BDHKNQV + AEHJNRW + AEIKNPU + BDHKMPT + AEIKMPU

Necessary Conditions
= A (4/4) No or low initial government regulations
= B (6/6) Medium initial government regulations
= D (5/5) Negative initial impact
= E (5/5) No initial impact
= G (2/2) Decrease in regulations
= **H (6/6) No change in regulations**
= I (2/2) Increase in regulations
= J (3/3) No or low current regulations
= K (7/7) Medium current regulations
= M (3/3) Negative current impact
= N (7/7) No current impact
= P (7/7) Low government responsiveness
= Q (2/2) Medium government responsiveness
= R (1/1) High government responsiveness
= S (1/1) High industry dissatisfaction
= T (2/2) Mild industry dissatisfaction
= U (4/4) Ambivalent industry dis/satisfaction
= **V (2/2) Mild industry satisfaction**
= W (1/1) High industry satisfaction

The Boolean algebraic analysis of the case information for this "Government Regulations and Controls" category shows two necessary conditions for success, two necessary conditions for non-success, and 17 contradictory necessary conditions. The two necessary conditions for success are 'high initial government regulations' or a 'positive current impact of regulations' on a new industry. The two necessary conditions for non-success are 'no change between initial and current regulations' or 'mild industry satisfaction' with the responsiveness of government to change regulations. The 17 contradictory necessary conditions of 'no or low' or 'medium initial regulations', 'negative' or 'no initial impact of regulations', a 'decrease' or 'increase in regulations', 'no or low' or 'medium current regulations', 'negative' or 'no impact of current regulations', 'low', 'medium', or 'high government responsiveness', or 'high' or 'mild dissatisfaction', 'ambivalence', or 'high industry satisfaction with government responsiveness' are, by definition, disregarded as critical causal conditions as none have a clear correlation with either success or non-success.

4.2.9 Processing

The processing phase of new product activity was perceived to be an important post-production task, as this is where specific products are prepared for distribution to the marketplace. The type and cost of processing facilities used during the initial stages of the industry was seen as having a potential impact on the continued development or otherwise of that industry. Thus, the first and

second variables respectively asked the 'initial type' used in and the 'level of investment' initially made by the industry. Following on from these two questions, the third variable assessed the 'impact of investment' in processing. The type of 'current processing' facilities was determined by the fourth variable, while the fifth asked for the 'processing location' of those facilities. The 'level of technology' in an industry's processing facilities was determined, so as a comparison with the level of technology in production could be made. The 'change in costs' to the grower/producer of processing new products over time was also taken at this stage, as was the 'current impact' on the industry as a whole. Finally, the 'supply – capacity ratio' between product available for processing and processing capacity was also evaluated. This category therefore included nine variables and a refined number of 24 responses.

Success

Essential Prime Implicants	=	aBFhjMORT + aBFJKORU + aBEHjMNRU + aBEhjKNRU + ACEHjMNRT + aBEjLOQU
Necessary Conditions	=	**a (5/6) Adapted initial processing facilities**
	=	B (5/5) No or low processing investment
	=	C (1/1) Medium processing investment
	=	E (4/4) Negative initial processing cost impact
	=	**F (2/2) No initial processing cost impact**
	=	**j (5/6) Centralised current processing facilities**
	=	K (2/2) Low processing technology
	=	L (1/1) Medium processing technology
	=	**M (3/3) High processing technology**
	=	N (3/3) Decrease in processing costs
	=	O (3/3) No change in processing costs
	=	Q (1/1) Negative current processing cost impact
	=	R (5/5) No current processing cost impact
	=	T (2/2) Production undersupply
	=	U (4/4) Production supply equals processing capacity

Non-Success

Essential Prime Implicants	=	aBEhjLNRT + ACEHjLOQT + aBEhjKOQT + aBFhjLORU + aCFHJKOQV + ACFHjLPQV + aBGhJKPQT + ACEHjKOQV + aCFHJLNRT + ACEHJLOQU + aBEhjLOQT + ACEhjLOQT + aBFhjKPQT + ABFHjLORT + ACFHjLORT
Necessary Conditions	=	B (7/7) No or low processing investment
	=	C (8/8) Medium processing investment
	=	E (7/7) Negative initial processing cost impact
	=	**G (1/1) Positive initial processing cost impact**
	=	K (5/5) Low processing technology
	=	L (10/10) Medium processing technology
	=	N (2/2) Decrease in processing costs
	=	O (10/10) No change in processing costs
	=	**P (3/3) Increase in processing costs**
	=	Q (10/10) Negative current processing cost impact
	=	R (5/5) No current processing cost impact
	=	T (10/10) Production undersupply
	=	U (2/2) Production supply equals processing capacity
	=	**V (3/3) Production oversupply**

The Boolean algebraic analysis of the case information for this "Processing" category shows four necessary conditions for success, three necessary conditions for non-success, and 11 contradictory necessary conditions. The four necessary conditions for success include 'adapted initial processing facilities' used by the new industry, 'no impact from initial processing costs', 'centralised current processing facilities', or a 'high level of technology' in the processing stage. The three necessary conditions for non-success include a 'positive impact' from initial processing costs, 'increase in processing costs', or 'production oversupply', where the new product's harvest exceeds the industry's processing capacity. The 11 contradictory necessary conditions of 'no or low' or 'medium investment in processing facilities', 'negative impact from initial processing costs', 'low' or 'medium processing technology', 'decrease' or 'no change in processing costs', 'negative' or 'no impact of current processing costs' on the industry, or 'production undersupply' or 'sufficient supply' are, by definition, disregarded as critical causal conditions as none have a clear correlation with either success or non-success.

4.2.10 Satisfying the Markets

The competitiveness of the new New Zealand product was addressed in this tenth category. The first and second variables respectively enabled a 'quality' and 'price comparison' to be made between the New Zealand product and the same product from offshore producers, whether on domestic or export shelves. Following this comparison, the question of whether 'improvements' in the quality and price of the New Zealand product was a continual, spasmodic, or non-existent process was addressed. As with the breadth of involvement in initiating the research and development process, the range of people and/or organisations involved in improving the quality and price of new products was measured and merged into narrow or broad 'improvement initiation'. Finally, the 'quality control' measures used in each of the case studies, their guardian and timing was recorded by the last variable. This category therefore included five independent variables and a refined total of 12 possible responses.

Success

Essential Prime Implicants	=	BDGJ + ADGJ + BFghj + BEghJ
Necessary Conditions	=	A (1/1) Quality is above standard
	=	B (3/3) Quality is equal to standard
	=	D (2/2) Price is above competitors
	=	E (1/1) Price is equal to competitors
	=	F (1/1) Price is below competitors
	=	h (2/2) No or limited improvement initiation
	=	**J (3/4) Multiple quality control mechanisms**

Non-Success

Essential Prime Implicants	=	ADhj + CDghj + AFghj + BEghj + BDghj + ADghj + BEGHj + AEghJ + BEGhJ + ADgHj + BFGhJ
Necessary Conditions	=	A (5/5) Quality is above standard
	=	B (5/5) Quality is equal to standard
	=	**C (1/1) Quality is below standard**
	=	D (5/5) Price is above competitors
	=	E (4/4) Price is equal to competitors
	=	F (2/2) Price is below competitors
	=	h (9/11) No or limited improvement initiation

The Boolean algebraic analysis of the case information for this "Satisfying the Markets" category shows one necessary conditions for success, one necessary condition for non-success, and six contradictory necessary conditions. The necessary condition for success is the presence of 'multiple quality control mechanisms' throughout the industry. The necessary condition for non-success is an 'inferior quality comparison' of the New Zealand new product than its marketplace competitors.

The six contradictory necessary conditions of an ‘above’ or ‘equal to standard quality comparison’, an ‘above’ or ‘equal to’ or ‘below standard price comparison’, or ‘no or limited initiation’ in quality and price improvements of the New Zealand new product are, by definition, disregarded as critical causal conditions as none have a clear correlation with either success or non-success.

4.2.11 Current Issues

The final category considered the existence or non-existence of ‘current threats’ and the ‘level of action’ taken by the industry organisation to address these threats. This category therefore included just two independent variables and a refined number of six possible responses.

Success

Essential Prime Implicants	=	No essential prime implicants for success exist, therefore
Necessary Conditions	=	No necessary conditions for success exist

Non-Success

Essential Prime Implicants	=	BD + AD + CF
Necessary Conditions	=	**A (1/1) No or low current threat**
	=	**B (1/1) Medium current threat**
	=	**D (2/2) No or low current action**
	=	**F (1/1) High current action**

The Boolean algebraic analysis of the case information for this “Current Issues” category shows no necessary conditions for success (in fact, not even any non-contradictory primitive expressions), four necessary conditions for non-success, and no contradictory necessary conditions. The four necessary conditions for non-success include ‘no or low’ or ‘medium current threats’ to the survival of an industry or ‘no or low’ or ‘high current action’ by the industry organisation in response to those threats.

4.3 Conclusion

This chapter has presented the outcomes of the Boolean algebraic analysis of the case information and identified the critical causal conditions for both success and non-success, as well as the contradictory necessary conditions. This analysis and its results have been presented using the 11 categories of the industry questionnaire. The disparate results from each category are synthesised and discussed in the next chapter.

Chapter 5
Results Synthesis and Discussion

5.1 Introduction

The Boolean analysis in Chapter 4 found 56 necessary conditions for the success or non-success of new land-based industries. These conditions are thus the 'key variables' associated with the development of new industries. This discussion takes these key variables back into the broader theoretical and empirical framework presented in Chapters 2 and 3 and examines links across the various categories. The key variables are merged into a synthesised, industry-wide synthesis of key success (and non-success) factors for new land-based industries.

The first and most substantial part of this discussion revolves around three key variables related to "Industry Organisation and Co-operation". These three key variables - the presence of an industry council, extensive functions, and extensive exogenous interactions - are critical for new industry success. A large number of the remaining key variables for success corroborate these three central key variables. Moreover, the three key variables for success are almost perfectly reflected in three key variables that are critical for non-success, and these are discussed as the inverse of the success variables. Thereafter, the remaining but still reasonably important key variables, critical for either success or non-success, are expanded systematically from category one to category eleven. This discussion also incorporates additional empirical information gained from the 22 cases (seven successful and 15 non-successful) to substantiate the algebraic results derived from the Boolean analysis.

5.2 Key Variables

Table 4 lists all the necessary conditions (hereafter referred to as 'key variables'), with their frequency threshold qualification in brackets, for success and non-success for the 11 categories. In compiling these lists, it was recognised that some key variables were of such low frequency - present in just one or two essential prime implicants, despite meeting the criteria used in the identification of necessary conditions - that they were considered to be of insufficient strength to be of any credible utility. The decision was taken, therefore, to omit from this discussion the 19 of the 56 variables that were only present in less than three essential prime implicants. These weak key variables are contained within the special brackets ({}) in the following table.

Table 4: Summary Table of Success and Non-success Key Variables by Category

QUESTIONNAIRE CATEGORY	KEY VARIABLES FOR SUCCESS (26)	KEY VARIABLES FOR NON-SUCCESS (30)
1. Origins and History of Industry	d (3/3) Limited initial problems	B (3/4) Improved financial returns
2. Product Characteristics and Environmental Requirements	{e (2/2) Limited environmental requirements}	a (4/4) Old source, but new to New Zealand
3. Industry Organisation and Co-operation	A (4/5) Industry council B (3/4) Extensive functions C (5/5) Extensive exogenous interactions	a (11/12) Grower association b (9/12) Limited functions D (4/4) Low exogenous co-operation I (3/3) Low producer input J (5/5) Medium producer input {L (1/1) Low producer satisfaction} M (3/3) Ambivalent producer satisfaction
4. Production Inputs and Capital Investments	F (3/3) Government enticements	f (5/6) No government enticements {I (1/1) High production technology}
5. Marketing and Market Development	f (6/7) No process market G (6/7) Export market l (6/7) No restaurants or cafes market clients M (6/7) Food retail market clients n (7/7) No health or souvenir retail market clients O (7/7) Wholesalers and/or importers market clients T (3/3) High marketing expenditure	i (13/15) No European export markets W (3/3) Increasing marketing expenditure x (14/15) Limited marketing techniques
6. Financial Resources	{C (1/1) High initial finance} F (2/2) Positive initial impact L (3/3) High current finance	J (5/5) Low current finance {M (2/2) Negative impact current finance}
7. Research and Development	B (4/6) Extensive initiation H (3/3) Positive cost impact {K (1/1) High genetic engineering	b (7/8) No or limited initiation {J (1/1) Medium genetic engineering} {M (1/1) Medium pest and disease control} {O (2/2) Negative contribution}
8. Government Regulations and Controls	{C (1/1) High initial government regulations} {O (1/1) Positive current impact	H (6/6) No change in regulations {V (2/2) Mild industry satisfaction}
9. Processing	a (5/6) Adapted initial processing facilities {F (2/2) No initial processing cost impact} j (5/6) Centralised current processing facilities M (3/3) High processing technology	{G (1/1) Positive initial processing cost impact} P (3/3) Increase in processing costs V (3/3) Production oversupply
10. Satisfying the Markets	J (3/4) Multiple quality control mechanisms	{C (1/1) Quality is below standard}
11. Current Issues	No necessary conditions or key variables	{A (1/1) No or low current threats} {B (1/1) Medium current threats} {D (2/2) No or low current action} {F (1/1) High current action}

5.3 Discussion of Key Variables

The first fundamental result of this research project is the presence of three mutually reinforcing key variables critical for success. They are all from the "Industry Organisation and Co-operation" category, and include: (1) the existence of an 'industry council' (A); (2) an industry organisation with 'extensive functions' (B); and (3) 'extensive interactions' with exogenous groups (C). A new industry that is able to establish an industry council with extensive functions and wide-ranging interactions with outside groups and networks as its formal organisation is far more likely to have succeeded than those that do not achieve this level of organisation. The type, functions and interaction of an industry's formal organisation are therefore critical factors for success. This key finding of the Boolean analysis is substantiated by the empirical information gathered on the 22 new industries. It became evident during the data gathering and collation that, as a generic formula, industry councils, or similar organisation, with umbrella responsibility, overseen by a mixed board of producers and business professionals, and staffed by full-time paid employees, were far more successful than less formal and limited types of industry organisations.

The three key variables critical for non-success, also from the "Industry Organisation and Co-operation" category, are almost the mirror image of those for success. These are: (1) the existence of a 'grower association' (a); (2) an industry organisation with 'limited functions' (b); and (3) a 'low level of co-operation' with exogenous groups (D). The first two key variables are the direct inverse of those for success, while the third is only slightly different from its corresponding success key variable. These three critical non-success key variables, therefore, are also mutually reinforcing and combine to succinctly express a second fundamental result of this research project for non-success. A new industry that only has a grower association with limited functions and a low level of co-operation with exogenous groups is far less likely to succeed than those that do achieve the above criteria. The type, functions, and co-operation of an industry's formal organisation are therefore the critical factors for non-success. Again, this key finding of the Boolean analysis is substantiated by the empirical information gathered on the 22 new industries. It became evident that, as a generic formula, grower associations, with bounded capacity and therefore limited functions, reliant on voluntary workers with agronomic rather than specific business skills, were far less likely to succeed than more formal and expansive types of industry organisations such as councils.

At this point it is opportune to recall an important point made towards the end of Chapter 1. That is, in presenting these correlations between the above key variables and success and the above key variables and non-success, we acknowledge that a new industry's success or non-success is in part a function of its age. Thus, these features of a new industry are to some degree the effect of success or non-success rather than simply the cause of success or non-success. Therefore, the key variables identified for success or non-success in fulfilment of the first objective of this research should be conceptualised as being associated with that outcome rather than causally connected to the outcome.

As noted in the introduction, these two opposite but reinforcing sets of three critical key variables provide the structure for the first and most substantial part of this discussion, within which other related key variables for success or non-success are also examined. Each of the three primary success key variables are taken in turn, linked with secondary explanatory or complimentary success or non-success key variables, and then the corresponding critical non-success key variable is examined to further strengthen the discussion of each critical success key variable.

5.3.1 Role of Industry Councils

The two most glamorous examples of the correlation between 'industry council' (3A)[1] and success were the New Zealand Game Industry Board (GIB) of the deer industry and the New Zealand Mussel Industry Council (MIC). Both the GIB and the MIC are multi-million dollar operations that are prominent not only in New Zealand but are also leaders in the global marketplace. Although extremely professional in structure and operation, there is little doubt that some considerable degree of the GIB's and MIC's success comes from the global uniqueness of their product. New Zealand was the world founder of farmed deer, a commercial operation that had its origins in the 1960s export of feral deer carcasses to Germany, and consequently still holds a 20 year advantage over other producers. Currently, New Zealand venison, marketed under the brand name Cervena© in North America and domestically since 1993, is highly desired on the global market, while more recent initiatives in deer velvet products have kept the GIB ahead of competitors. While other countries have also moved into mussel farming, New Zealand's Greenshell© mussel, *Perna canaliculus*, is now a registered trademark of the MIC and remains a unique product distinct from and superior to the blueshell mussel grown in other parts of the world.

The uniqueness of these two products has undoubtedly given the GIB and MIC a global competitive edge that most new industries do not share. Indeed, the uniqueness of Cervena© venison and the Greenshell© mussel draws attention to the presence of the 'old source, but new to New Zealand' key variable (2a) on the non-success list of the "Product Characteristics and Environmental Requirements" category. This result means that while some old sources of new products (i.e., those already produced elsewhere in the world) were successful and the majority were non-successful, there were no instances of new sources of new products being non-successful. The implication is that if a new product is unique on a global scale it is more likely to be successful. When that competitive advantage is supported with a formal industry council, success appears even more certain, as the examples of the Game Industry Board and the Mussel Industry Council testify.

The inverse of this correlation between industry council and success is the key variable for non-success of 'grower associations' (3a) as the industry organisation. There was a large proportion (11 out of 12 cases) of grower associations within the non-successful new industries. In fact, in the original data before it was reduced by grouping in the truth table, there were 13 out of 15 cases of grower associations within the non-successful new industries. Perhaps the most illustrative example was the New Zealand Passionfruit Growers' Association, an industry organisation that certainly highlights the difficulties of reliance on voluntary grower administrators. A member of the Association's executive claimed he was in that position more by default than election, and his off-farm employment meant that time and effort for passionfruit matters was limited. Moreover, this grower was about to remove his own passionfruit vines and leave the industry but there was no replacement arranged for his executive position. Circumstances such as these clearly limit a grower association's capacity to undertake a wide range of functions and engage in extensive or highly co-operative interactions with outside groups and broader networks.

The impact of these circumstances on the passionfruit industry is profound. There is only a limited export market, with only about 40 per cent of New Zealand's production going offshore, but this is also susceptible to fluctuating prices. Moreover, New Zealand passionfruit does not maintain its identity on foreign food retail shelves, hindering market development and sales returns. The New Zealand passionfruit industry is small and transient, in part a result of a vine disease problem that affects yields, quality, and the viability of planting and maintaining passionfruit orchards. The size of the domestic industry is such that it cannot supply a 200 tonne per year process market, and passionfruit pulp is consequently imported. The effect is that the New Zealand Passionfruit Growers' Association accomplishes little more than information dissemination within the industry,

[1] In this notation, the number refers to the list of categories given in the preceding section and the letter refers to the particular variable within this category. This notation is used throughout this discussion.

local market promotion and a limited amount of research and development, and is an illustrative example of a limited function grower association correlating to a non-successful new industry.

Three further inferences regarding the ideal form of industry organisation can be made from the key variables for non-success from this "Industry Organisation and Co-operation" category. First, the presence of a 'low level of exogenous co-operation' (3D) between an industry organisation and outside groups as a key variable for non-success indicates that as the level of exogenous co-operation increases so to does the likelihood of success. This relationship is not a direct correlation, however, because a high level of exogenous co-operation is not a key variable of success, but the absence of low exogenous co-operation on the success list is suggestive of this association between higher exogenous co-operation and an increased probability of success. A comparison of the garlic and asparagus industries illustrates this modest association. The Marlborough-based garlic industry, which is small and currently faces many significant problems, has limited interaction and co-operation with outside networks. For example, the industry organisation, the New Zealand Garlic Export Council, withdrew from the Horticultural Export Authority in the late 1990s as the latter began to focus not on maximising return to garlic growers but on simply maximising export returns. The industry, according to one influential grower, has been in limbo ever since. In contrast, the New Zealand Asparagus Council is extensively involved, amongst other agencies, with the New Zealand Vegetable and Potato Growers' Federation (Vegfed). The total sales value of the asparagus industry in 1999 was in excess of $25 million.

Second, the presence of a 'low level of producer input (3I)' or 'medium level of producer input' (3J) into an industry organisation's decision and policy-making process on the non-success list of key variables suggests that the retention of a higher degree of producer input is a desirable feature of industry organisations. Again, however, this proposition is only a modest association and not a direct correlation, for a high level of producer input is linked to both success and non-success. The important point is that there are no instances of low or medium producer input levels that correlate with success. Again, this modest association is demonstrated by two of the cases. First, the New Zealand Emu Farmers' Association has deliberately minimised the level of producer input as it attempts to launch the industry. On the other hand, the New Zealand Deer Farmers' Association nominates four of the nine directors of the New Zealand Game Industry Board, maintaining a high level of producer input into and oversight of the industry council.

Third, the presence of producer 'ambivalence' (3M) towards the performance of the industry organisation when combined with the presence of a 'low level of producer dissatisfaction' (3L) are related key variables for non-success. They suggest their opposite, namely that an industry organisation that pursues and maintains producer satisfaction with its performance is another advantageous attribute. The suggestion is only tentative because the later variable has only one instance and is otherwise not included in this discussion. Again, this result is tentative because there is not direct correlation, and high levels of producer satisfaction are not key variables of success. However, the fact that no instances of low dissatisfaction or ambivalence were successful lends weight to this argument that as producer satisfaction increases so to does the probability for success. Indeed, it seems probable that this and the preceding result on producer input are linked. Perhaps the beneficial consequence of a high level of producer input into an industry organisation's decision and policy making process is the means by which higher degrees of producer satisfaction are achieved and sustained. This potential link is supported by an extension of the two preceding examples, with a member of the New Zealand Emu Farmers' Association's Executive claiming that producers tend to blame the Association for the industry's problems in general, and lack of expansion in particular. In contrast, an employee of the Game Industry Board claims that 96 per cent of deer farmers expressed support for the GIB in a recent poll.

In summary, the first critical key variable for industry success is the presence of an industry council as a new industry's formal organisation. Such councils are closely correlated with success. Grower associations have a stronger correlation with non-success. Two examples of the former and one of the latter relationships highlighted these specific correlations, and the differences between them. Moreover, three non-success key variables, also supported by empirical evidence, were used to make inferences about specific attributes of successful industry organisation. While these inferences - including positive relationships between exogenous co-operation, producer input, and producer satisfaction on the one hand and success on the other - are not direct correlations, they are derived from strong associations. The existence, therefore, of an industry council with these features is far more likely to lead a new industry to success than a grower association without these features.

5.3.2 Role of Industry Organisation Functions

The second critical key variable for success is that of an industry organisation with 'extensive functions' (3B). It is evident from the above discussion of industry councils compared to grower associations that the former are able to engage in a much broader range of functions than the latter, thus the above results are connected to the results here. Questionnaire results show that these functions include: (1) the regulation of production and processing; (2) the flow of information between different parts of the industry; (3) local promotion and export marketing; (4) establishing quality control regimes; and (5) overseeing research and development. An active involvement by an industry council in more than half of these functions - and undoubtedly some other secondary tasks as well - will significantly increase that industry's likelihood of success. Furthermore, most of the key variables, for both success and non-success, of three other categories – marketing, finance, and research – are related to industry functions. In the discussion that follows these functions are examined in detail. Thus, a number of categories are considered together to show precisely how extensive functions of an industry are carried out.

The first of these three other categories, that of "Marketing and Market Development", produced the somewhat surprising result that the entity that undertakes the marketing of a new product is not a powerful determinant for success or non-success. This result flows from the absence of any correlation between marketing by 'industry organisation' (5A), 'individual producers' (5B), 'dedicated processors/exporters' (5C), or 'generic processors/ exporters' (5D) and success or non-success. Because there was no correlation, these terms do not appear in Table 4. As shall be demonstrated in the following discussion, however, that the marketing of a new product does get done is critical to success; who does the marketing is therefore not as important as how and what is done. The other key variables that are present in this category, for both success and non-success, are of significantly more utility and highlight the importance of marketing and market development.

The most important of these key variables in this regard is the presence of only 'limited marketing techniques' (5x) as a crucial factor for non-success. This result is entirely logical, for a new product that is not marketed sufficiently is unlikely to break into and expand markets, either domestic or export. This was certainly the case, for a variety of reasons, with the fledgling babaco industry in New Zealand during the 1980s. A limited marketing campaign was unable to overcome consumer ignorance about this Ecuadorian subtropical fruit on the domestic market, and the industry never established itself to launch an export campaign. In the words of the babaco industry champion, who first brought the plant to New Zealand and attempted to produce the fruit commercially, the lack of a sufficient marketing campaign "is the sole reason that interest has waned in babaco growing over the years".

While this correlation between limited marketing and non-success makes sense, it is somewhat of a surprise that the inverse, or 'extensive marketing techniques' (5X), was not a key variable for success and therefore is not listed in Table 4. This result means that some new industries with only limited marketing techniques were successful, and also that all new industries with extensive

marketing techniques were successful. Moreover, the correlation between limited marketing techniques and non-success represents a very strong cause and effect relationship. This algebraic result is backed up by empirical impressions that industries, or more accurately industry organisations, and especially councils, with sophisticated marketing strategies were far more successful than industries with *ad hoc*, piecemeal marketing approaches. The New Zealand Buttercup Squash Council, for example, has a broad but integrated marketing strategy codified in a thorough 32 page Export Marketing Strategy document. Indeed, in 1995 the Buttercup Squash Council won a prestigious Television New Zealand/Marketing Magazine award for marketing excellence, with the judges' commenting that the Council:

> "is to be commended particularly because it was already doing brilliantly. To target going even further was a real achievement…There is not a single thing they failed to do in targeting that (Japanese) market" (*Marketing Magazine* August 1995:48).

Limited marketing techniques, therefore, are an undoubted obstacle for success, while extensive marketing techniques are certainly a beneficial aide for success.

A second empirical impression in this context was that the problem of limited marketing techniques is exacerbated when combined with the presence of 'extensive marketing problems' (5Y). Clearly, a new industry that faces significant marketing obstacles with only limited marketing tactics while trying to establish itself is far less likely to succeed than one with only few problems and few techniques. Although this empirical impression was not verified by the Boolean analysis, by returning to the data table (Appendix 2) it is evident that seven out of the eight cases with limited marketing techniques but extensive marketing problems were non-successful. (The reader is reminded that because of the presence of one contrary case this variable was not included in the key success results.) An illustrative case in point is the tamarillo industry, which suffers from this coupling of limited marketing techniques with extensive marketing problems. In New Zealand, the tamarillo tree is infected with the tobacco mosaic disease that affects yield, quality, and the life expectancy of the tree itself. As a consequence, undersupply, low quality, and therefore low returns are all marketing problems endemic to the tamarillo industry, thus not only causing but widening the gap between techniques and problems. The implication for such new industries, therefore, is that it is important to overcome marketing problems before attempting to expand marketing techniques.

After this problem of limited marketing techniques, the second most important key variable from this marketing category is the presence of an 'export market' (5G) as a critical factor for success. While not all of the new industries with strong export markets were successful, the crucial point is that those new industries that were successful did have a strong export market and those new industries that did not have such a market were non-successful. The explanatory reasoning here is twofold. First, export markets are much larger than New Zealand's limited domestic market, thus economies of scale are more favourable. Second, export markets tend to be more affluent and amenable to paying 'top-dollar' for high quality imported products, whereas the scope for premium prices for New Zealand product on domestic markets, regardless of quality, is limited. The result for the new industry is the opportunity for greater volumes at better prices and consequently more attractive returns to producers.

The price for process asparagus in New Zealand, for example, was expected to be $2.10 per kilogram in the 1999 harvest, with prices for fresh asparagus expected to be only slightly above this level. Prices for export asparagus, however, were significantly higher. In 1998/99, premium South Island purple asparagus sold for up to $6.00 per kilogram in Japan, while more traditional varieties earned $3.18 per kilogram. With a combination of lower Australian production and a favourable exchange rate, the 1997/98 season produced average export prices of $7.50 on average per

kilogram, the highest in ten years (Burtt, 2000). Such circumstances are probably critical at the outset of a new industry, for it helps promote a good image of the new industry, sustain initial growth and continue to attract investment and new producers. Given the dangers of the perception amongst potential new producers of significantly improved financial returns at the beginning of a new industry (discussed more fully below), however, over-inflated, unrealistic and ultimately unsustainable prices and returns at the start of a new industry are not desirable.

The importance of good export returns was verified by impressions gained during the interviews: many respondents knew instinctively that establishing a sustainable export market was a priority for any new industry. This result is further supported by the presence of 'wholesalers and/or importers' as market clients (5O) as a key success variable. Clearly, the existence of importers as market clients implies the presence of an export market, reinforcing the preceding result. This Boolean result and the empirical impressions suggest that opening and expanding export markets should be one primary focus of the marketing strategy of a success-oriented new industry.

The high correlation between the absence of a 'European export market' (5i) and non-success also supports this argument about the importance of exports for success, but does so with more than a touch of irony given the supposed end in the 1960s of New Zealand's historical reliance on European markets. This paradox strongly suggests that for a new industry to ignore Europe as an export market is to run a very high risk of non-success. Indeed, by referring back to the essential prime implicants for success, it can be seen that the presence of European export markets (5I) appears in five of the seven essential prime implicants, and therefore missed qualification as a key variable for success by only one term. This strong dichotomy between Europe and success on the one hand and not Europe and non-success on the other suggests that this is one region that fulfils the high volume, affluent market characteristics proposed above as possible reasons why export markets are so critical to new industry success.

Further, the absence of a process market (5f) as a key variable for success supports this affluence hypothesis. Process markets, defined as the can and juice markets for fruit, are the large volume, low return markets for low quality or otherwise un-sellable, excess product. A common feeling amongst interviewees was that selling a new product to a process market was an inherently undesirable phenomena, more so if it begins to dominate fresh markets, whether domestic or export, and disastrous if it becomes the reliant market of a new industry. This impression is a simple economic one, as prices paid for process grade or excess product, especially fruit and vegetables, are so low that even the cost of harvesting the product may make it unprofitable for the producer. Prices for process grade feijoas are illustrative here, with growers receiving between $0.50 and $0.90 only per kilogram in 1999. The low prices for process feijoas compares to around $4.00 per kilogram on both the local and export fresh market, depending on size and time of season (Burtt, 2000). Avoiding a process market, or at least not having a process market as a significant part of total sales, therefore, appears another key strategy for success in new industries.

The undesirability of a significant process market is further substantiated by the presence of 'production oversupply' (9V) as a key variable for non-success. An overabundance of product may mean the process market becomes the only viable outlet for this excess production, but its capacity to absorb high volumes is countered by the consequently low prices. This oversupply key variable is, however, an intriguing result, because intuition would suggest that 'production under-supply' (9T) would constitute the threat on this issue, not the opposite, for volume is surely critical in securing new markets. One Canterbury walnut processor, for example, is desperate for higher volumes to satisfy a small but under-supplied clientele. On the other hand, however, the experience of the feijoa industry noted above, and other examples like it, suggest that oversupply is indeed a problem. The implication, therefore, is that a balance between supply and processing capacity (outside the process market, for normal processing and value added products) is desirable.

The importance of an export market is also reflected in three other key variables for success from the "Marketing and Market Development" category. These three key variables are the absence of 'restaurants and cafes' (5l), the absence of 'health and souvenir shops' (5n), and the presence of 'food retail outlets' (5M) as market clients. The absence of the first two of these three types of market clients, which are all overwhelmingly domestic operations, illustrates the predominant focus of successful new industries on export markets. Both restaurants and cafes, and health and souvenir shops may provide a lucrative 'top-end' of the domestic market during the novelty stage of a new product's life, but they are likely to not only involve low volumes but also inconsistent demand. The current situation of one Nelson Emu farmer and processor highlights both of these problems, for the business is reliant on small volumes and spasmodic (often one-off) orders from restaurants and cafes wanting Emu meat as a menu special. Such outlets, therefore, are unlikely to require the necessary volumes and consistency of demand to sustain an entire industry.

Moreover, high initial prices that may be obtained from the above domestic outlets are probably a short-term phenomenon. Once the novelty phase passes such retail outlets are more likely to purchase products from wholesalers, rather than directly from producers themselves, thus bringing down the price and reducing returns to the grower. Short term high prices are a fear of the olive industry, for example, with the current retail price for the first New Zealand produced Extra Virgin olive oil of $100 per litre being viewed by many as untenable. Such new industries may therefore be unsustainable at such price levels.

Conversely, the single food retail type of market client (5M) that is present on the domestic market suggests that a focus on those domestic outlets that require significant volumes, albeit at lower prices, will increase a new industry's likelihood of success. In combination, therefore, these three key variables suggest that it is better to target, on the domestic market at least, higher volume, lower price market clients in order to establish and maintain a stable and sustainable new industry.

These twin results pinpointing the need for price-oriented export and volume-oriented domestic market clients indicate that a sophisticated, double-edged marketing and market development programme is necessary for success, and this is certainly verified by the presence of a high marketing expenditure as a key variable for success (5T). Clearly, mounting a foreign commercial marketing campaign is far more expensive than a local domestic market operation. Moreover, as a concerted export marketing strategy is well beyond the capacity of most grower associations, this result also reinforces the need for an industry council with marketing and market development as one of its central functions. The challenge, of course, is for new industries to reach a point where such marketing expenditure is possible and sustainable.

The final key variable for non-success from this marketing category is an 'increase in marketing expenditure' (5W) over the last two to three years and at first glance is an anomalous result. Given that a high level of marketing expenditure was shown above to be a key variable for success, one would have thought that an increasing level of marketing expenditure in recent times would have been more closely associated with success than non-success. The probable explanation, however, is that a currently expanding marketing budget does not necessarily mean it has reached the high level associated with success above. Indeed, the total absence of an increase (5W) and the dominance of no change (5V) in the level of marketing expenditure in the essential prime implicants for success lend strong support to this argument. This result illustrates that successful new industries, once established, do not need to continually expand their marketing budgets - they have reached their marketing plateau. They may continue to review, update and improve their marketing strategies, but this does not necessarily result in an actual increase in expenditure, just a change in how and where that marketing money is spent. This result, therefore, possibly has more to do with the age of new

industries, with younger enterprises still increasing their marketing budget, rather than their actual current or future level of success.

The range of marketing activities that an industry organisation is able to undertake is clearly influenced by the level of its marketing budget. A small, even if increasing, level of marketing expenditure will clearly limit marketing techniques, which in turn reduces the chances of industry success. The marketing and market development activities undertaken by an industry organisation, therefore, are at least one aspect of its range of functions determined, at least in part, by the organisation's monetary base.

This hypothetical link between finance and functions and success or non-success is strengthened considerably by an inverse but therefore mutually reinforcing pair of key variables in the "Financial Resources" category. This couplet is the presence of 'low current finance' (6J) on the list of key non-success variables and the presence of 'high current finance' (6L) on the list of key success variables. A low financial status therefore limits industry organisation functions that, as we have seen, is a key variable critical for non-success. The New Zealand Garlic Export Council, for example, lost its production levy funding in the late 1990s and has effectively been a dead-letter ever since. Conversely, a high financial status expands industry organisation functions that, as we have seen, is a key variable critical for success. Again, the two prime examples are the Game Industry Board and the Mussel Industry Council. While this relationship between finance and success may appear obvious, the strength of this result is particularly robust – because both sides of the same relationship are present – and is therefore even more worthy of emphasis. Similarly, while it is probable that half of this relationship is a consequence of industry organisations being financially sound because they are successful, the reverse is also true and again worthy of emphasis. Industry organisations that are financially responsible, limit expenditure to income levels, and focus those resources on priorities, are far more likely to succeed than those who contravene these essential financial practices.

A secondary key variable for success under financial resources but of slightly less utility than the above pair is the positive initial impact (6F) of an industry organisation's financial status. This result suggests that it is important for an industry organisation to 'get off to a good start' financially and, given the previous key variable for success, to maintain such a strong beginning. One such example is the New Zealand Asparagus Council, which benefited considerably from significant early income from production levies. Again, this relationship may seem intuitively obvious, but its presence as a key success variable gives it strong credibility.

If the marketing and market development activities of an industry organisation are dependent, at least to some degree, on its financial resources, as hypothesised earlier, then so to are its research and development functions. As with the financial resources pairing above, the "Research and Development" category produced a critical, inverse coupling that mutually reinforces the same result. This fundamental result from one of the more important categories is the dual correlation between a 'extensive initiation' (7B) of a new industry's research and development programme and success on the one hand and a 'no or little initiation' (7b) of research and development and non-success on the other. Hence this very robust result demonstrates that when many industry sectors, for example, producers, processors, industry organisation, and research and development agencies themselves, are involved in instigating the research and development process there is industry success. The Game Industry Board is an illustrative example here also, with a processors' technical committee, the Deer Farmers' Association, marketing companies and specific research and development agencies all contributing to the deer industry research agenda. Moreover, the result also demonstrates that the reverse is also true, that the fewer industry sectors involved in this initiation the less likely a new industry is to succeed. This non-success and limited involvement in research and development is a fate that has befallen, amongst others, the feijoa, passionfruit, and

tamarillo industries. It is therefore critical that an industry organisation does not insulate the research and development agenda from any industry sector, for the correlation between an open research and development process and success and a closed research and development process and non-success is very apparent.

A more direct relationship between financial resources and research and development functions is evident in the second key variable for success, that of a 'positive cost impact' (7H) with a new industry's research and development programme. Clearly, a prohibitively expensive research and development agenda could mean that no such work is undertaken, or that if some work is done then it will be small, achievable tasks only. The danger of this approach is that it increases the likelihood that major, critical items will not be addressed and the contribution of research and development to the new industry will be limited accordingly. Indeed, many interviewees from non-successful new industries indicated that research and development agendas often amounted to doing what the industry organisation can afford to do, not what is both urgent and important to do. Perhaps the most illustrative example of this came from an executive member of the New Zealand Chestnut Council, himself a research scientist, who stated that the Council's lack of money is holding back research to the point where the Chestnut industry has been "sitting on key issues for years. Smaller, specific projects get done, but there are no resources for multi-year projects".

In these cases there is a movement away from a 'positive' (7H) and towards a 'negative cost impact' (7F) of a new industry's research and development programme. Although this latter condition did not come through the Boolean minimisation as necessary for non-success, the essential prime implicants show that this was only because just one of the essential prime implicants for success included a negative cost impact from research and development. Therefore, this single instance automatically but somewhat erroneously rules out the five instances of a negative cost impact from research and development in the essential prime implicants for non-success. This rather arbitrary result highlights another minor problem with the Qualitative Comparative Analysis method: a single contradictory instance has the power to effectively eliminate arelationship from consideration.

The above paragraphs show how extensive functions (3B) are manifest in successful industries. There is an equally strong relationship between 'limited functions' (3b) and non-success. These two results, therefore, are mutually reinforcing and emphatically demonstrate that extensive functions correlates with success and limited functions correlates with non-success. The former relationship has been examined in detail, with many other key variables linked to and supportive of this critical result. Unfortunately, however, there are few strong other key variables that are connected to or substantiate this relationship between limited functions and non-success. The following points, therefore, are somewhat fewer but still add considerable flesh to this association between cause and effect.

The first point in this regard is to reiterate the importance of this main result itself, the direct correlation between limited industry organisation functions and non-success. That three quarters of the essential prime implicants for non-success and only one of the five essential prime implicants for success include limited functions is incontrovertible evidence of this association. In turn, this association is juxtaposed with the opposite relationship between extensive functions and success, meaning that these two results are mutually reinforcing.

The only other key variable that substantiates this 'limited functions equals non-success' relationship is the presence of 'low current finance' (6J) as another key variable for non-success. Indeed, just as the correlation between high current finance and success was central to the preceding discussion of the finance – function relationship, so to is this correlation between low current finance and non-success central to this discussion on the inverse of that finance – function

relationship. In other words, the correlation between extensive functions and high current finance and success on the one hand and limited functions and low current finance and non-success on the other are not only mutually reinforcing pairs within themselves, but also mutually reinforcing of the other pair. Industry organisations with high current finance that are consequently able to undertake a broad range of functions, therefore, are far more likely to succeed than those with low current finance that are consequently able to only engage in a narrow range of functions.

There are numerous instances of this dual pairing in the 22 cases examined. For example, the New Zealand Buttercup Squash Council, the Mussel Industry Council, and the Persimmon Industry Council are all high finance, extensive function organisations of successful new industries. Conversely, the New Zealand Feijoa Growers' Association, Chestnut Council, and Tree Crops (Walnuts and Hazelnuts) Association are all low finance, limited function organisations of non-successful new industries. The same general point, therefore, is arrived at through these two different approaches of extensive and limited functions, respectively substantiated by the high and low current finance key variables. Industry organisation capable of undertaking a broad range of functions is far better placed to advance a new land-based industry than an industry organisation with minimal roles.

5.3.3 Role of Extensive Interactions

The third and final critical key variable for success, that an industry organisation with 'extensive exogenous interactions' (3C), extends this point regarding extensive functions. By implication an industry organisation that fulfils extensive functions is more likely to engage in extensive interactions with outside individuals and groups. This association was implicit in the above discussion, where extensive marketing techniques on both the domestic and export markets will bring an industry organisation into contact with not only producers and processors, but local market representatives, market clients of all descriptions, exporters, foreign importers, marketing and advertising agencies, amongst others. Similarly, an industry organisation with an active research and development programme will inevitably have to interact, for example, with research providers, Crown Research Institutes, and public funding agencies. New industries with extensive functions will also encounter hygiene and safety authorities, boarder control organisations (at home and abroad), overarching government departments, broader agricultural and horticultural networks, and a whole range of other minor groups.

This correlation between extensive exogenous interactions and success is to a large extent mirrored, although certainly not perfectly, in the third key variable for non-success, that of a 'low level of exogenous co-operation' (3D). The difference between exogenous interaction and exogenous co-operation is that the former is an indication purely of the number of outside groups with which an industry organisation interacts, while the latter is an assessment of how well an industry organisation co-operates with those outside groups. The two variables are therefore slightly different, but the link between them is strong: an industry organisation with extensive interactions is more likely to have a high level of co-operation, while an industry organisation with limited interactions is more likely to have a low level of co-operation. Thus, the presence of a low level of exogenous co-operation as a key variable for non-success compliments well the presence of extensive exogenous interactions as a key variable for success.

These two sets of key variables for success and non-success can be summarised as three corresponding pairs (that is, 3A and 3a, 3B and 3b, and 3C and 3D) that are mutually reinforcing and, because they link to so many of the other key variables for both success and non-success, provide the first, double-edged fundamental result of this research project. That result is to propose that the ideal form of industry organisation is an industry council with an extensive range of functions and a high level of exogenous interaction with outside groups. These three components are critical in themselves, but even more so because they form a central hub around which many

other key variables – for both success and non-success – revolve. Moreover, the three central key variables for non-success form an inverse but reinforcing hub – again with other key variables rotating around it – that proposes a somewhat less than ideal form of industry organisation. This less than perfect style of industry organisation is a grower association with a limited range of functions and a low level of exogenous co-operation with outside groups. This discussion has emphatically demonstrated the strong correlations between multifaceted, highly interactive industry councils and success on the one hand and grower associations and non-success on the other, the first fundamental result of this research project.

5.3.4 Other Key Variables

Beyond the two sets of three key variables for success and non-success just discussed, 13 key variables remain. While these key variables fall outside of the main discussion just completed they are, in fact, of equal importance as key variables for either success or non-success. The following discussion, therefore, continues in the same vein by identifying each key variable, explaining its wider theoretical relevance, identifying links between two or more key variables and providing illustrative examples for each.

The first of these remaining key variables is the presence of only 'minimal initial problems' (1d) in the early stages of an industry's life, which is closely correlated with success. Although just minimal initial problems were also present in four out of six of the non-success essential prime implicants, contrasting with the presence of significant initial problems in the other two, the critical point of this algebraic result is that the essential prime implicants for success ONLY include minimal initial problems. In other words, there are no instances of success with significant initial problems. This algebraic result demonstrates the robustness of the Boolean analysis, for it is theoretically logical that new industries, struggling to establish themselves even in the best of circumstances, will simply disintegrate if they are faced with significant problems in their early years. These problems may not be overwhelming to an established enterprise, but may be serious enough to prove fatal to a new industry. This downfall was precisely what happened to the fledgling babaco industry in the 1980s, as it collapsed under the weight of regulatory, production, price, quality, marketing, market access, and financial difficulties. While the presence of only minimal initial problems does not always lead to success, the critical point of this category is twofold: in all instances of success only minimal initial problems had been experienced and in all instances of significant initial problems new industries were non-successful.

The correlation between the perception amongst producers of 'significantly increased financial returns' (1B) from a new product as a driving force behind the initial development of a new industry and non-success is not surprising given empirical impressions. For during the field interviews many respondents commented that a key to success was avoiding what was colloquially referred to as "the kiwifruit syndrome", where a new industry attracted financial investors looking for a "quick buck", rather than dedicated new producers focussed on the sustainable development of a new industry. This adverse "kiwifruit syndrome" befell the salmon industry during the 1980s. One original participant comments that financial investor's "flash money" - up to $150 million in the first five years of the industry - was one critical reason behind the industry's collapse, which it has never really recovered from, because these were entrepreneurs not "actual, practical farmers" with what this observer calls "interested money". The association between the perception of a significant increase in financial returns as an establishment factor and non-success in new industries, therefore, appears to support this popular viewpoint.

A related, inverse pair of results is the presence of 'government enticements' (4F) that correlates with success and the absence of 'government enticements' (4f) that correlates with non-success. The high correlation between government enticements and success is somewhat of a surprise, for the empirical impression gained from the interviews was that the dominant form of such incentives,

namely the substantial tax breaks of pre-1984 New Zealand, were undesirable. The common perception amongst respondents was that such tax breaks tended to attract, as one commentator in the goat fibre industry – an industry that suffered enormously from this experience – claimed, "the wrong type" of producer. Rather, these 'producers' were 'investors', driven by the (often-erroneous) perception of huge financial returns with minimal capital investment; a margin widened by the tax breaks themselves. Government enticements, therefore, appeared to be clearly linked with the "kiwifruit syndrome".

With the beginning of the end for these tax breaks post-1984, and the share market collapse of 1987, such investors left the affected industries, often precipitating their collapse and leaving the "real growers" to pick up the pieces. This "kiwifruit syndrome" boom-and-bust cycle was, of course, limited to those new industries in existence pre-1984 and that survived, albeit in a much different form, at least until the 1987 share market collapse. And herein lies a possible explanation for this *prima facie* contradictory result: that those new industries that have succeeded in the presence of such government enticements have survived this boom-and-bust cycle. Thus, those new industries in existence prior to 1984, which experienced the 1987 share market collapse, and are still in existence today may have done so *in spite of* government enticements, not because of them. Conversely, those new industries, whether successful or otherwise, that have emerged since 1987, and therefore avoided both the pre-1984 tax breaks and the 1987 share market collapse, have done so in an environment lacking these two important determinants of the boom-and-bust cycle. The presence of government enticements in the form of tax breaks, therefore, is almost an 'historical artefact'. This dismissal is especially credible now as such incentives all but vanished from the political - agricultural landscape during the 1990s and despite their current minor scale comeback.

The first key variable for success from the "Processing" category is the use by a new industry of 'adapted processing facilities' (9a) rather than new, purpose-built processing facilities at the outset. This is perhaps a straightforward result, as it does seem reasonable that a new industry would stand a better chance of success if it is free from the considerable knowledge and financial problems of establishing completely new processing facilities. By being able to utilise adapted processing facilities in its initial phases a new industry will surely benefit from learning to walk before attempting to run. This is certainly the approach of the alpaca and llama industry, which has utilised wool processing facilities rather than new, expensive machines purpose built for the much finer alpaca and llama fibre. Although this adaptive approach has not been without its practical difficulties, it has certainly avoided the high cost of investment in new processing facilities.

As a possible means of minimising processing costs as a new industry develops, the presence of 'centralised current processing facilities' (9j) as another key variable for success appears to be an effective tactic. With a small number of processing facilities servicing a much larger number of producers, economies of scale will keep processing costs down and prevent task duplication within the industry, thus increasing efficiency. This centralised processing feature is certainly present in the mussel industry and the olive industry looks set to emulate this in the future.

The fourth and final key variable for success is a 'high level of technology' (9M) in the processing stage, which seems to run counter to the logic that the higher the level of processing technology the higher the processing cost, a characteristic unlikely to lead to new industry success. Perhaps, however, a high level of processing technology enables a new industry to develop high quality, innovative value added products that command premium prices and better returns to producers. Certainly the olive industry, with its high cost processing technology, is heading this way with a range of novelty, expensive value-added products in the minds of some producers and processors, if not yet on the shelves. Moreover, in some cases high processing technology is a necessity demanded by the product itself. There is no better example than the strict hygiene and food

handling standards required in the mussel industry to prevent product contamination, which in seafood is inherently more risky than in other food sources.

The final key variable from the "Processing" category, that of an 'increase in processing costs' (9P) since the new industry's inception correlates with non-success and appears rather straightforward. For a new industry that is unable to effectively control its processing costs will be less efficient, and therefore less likely to be successful, than a new industry whose processing costs remain constant or even decline over time. In the garlic industry, for example, recent increases in processing costs, as well as in packaging and transport costs, have been exacerbated by a simultaneous decline in volumes. Perhaps adapted initial and centralised current processing facilities are means by which processing costs can be controlled.

Finally, the last key variable for success is the presence of 'multiple quality control mechanisms' (10J) also seems an intuitively logical result. For the more stringent a new industry's quality control regime the more likely the product will break into export markets and command a premium price. The processing of mussels is again instructive here, which has undergone a continual increase in hygiene and food handling standards, but with the consequential benefit of an improvement in certified quality standards and therefore in prices and returns.

This final grouping of 13 key variables for success and non-success provide another dimension to the two sets of three key variables presented in the first and most substantial part of this discussion. The former results of the Boolean analysis, however, are no less important than the latter and allow further insights into key factors for the success or non-success or new land-based industries.

5.4 Conclusion

This discussion began by re-presenting the algebraic results of the previous chapter in corresponding lists of success and non-success according to the eleven categories of the questionnaire. These necessary conditions were re-conceptualised as key variables and were examined in a comprehensive discussion of each key variable and links between two or more of those key variables, whether for success or non-success and regardless of category. The discussion also substantiated these key variables with appropriate empirical examples from the 22 cases studied in this project. This report now moves on to its final chapter, in which these key variables for success or non-success in new land-based industries are synthesised into the main findings.

Chapter 6
Conclusion

6.1 Introduction

This conclusion begins with a discussion that synthesises the main research findings presented in the previous chapter. This response to the primary research objective of identifying key factors for success and non-success in new industries is then discussed in terms of a comparison with the established literature, implications for government policy towards such new industries, and finally in terms of implications for future research. The final section concludes this report by reviewing this entire research project on new land-based industries.

6.2 Summary of Key Results

A formal industry council, not necessarily in name but in function, with extensive functions and extensive interaction with exogenous groups is important for industry success. This central finding links with a number of other key variables for success. Marketing and market development, and research and development activities are two of the most important areas of operation of a successful industry organisation – council or otherwise. Financial resources of an industry organisation are a significant determinant of the range and extent of functions undertaken, and therefore finance is of considerable importance as a success factor. Thereafter, the discussion in Chapter 5 considered a list of other key variables for success in new industries, including the following: limited initial problems, government enticements, adapted initial processing facilities, centralised current processing facilities, high processing technology, and multiple quality control mechanisms. In addition to these key variables with a strong correlation with success, a number of the key variables for non-success enabled weaker but still significant inferences for supplementary key factors for success. These included the following: the inferred advantages of a new product from a new source on the global scale, high producer input into the industry organisation, high producer satisfaction with the industry organisation, European export markets, extensive marketing techniques, stable or decreasing processing costs, and a balance between production and processing capacity.

The first fundamental result for non-success is the inverse of that for success, which means that these two findings are mutually reinforcing. The three critical key variables from the “Industry Organisation and Co-operation” category can be amalgamated to show existence of a grower association with limited functions and a low level of co-operation with exogenous groups is correlated with non-success. This result also identifies links between an absence of critical marketing and market development and research and development functions as factors for non-success. Moreover, the key variable for non-success from the “Financial Resources” category demonstrates that low current finance of an industry organisation places a severe limitation on its capacity to undertake extensive functions and is therefore a related obstacle to success. Thereafter, Chapter 5 considered a list of key variables for non-success in new industries, including the following: an initial perception of significantly improved financial returns, low producer input into and dissatisfaction with the industry organisation, no government enticements, increasing marketing expenditure, limited marketing techniques, limited research and development initiation, increasing processing costs, and production oversupply.

There is an important qualifier to this correlation between industry council, extensive functions, and extensive exogenous interactions and success on the one hand and the inverse correlation between grower association, limited functions, and low exogenous co-operation and non-success on the other. An emerging industry cannot immediately achieve all of the desired characteristics and then experience success. The reality is that some characteristics can be achieved, giving some success,

upon which additional characteristics can be achieved and from which would flow further success. That is, emerging industries may slowly develop and evolve towards a pinnacle of success. The results of this study identify the characteristics of successful industries that have achieved such a level of success. The critical point, however, remains that the results show that a new industry's probability of success increases the more it moves away from a grower association, with all its associated limitations, and towards an industry council, with all its associated beneficial characteristics.

The overall results can therefore be summarised in ideal terms by giving a profile of a successful and an unsuccessful industry. Table 5 shows these results.

Table 5: Profiles for New Industry Success and Non Success

Profile of a Successful New Industry	Profile of a Non-Successful New Industry
Industry Council (or equivalent)	**Grower Association**
Professional, full-time, paid employees	Amateur, part-time, unpaid volunteers
With Extensive Functions	**With Limited Functions**
Undertakes a wide range of functions	Undertakes a narrow range of functions
And Exogenous Interactions	**And Low Exogenous Co-operation**
Extensively involved with outside groups	Low co-operation with outside groups
Limited Initial Problems	**Old Source, New to New Zealand**
Export Market	**Low Producer Input and Satisfaction**
Multiple Quality Controls	**Limited Marketing Techniques**
Extensive R&D Initiation	**Limited R&D Initiation**
High Current Finance	**Low Current Finance**

In essence, the results reflect the stringent criterion used at the outset to classify successful industries. The successful new industries had over $1.0m in sales and so have had the resources to develop industry council characteristics. However, having achieved this level of success they provide a useful target for those industries that are presently emerging and have yet to achieve success. Our point is, given the evidence from the 22 cases studied, the successful characteristics identified here are what emerging new industries need to acquire in order to achieve success. This conclusion is based on the assumption that the results derived from the sample of 22 cases are applicable to other new industries. Such an assumption is supported by the results.

6.2.1 Theoretical Implications

These two groupings of key factors for success and non-success in new industries are now compared with the results of previous empirical research presented in the literature review of Chapter 2 (Section 2.3). The first of the three critical key factors for success, that of the importance of an industry council, is effectively the same result of a number of other research projects. For example, Hyde (1998), Hodges (1997), Felker (1996), Waters (1990) Lazaroff (1989), the OECD (1989), and Douglas (1997) all emphasise, in their own ways, the desirability of a professional industry organisation led by an enthusiastic, motivated, and dedicated 'industry champion(s)' as the best means to advance a new industry. Moreover, Hyde (1998), Felker (1996), Bordelon et al. (1996), Lazaroff (1989), and Douglas (1997) also emphasised, again in their own terms, results that fit our conceptualisation and importance of extensive industry organisation functions. At a lower level of comparability, Bordelon et al. (1996) and Lazaroff (1989) also acknowledge the flow of information as an important function of an industry organisation. Finally, Felker (1996), Lazaroff (1989), and Douglas (1997) also highlight the need for an industry organisation to establish extensive exogenous interactions, with Lazaroff particularly emphasising integration into existing industry and marketing frameworks.

On the marketing issue specifically, Wood et al. (1994), Hyde (1998), Bordelon et al. (1996), Lazaroff (1989), the OECD (1989), and Wynn-Williams and Logan (1985) all pinpoint marketing and market development issues as critical to new industry success. Philp (1997) also stresses the importance of export markets in new industry development, although as noted in the literature review itself the scope of this study means this result is hardly surprising. Hyde (1998), Waters (1990), and Wynn-Williams and Logan (1985) also substantiate the importance of financial resources to new industry success, while Muchaili (1989) highlights the lack of financial resources as a fundamental reason for new industry failure. With regard to research and development, Hyde (1998), Hodges (1997), the Centre for International Economics (1994), Janick and Simon (1990) and Janick (1996) also consider this area to be another critical one for new industry organisations.

In addition to these main results, Douglas (1992, 1993) highlights the need to identify products with defined international market opportunities. As the New Zealand deer and mussel industries illustrated, new products being derived from new sources on the global scale provide a considerable advantage for new industry success. Finally, Wynn-Williams and Logan (1985) emphasise the necessity of producer enthusiasm and innovation for new industry development, which alludes to the current result that an industry organisation should maintain a high level of producer input and satisfaction, for without it producer enthusiasm and innovation will surely diminish.

There is considerable overlap, therefore, between the fundamental results of this research project and those of previous empirical studies in the literature. There may be variation in the terminology and precise meaning or conceptualisation of each factor for success between this and the existing studies, but the general comparability of these results remain the same. Especially important is the comparable results regarding the importance of an industry council with extensive functions and interactions as a fundamental hub of factors for success in new industries. Equally significant is the similarity between these results and the literature with regard to marketing and market development, financial resources, and research and development. Similarities in findings with respect to new sources of new products and high producer input into and satisfaction with industry organisations are also reaffirming of our conclusions.

The key factors for the success of new industries that are unique to this report, therefore, are those not covered by this existing literature. The first of these is that of extensive marketing techniques, for although the literature has previously identified marketing as a key area, it has done so in rather abstract terms. The current finding that a wide range of marketing techniques is essential to success, and is clarified further when considered in the context of a new industry's marketing problems, is therefore a significant clarification of the nature of marketing.

Furthermore, this research has emphasised a number of key factors for success that only appear in the low frequency category in the summary table (Table 2) of the new industry literature. These factors, previously recognised but not considered to be greatly significant, were the importance of a formal industry organisation, financial resources, and the flow of information between different groups of the new industry (part of the 'extensive functions' of an industry organisation). These factors are part of the main results of this study that emphasises industry organisation, industry functions and interactions. By not consistently emphasising industry organisation, the literature to date has been overly reliant on marketing, production and agronomic factors in explaining success. These are necessary but not sufficient factors in success. Our research has considered and found a broader range of factors involved in success. If our assessment of the literature is correct then the method used here has been more comprehensive than the existing literature.

The need for stable or declining processing costs and the equal need for a balance between production volumes and processing capacity are two other unprecedented results of this research.

Indeed, the importance of these processing factors is evidently at odds with Wood et al. (1994), who determined that such issues within the processing facet of new industries were not closely correlated with success. Results from this research, however, suggest otherwise.

Because this report simultaneously examined factors of non-success in new industries and the existing literature did not, the current results concerning key factors of non-success are unique. Specifically, the undesirability of a grower association with only limited functions and low exogenous co-operation is a new result. This characteristic is perhaps what separates this report from those preceding it, for in seeking to identify factors of success this method has enabled factors for non-success to show a more complete and seemingly previously unseen picture of success in new industries. The minimal consideration of non-success factors in the literature should be redressed, and perhaps this project points to at least this one avenue for future research.

The literature reviewed exhibited different theoretical approaches to the study of success factors, including the Commodity Systems Approach (CSA), the Product, Marketing, and Consumption (PMC) approach, the Farming Systems Research (FSR) approach, and the Actor Network Theory (ANT) approach. The PMC and ANT approaches appear to be most relevant to research on success factors in new industries because they are holistic and thereby focus on the wider system. The Qualitative Comparative Analysis method applied here does not simply fit either of these approaches. Our QCA approach was not an example of a PMC approach because factors other than those associated with production, marketing, and consumption were included. For example, the character of a new industry's formal organisation was included and results show it to be a decisive factor (council versus association).

In this respect the QCA method is closer to Actor Network Theory because the latter emphasises networks of actors. Successful new industries require the construction of networks that include both non-human 'actors' such as plants, roads, and ports, etc, and human actors such as producers, consumers, processors, marketers and scientists, etc. Furthermore, ANT entails consideration of inanimate objects as things with a life of their own: in this context of new industries, the industry itself should be seen as a thing which requires enrolment of a complex array of other actors to work in its favour to achieve success. The combinations of factors that form around the hub of industry organisation illustrate how networks are formed in the case of successful industries. However, a thorough ANT approach would go further than this study by explaining not just what factors are critical for success but how they are developed. Such research would involve a greater focus on the actual process by which new industry participants go about forging and maintaining networks. In the meantime, however, the lesson to be learnt from ANT is that an emerging new industry has a life of its own and that in order to be successful it needs to develop a supportive network. Results from this research identify what kinds of characteristics a successful network incorporates.

6.2.2 Policy Implications

The important role of councils means that the aim of government policy should be to assist industry organisations develop from grower associations, which is how industry organisations invariably begin life, into more professional, multifaceted, and co-operative industry councils. An industry organisation's level of financial resources is critical to this development. In seeking to assist the transition from grower association to industry council, therefore, government policy could consider ways of lowering costs at the early stages of industry development knowing that at maturity the new industry will be able to earn its own way and return taxes to the government. While the Commodity Levies Act provides for new industries to raise funds for association activities, there were reports that some new industry organisations were struggling because either they had only a voluntary production levy or, in some instances, a compulsory levy was not being enforced strictly enough. There may be a need to review the effectiveness of the Act for new industries.

Research and development costs can inhibit new industries. Members of some struggling new industries said that they recognised the importance of research and development in promoting their industry. However, they could not afford user-pays research and development programmes until their industry developed further but that initial development required research. Clearly, there is a need for lower costs for research and development.

Further policy recommendations can be made from the key factors for non-success. Government research and development programmes that assist in the identification of new sources for new products that are unique, or almost so, on a global scale, should be continued and further supported. Continued attention should be given to the development of new products, or new value-added products, from existing sources that are also unique on a global scale.

Finally, there are implications for new land-based industries themselves. The summary profiles for successful and non-successful new industries clearly suggest targets for new industries that are at the association stage. The characteristics associated with success are targets that can be sought knowing that some will be achieved more easily and sooner than others. The profiles present ideals and are not meant to suggest that all new industries have all these characteristics.

6.2.3 Research Implications

The results above that show the character of successful new industries as targets illustrate broad strategies rather than specific tactics, that is, destinations not journeys. Future research, therefore, could specifically address detailed issues of the means to achieve the end of success in new industries. Of special consideration would be specific marketing and market development tactics and facilitation of the provision of research and development services to new industries. Such research could show how problems have been successfully overcome and thus provide very useful information for emerging industries. Also relevant would be to use methods that showed the historical development of industries rather than having to rely on the status of an industry at a particular time as this research has done. Such an approach would address the issues of the link between success and maturity. Attention should be given to the case histories of non-successful industries on order to identify key factors that prevented industry councils form forming. Policy research could focus on the details of the right balance between the free market and state intervention in order to identify the best options for government strategies aimed at new industry development. There are a number of agencies involved with new industries and this research has not examined their roles or how their performance could be improved in the light of the research results.

Finally, further research is needed to extend the generality of the results presented here. The conclusions are based on 22 cases. If more cases were studied, results could be extended to develop a refined understanding of success factors and, as a consequence, greater confidence can be placed in the application of the implications to other new industries. A topic for research in this context are the success factors involved in new industries that are driven by processors or by one or a few key players. This type of development was excluded from the analysis by our definition of ‘industry’.

6.3 Conclusion

This research report has achieved its objectives of identifying key factors for success in new land-based industries. Those key factors include, most importantly, the presence of a well financed industry council or council-like organisation. For successful industries, the council has extensive functions, especially marketing and market development and research and development activities, and extensive interactions with exogenous groups. This framework for success is substantiated by other key factors, such as the desirability of unique products, a multitude of processing

characteristics, and multiple quality control mechanisms. Furthermore, this broad picture of success was further clarified by simultaneous analysis of key factors for non-success. This parallel analysis showed that a grower association with restricted income and limited functions, especially few marketing techniques and narrow initiation of its research and development programme, and a low level of co-operation with exogenous groups was an unlikely road to success in new industries.

The research method that led to these results, the Qualitative Comparative Analysis method, is relatively unknown and was therefore given a thorough introduction in Chapter 3. Thereafter, the specific application of this QCA method was also comprehensively described, and the specific modifications of Ragin's model identified and explained. Finally, Chapter 3 concluded with a critique of the Qualitative Comparative Analysis method based on the experience of its application in this research project.

Chapter 4 moved the project into the analysis stage, and presented the specific steps of Boolean algebra that is the analytical tool of the QCA method. The dual Boolean algebraic analysis of the independent variables across eleven categories resulted in the 56 necessary conditions for either success or non-success. These necessary conditions were then re-conceptualised as key variables and provided the basis for the result discussion undertaken in Chapter 5. That discussion highlighted two sets of three key variables as a central hub around which a significant number of other key variables revolved. The remaining key variables were stressed as being equally important, despite not being so closely tied to this inner core.

Chapter 6 compared the results with those from the literature review in Chapter 2 finding overall similarities but some differences in emphasis. The chapter then discussed the policy and research implication of the results.

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Appendix 1: Questionnaire

1. Origins and History of Industry

[A] What was / were the main driving force(s) that led to the creation of the industry? [5]

(i) Producer Diversification
(ii) Increased Financial Returns
(iii) Local Market Driven
(iv) Export Driven
(vi) Science Driven

[5] Variable merged with another similar variable on data table

[B] Who was / were the main initiator(s) that led to the creation of the industry? [5]

(i) Producers (ii) Scientists (iii) Government

[5] Variable merged with another similar variable on data table

[C] What type of initial problems did the industry face when establishing it? [1, 2, 3]

(i) Production
(ii) Processing
(iii) Transport / Distribution
(iv) Price / Competition
(v) Regulations / Controls
(vi) Market Access
(vii) Quality Standards
(viii) Lack of Information

[1] Coding criteria within each possible response of presence > 50 per cent and absence < 50 per cent for data table.

[2, 3] Reduced to a mutually exclusive variable with only two possible responses, 'minimal problems' and 'significant problems' and therefore only one letter code, on data table.

[D] What was the pattern of initial growth in the industry?

(i) Spasmodic / Uneven
(ii) Marginal Growth
(iii) Steady Growth
(iv) Rapid Growth

2. Product Characteristics and Environmental Requirements

[A] What characteristics render this a new product? [2]

(i) Old Source, New NZ
(ii) New Source, New NZ

[2] A mutually exclusive variable with only two possible responses, therefore only one letter code, on data table.

[B] What is / are the end use(s) of this new product? [2, 6]

(i) Food / Drink
(ii) Medicinal
(iii) Clothing
(iv) Decorative

[2] A mutually exclusive variable with only two possible responses, therefore only one letter code, on data table.

[6] Possible responses with no responses not included on data table.

[C] What is the temporal availability of this new product? [2]

(i) Seasonal (ii) Year Round

[2] A mutually exclusive variable with only two possible responses, therefore only one letter code, on data table.

[D] In what location(s) is the new product grown? [2, 3]

(i) Throughout New Zealand (iv) Northern SI
(ii) Northern NI (v) Southern SI
(iii) Southern NI

[2, 3] Reduced to a mutually exclusive variable with only two possible responses, 'broad geographical base' and 'narrow geographical base', therefore only one letter code, on data table.

[E] In which environmental factors does this new product require specific conditions? [2, 3]

(i) Temperature (iv) Water
(ii) Soil (v) Pollinating Agent
(iii) Air

[2, 3] Reduced to a mutually exclusive variable with only two possible responses, 'broad environmental requirements' and 'narrow environmental requirements', therefore only one letter code, on data table.

[F] Which of the following environmental events has the new industry experienced? [5]

(i) Diseases (ii) Pests

[5] Variable merged with another similar variable on data table

[G] What has been the impact of those diseases and / or pests on the new industry? [5, 7]

(i) None (iii) Medium
(ii) Minor (iv) High

[5] Variable merged with another similar variable on data table

[7] 'No' and 'low' possible responses merged together on data table.

3. Industry Organisation and Co-operation

A] Is there an umbrella industry organisation, and is there an alternative industry organisation? [2, 5]

(i) Industry Organisation (ii) Alternative Organisation

[2] A mutually exclusive variable with only two possible responses, therefore only one letter code, on data table (see explanation, page 12).

[5] Variable merged with another similar variable on data table

[B] What type of organisation is the main industry body? [2, 5]

(i) Grower Association
(ii) Producer Board
(iii) Industry Council

[2] A mutually exclusive variable with only two possible responses, therefore only one letter code, on data table.

[5] Variable merged with another similar variable on data table

[C] What functions does the industry organisation undertake? [1, 2, 3]

(i) Regulate Production
(ii) Regulate Processing
(iii) Flow of Information
(iv) Export Marketing
(v) Local Promotion
(vi) Quality Control
(vii) Research and Development

[1] Coding criteria within each possible response of presence > 50 per cent and absence < 50 per cent for data table.

[2, 3] Reduced to a mutually exclusive variable with only two possible responses, 'limited functions' and 'broad functions', therefore only one letter code, on data table.

[D] With what exogenous groups does the industry organisation interact? [1, 2, 3]

(i) Producers
(ii) Processors / Exporters
(iii) Marketers
(iv) Research and Development
(v) Government
(vii) Existing Broader Networks

[1] Coding criteria within each possible response of presence > 50 per cent and absence < 50 per cent for data table.

[2, 3] Reduced to a mutually exclusive variable with only two possible responses, 'limited interaction' and 'broad interaction', therefore only one letter code, on data table.

[E] What level of endogenous co-operation exists between different parts of the industry organisation?

(i) Low (ii) Medium (iii) High

[F] From what sources does the industry organisation receive funding? [6]

(i) Membership Subs / Levies
(ii) Government Agency

[6] Possible responses with no responses not included on data table.

[G] Is membership of the industry organisation…?

(i) Compulsory
(ii) Voluntary

[H] What is the level of producer input into the industry organisation's decision / policy making process? [7]

(i) None
(ii) Low
(iii) Medium
(iv) High

[7] 'No' and 'low' possible responses merged together on data table.

[I] What is the level of producer satisfaction with the industry organisation? [6]

(i) Highly Dissatisfied
(ii) Mildly Dissatisfied
(iii) Ambivalent
(iv) Mildly Satisfied
(v) Highly Satisfied

[6] Possible responses with no responses not included on data table.

4. Production Inputs and Capital Investments

[A] What is the investment level required in order to establish oneself as a new producer?

(i) Low (ii) Medium (iii) High

[B] What pre-production activities were undertaken by the new industry? [6]

(i) Pilot Schemes
(ii) Feasibility Studies
(iii) Growth Tests
(iv) Environmental Assessment
(v) Market Testing
(vi) Small Scale / Pragmatic

[6] Possible responses with no responses not included on data table.

[C] What level of technology input is required at the production stage?

(i) Low (ii) Medium (iii) High

[D] What types of investment enticements were made to potential new producers in the first two – three years of the industry? [6]

(i) Government Enticements
(v) Industry Enticements

[6] Possible responses with no responses not included on data table.

[E] Are investment enticements still being offered, and if so who are the current targets? 4

(i) None (ii) New Producers (iii) Existing Producers

[4] Whole variable with no responses not included in data table.

5. Marketing and Market Development

[A] Who undertakes the current marketing of the product?

(i) Industry Organisation(s)
(ii) Individual Producers
(iii) Dedicated Processors / Exporters
(iv) Generic Processors / Exporters

[B] What type of markets does the industry currently supply, and what ratio of its production goes to each market?

(i) Domestic (ii) Process (iii) Export

[C] What export markets does the industry currently supply? [1]

(i) Asia / Pacific
(ii) Europe
(iii) Africa / Middle East
(iv) North / South America

[1] Coding criteria within each possible response of presence > 50 per cent and absence < 50 per cent for data table.

[D] What market clients do the industry currently supply?

(i)	Restaurants / Cafes	(iv)	Health Retails
(ii)	Food Retail (Grocery)	(v)	Wholesalers / Importers

[E] How is the industry's marketing funded?

(i)	Membership Subs / Levies	(iii)	Private Companies / Exporters

[F] What is the industry's current marketing expenditure?

(i)	Low	(ii)	Medium	(iii)	High

[G] What is the industry's current marketing status?

(i)	Decreasing	(ii)	No Change	(iii)	Increasing

[H] What are the industry's marketing techniques? [1, 2, 3]

(i)	Quality Assurance	(iv)	Market Research
(ii)	"Clean and Green"	(v)	Commercial Advertising
(iii)	Product Branding	(vi)	Other Techniques

[1] Coding criteria within each possible response of presence > 50 per cent and absence < 50 per cent for data table.

[2, 3] Reduced to a mutually exclusive variable with only two possible responses, 'limited techniques' and 'extensive techniques', therefore only one letter code, on data table.

[I] What marketing problems does / has the industry encounter/ed? [1, 2, 3]

(i)	Market Access	(v)	No Niche
(ii)	Price	(vi)	Limited Window
(iii)	Quality	(vii)	Supply Problems
(iv)	Transport / Quarantine	(viii)	Other

[1] Coding criteria within each possible response of presence > 50 per cent and absence < 50 per cent for data table.

[2, 3] Reduced to a mutually exclusive variable with only two possible responses, 'limited techniques' and 'extensive techniques', therefore only one letter code, on data table.

6. Financial Resources

[A] What was the industry organisation's initial financial status?

(i)	Low	(ii)	Medium	(iii)	High

[B] What was the impact of the industry organisation's initial financial status?

(i)	Negative	(ii)	No Impact	(iii)	Positive

[C] How has the industry organisation's financial status changed since its inception?

(i)	Decrease	(ii)	No Change	(iii)	Increase

[D] What is the industry organisation's current financial status?

(i)	Low	(ii)	Medium	(iii)	High

[E] What is the impact of the industry organisation's current financial status?

(i)	Negative	(ii)	No Impact	(iii)	Positive

7. Research and Development

[A] What is the current status of the industry's research and development? [2, 7]

(i) None (ii) Spasmodic Research (iii) Continual Process

[2] Reduced to a mutually exclusive variable with only two possible responses, 'limited techniques' and 'extensive techniques', therefore only one letter code, on data table.

[7] 'No' and 'low' possible responses merged together on data table.

[B] Who has responsibility for the industry's research and development? [2]

(i) Industry Organisation (ii) Government Agency

[2] A mutually exclusive variable with only two possible responses, therefore only one letter code, on data table.

[C] Who initiates the research and development process? [2, 3]

(i) Producers (iii) Industry Organisation
(ii) Processors (iv) Research and Development

[2, 3] Reduced to a mutually exclusive variable with only two possible responses, 'no/limited initiation' and 'extensive initiation', therefore only one letter code, on data table.

[D] What cost level is associated with the industry's research and development?

(i) Low (ii) Medium (iii) High

[E] What impact does the cost of research and development have on the industry?

(i) Negative (ii) No Impact (iii) Positive

[F] What is the current level of genetic engineering research within the industry's research and development programme? [7]

(i) None (iii) Medium
(ii) Low (iv) High

[7] 'No' and 'low' possible responses merged together on data table.

[G] What is the current level of disease / pest control research within the industry's research and development programme? [7]

(i) None (iii) Medium
(ii) Low (iv) High

[7] 'No' and 'low' possible responses merged together on data table.

[H] What has been the contribution of research and development on the industry?

(i) Negative (ii) No Impact (iii) Positive

8. Government Regulations and Controls

[A] What was the level of initial regulations and controls at the industry's inception? [7]

(i) None
(ii) Low
(iii) Medium
(iv) High

[7] 'No' and 'low' possible responses merged together on data table.

[B] What was the impact of those initial regulations and controls?

(i) Negative (ii) No Impact (iii) Positive

[C] How have those regulations and controls changed?

(i) Decrease (ii) No Change (iii) Increase

[D] What is the level of the current regulations and controls affecting the industry? [7]

(i) None
(ii) Low
(iii) Medium
(iv) High

[7] 'No' and 'low' possible responses merged together on data table.

[E] What is the current impact of these regulations and controls on the industry?

(i) Negative (ii) No Impact (iii) Positive

[F] What is the level of government responsiveness to changing regulations and controls at the industry's suggestion?

(i) Low (ii) Medium (iii) High

[G] What is the level of industry satisfaction with this level of government responsiveness?

(i) Highly Dissatisfied
(ii) Mildly Dissatisfied
(iii) Ambivalent
(iv) Mildly Satisfied
(v) Highly Satisfied

9. Processing

[A] What type of initial processing facilities did the industry use in its first two – three years? [2]

(i) New Facilities (ii) Adapted Facilities

[2] A mutually exclusive variable with only two possible responses, therefore only one letter code, on data table.

[B] What was the level of initial investment in processing made by the industry? [7]

(i) None
(ii) Low
(iii) Medium
(iv) High

[7] 'No' and 'low' possible responses merged together on data table.

[C] What was the impact on the industry of the initial costs of processing?

(i) Negative (ii) No Impact (iii) Positive

[D] What type of processing facilities is the industry currently using? [2]
(i) New Facilities (ii) Adapted Facilities

[2] A mutually exclusive variable with only two possible responses, therefore only one letter code, on data table.

[E] What is the location of the current processing facilities? [2]
(i) Centralised (ii) Producer Specific

[2] A mutually exclusive variable with only two possible responses, therefore only one letter code, on data table.

[F] What is the level of technology in the industry's processing facilities?
(i) Low (ii) Medium (iii) High

[G] How have processing and transport costs changed since the first two – three years?
(i) Decrease (ii) No Change (iii) Increase

[H] What is the impact on the industry of the current costs of processing?
(i) Negative (ii) No Impact (iii) Positive

[I] Which of the following best describes the supply of product to processing facilities…
(i) Undersupply (ii) Sufficient Supply (iii) Oversupply

10. Satisfying the Markets

[A] Is the quality comparison to other producers of the New Zealand produced product…? [1]
(i) Above Standard (iii) Below Standard
(iii) Equal to Standard

[1] Coding criteria within each possible response of presence > 50 per cent and absence < 50 per cent for data table.

[B] Is the price competitiveness of the New Zealand produced product…? [1]
(i) Above Competitors (iii) Below Competitors
(iii) Equal to Competitors

[1] Coding criteria within each possible response of presence > 50 per cent and absence < 50 per cent for data table.

[C] What is the current status of improvements in the quality and price of the New Zealand produced product? [2]
(i) None (iii) Continual Process
(iii) Spasmodic Improvements

[2] A mutually exclusive variable with only two possible responses, therefore only one letter code, on data table.

[D] Who are the initiators of these improvements? [2, 3]

(i)	Individual Producers	(iv)	Research and Development
(ii)	Processors / Exporters	(vi)	Dedicated Marketers
(iii)	Industry Organisation	(vii)	Product Clients

[2, 3] Reduced to a mutually exclusive variable with only two possible responses, 'no/limited initiation' and 'extensive initiation' therefore only one letter code, on data table.

[E] At what time(s) do quality inspection(s) take place? [2, 3]

(i)	Production / Producer	(iii)	Distribution / Exporters - MAF
(ii)	Processing / Processor	(iv)	Delivery / Client

[2, 3] Reduced to a mutually exclusive variable with only two possible responses, 'limited quality control' and 'multi quality control', therefore only one letter code, on data table.

11. Current Issues

[A] Do any current issues facing the industry represent…? [1]

(i) No/Low Threat (ii) Medium Threat (iii) High Threat

[1] Coding criteria within each possible response of presence > 50 per cent and absence < 50 per cent for data table.

[B] With what level of current action is the industry responding to these threats? [7]

(i)	None	(iii)	Medium
(ii)	Low	(iv)	High

[7] 'No' and 'low' possible responses merged together on data table.

Appendix 2: Data Tables

Please note that the names of each of the new industries studied have been removed from these truth tables in order to protect the confidentiality of some of the information provided by some of the new industry organisations and interviewees.

Data Table for "Origins and History of Industry" Category

Variable:	Force(s) / Initiator(s)			Initial Problems		Initial Growth				Success
Boolean Code:	A	B	C	d	D	E	F	G	H	Z
Response Options:	*Producer* Diversification	Improved Returns	Export Market / Overseas Contacts	Minimal Problems	Significant Problems	Uneven Growth	Marginal Growth	Steady Growth	Rapid Growth	Output Value
New Industry:										
1	1	1	0	1	0	0	0	0	1	0
2	1	1	1	1	0	0	0	0	1	1
3	1	0	0	0	1	1	0	0	0	0
4	1	0	1	1	0	0	0	1	0	1
5	1	0	0	1	0	0	0	1	0	0
6	1	0	1	1	0	1	0	0	0	1
7	1	1	0	1	0	0	0	0	1	0
8	1	0	0	1	0	0	1	0	0	0
9	1	1	1	1	0	1	0	0	0	0
10	1	1	1	0	1	0	0	0	1	0
11	1	0	0	1	0	0	0	0	1	1
12	1	0	0	1	0	0	1	0	0	0
13	1	0	0	1	0	1	0	0	0	1
14	1	1	0	1	0	0	0	0	1	0
15	1	0	1	1	0	0	0	1	0	1
16	1	1	0	0	1	1	0	0	0	0
17	1	0	0	1	0	0	1	0	0	0
18	1	0	1	1	0	0	1	0	0	1
19	1	1	0	1	0	0	0	0	1	0
20	1	1	0	1	0	0	0	0	1	0
21	1	1	0	1	0	0	1	0	0	0
22	1	0	1	1	0	0	1	0	0	0

Data Table for "Product Characteristics and Environmental Requirements" Category

Variable:	Old/New Product?		End Use		Temporal Availability		Geographic Location		Environmental Requirements		Pest and Disease Impact			Success
Boolean Code:	a	A	B	b	C	c	D	d	e	E	F	G	H	Z
Response Options:	Old Source New NZ	New Source New NZ	Food	Clothing	Seasonal	Year Round	Narrow Geog Base	Broad Geog Base	Limited Env Req	Extensive Env Req	Minor P&D	Medium P&D	Major P&D	Output Value
New Industry:														
1	1	0	0	1	1	0	0	1	1	0	1	0	0	0
2	1	0	1	0	1	0	0	1	1	0	0	1	0	1
3	1	0	1	0	1	0	1	0	0	1	0	0	1	0
4	1	0	1	0	1	0	0	1	1	0	1	0	0	1
5	1	0	1	0	1	0	0	1	0	1	1	0	0	0
6	0	1	1	0	0	1	0	1	1	0	1	0	0	1
7	1	0	1	0	0	1	0	1	1	0	1	0	0	0
8	1	0	1	0	1	0	1	0	0	1	0	1	0	0
9	1	0	1	0	1	0	1	0	1	0	0	0	1	0
10	1	0	0	1	0	1	0	1	1	0	1	0	0	0
11	1	0	1	0	0	1	0	1	1	0	1	0	0	1
12	1	0	1	0	1	0	0	1	1	0	1	0	0	0
13	0	1	1	0	0	1	1	0	1	0	1	0	0	1
14	1	0	1	0	1	0	0	1	1	0	1	0	0	0
15	1	0	1	0	1	0	1	0	1	0	0	1	0	1
16	1	0	1	0	0	1	0	1	1	0	1	0	0	0
17	1	0	1	0	1	0	1	0	0	1	0	0	1	0
18	1	0	1	0	1	0	1	0	1	0	0	1	0	1
19	1	0	1	0	1	0	1	0	1	0	0	0	1	0
20	1	0	1	0	1	0	1	0	1	0	0	0	1	0
21	1	0	1	0	1	0	0	1	0	1	1	0	0	0
22	1	0	1	0	1	0	1	0	0	1	0	0	1	0

Data Table (Part 1) for "Industry Organisation and Co-operation" Category

Variable:	Industry Organisation		Organisation Functions		Exogenous Interaction		Level of Co-operation			Funding	Success
Boolean Code:	a	A	b	B	c	C	D	E	F	G	Z
Response Options:	Grower Association	Industry Council	Limited Functions	Extensive Functions	Limited Interaction	Extensive Interaction	Low Co-operation	Medium Co-operation	High Co-operation	Subs and/or Levies	Output Value
New Industry:											
1	1	0	1	0	0	1	0	1	0	1	0
2	0	1	1	0	0	1	0	0	1	1	1
3	1	0	1	0	1	0	1	0	0	0	0
4	0	1	0	1	0	1	0	0	1	1	1
5	1	0	1	0	0	1	1	0	0	1	0
6	0	1	0	1	0	1	0	0	1	1	1
7	1	0	1	0	1	0	1	0	0	1	0
8	1	0	1	0	1	0	0	1	0	1	0
9	1	0	1	0	1	0	1	0	0	0	0
10	0	1	0	1	0	1	0	1	0	1	0
11	0	1	1	0	0	1	0	1	0	1	1
12	1	0	1	0	0	1	0	1	0	1	0
13	0	1	0	1	0	1	0	0	1	1	1
14	1	0	1	0	1	0	0	1	0	1	0
15	1	0	0	1	0	1	0	1	0	1	1
16	1	0	0	1	0	1	0	1	0	1	0
17	1	0	0	1	0	1	0	1	0	1	0
18	1	0	0	1	0	1	0	1	0	1	1
19	1	0	1	0	1	0	0	0	1	1	0
20	1	0	0	1	0	1	0	0	1	1	0
21	1	0	1	0	1	0	0	1	0	1	0
22	0	0	0	0	1	0	1	0	0	0	0

Data Table (Part 2) for "Industry Organisation and Co-operation" Category

Variable:	Membership		Producer Input			Producer Satisfaction				Success
Boolean Code:	H	h	I	J	K	L	M	N	O	Z
Response Options:	Compulsory Membership	Voluntary Membership	Low Input	Medium Input	High Input	Low Dissatisfaction	Ambivalent	Low Satisfaction	High Satisfaction	Output Value
New Industry:										
1	0	1	0	1	0	0	0	1	0	0
2	0	1	0	0	1	0	0	1	0	1
3	0	1	1	0	0	0	1	0	0	0
4	1	0	0	0	1	0	0	1	0	1
5	0	1	0	0	1	0	0	0	1	0
6	0	1	0	0	1	0	0	0	1	1
7	0	1	1	0	0	1	0	0	0	0
8	0	1	0	1	0	0	0	0	1	0
9	0	1	0	0	1	0	1	0	0	0
10	0	1	0	1	0	0	0	1	0	0
11	0	1	1	0	0	0	0	1	0	1
12	0	1	0	1	0	0	1	0	0	0
13	0	1	0	0	1	0	0	1	0	1
14	0	1	1	0	0	0	0	1	0	0
15	0	1	0	1	0	0	0	1	0	1
16	0	1	0	1	0	0	0	1	0	0
17	0	1	0	0	1	0	0	0	1	0
18	0	1	0	0	1	0	0	1	0	1
19	0	1	0	0	1	0	0	1	0	0
20	0	1	0	1	0	0	0	1	0	0
21	0	1	0	1	0	0	1	0	0	0
22	0	0	1	0	0	0	1	0	0	0

NB: As no 'High Dissatisfaction' amongst producers towards the Industry Organisation responses was recorded, this possible response has been omitted from this Data table.

Data Table for "Production Inputs and Capital Investment" Category

Variable:	Investment Level			Pre-production Activities		Government Enticements	Level of Technology			Success
Boolean Code:	A	B	C	D	E	F	G	H	I	Z
Response Options:	Low Investment	Medium Investment	High Investment	Pilot Schemes	Environmental Assessments	Government Enticements	Low Technology	Medium Technology	High Technology	Output Value
New Industry:										
1	0	0	1	0	1	0	1	0	0	0
2	0	1	0	1	0	1	1	0	0	1
3	0	0	1	1	0	0	0	1	0	0
4	1	0	0	1	0	0	1	0	0	1
5	1	0	0	1	0	0	1	0	0	0
6	0	0	1	0	0	1	0	1	0	1
7	0	1	0	0	0	0	1	0	0	0
8	1	0	0	0	0	0	1	0	0	0
9	0	0	1	0	0	1	0	1	0	0
10	0	1	0	0	0	1	1	0	0	0
11	0	1	0	0	1	1	1	0	0	1
12	0	1	0	0	0	0	1	0	0	0
13	0	0	1	1	0	1	0	1	0	1
14	0	1	0	1	0	0	1	0	0	0
15	0	1	0	0	0	1	0	1	0	1
16	0	1	0	0	0	0	1	0	0	0
17	0	1	0	0	0	0	1	0	0	0
18	0	1	0	0	0	0	0	1	0	1
19	0	0	1	1	0	0	0	0	1	0
20	1	0	0	0	0	0	1	0	0	0
21	0	1	0	1	0	0	1	0	0	0
22	0	0	1	1	0	0	0	1	0	0

Data Table (Part 1) for "Marketing and Market Development" Category

Variable:	Current Marketing				Markets Supplied			Export Markets				Market Clients			
Boolean Code:	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
Response Options:	Industry Organisation	Individual Producers	Dedicated Proc/Expt	Generic Proc/Expt	Domestic Market	Process Market	Export Market	Asia/ Pacific	Europe	Africa/ Mid East	Nth/Sth America	Restaurants and Cafes	Food Retail	Health/ Souvenir	Wholesalers /Importers
New Industry:															
1	0	1	0	0	1	0	0	0	0	0	0	0	0	1	0
2	0	0	1	1	1	1	1	1	0	0	0	0	1	0	1
3	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	1	1	0	1	0	1	1	0	0	0	0	1	0	1
5	1	0	1	0	1	0	1	1	0	0	0	0	0	0	1
6	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1
7	0	1	1	0	1	1	0	0	0	0	0	1	1	0	0
8	1	0	0	1	1	1	1	1	0	0	1	0	1	0	1
9	0	1	1	0	1	0	1	1	1	0	0	1	0	0	1
10	0	0	1	0	1	0	1	1	1	0	0	0	0	1	1
11	0	0	0	1	1	0	0	0	1	0	1	0	0	0	1
12	0	0	1	0	1	1	0	0	0	0	0	1	1	1	0
13	1	0	1	0	1	0	1	1	1	0	1	1	1	0	1
14	0	1	1	0	1	1	1	0	0	0	1	1	1	1	0
15	0	1	1	0	1	0	1	1	1	0	0	0	1	0	1
16	0	1	1	0	1	0	0	0	0	0	0	1	0	0	0
17	0	0	0	1	1	0	1	1	0	0	1	0	1	0	1
18	1	0	0	1	1	0	1	1	1	0	0	0	1	0	1
19	0	0	1	0	1	0	1	1	0	0	0	1	1	0	1
20	1	0	0	1	1	0	1	1	0	0	1	0	1	0	1
21	1	0	1	0	1	0	0	0	0	0	0	1	1	1	0
22	0	0	0	1	1	0	1	1	0	0	0	0	1	1	1

NB: 'Proc/Expt' is shorthand for Dedicated and Generic 'Processors and/or Exporters', while 'Whole/Impts' is shorthand for 'Wholesalers and/or Importers'.

Data Table (Part 2) for "Marketing and Market Development" Category

Variable:	Marketing Funding		Level of Expenditure			Change in Marketing			Marketing Techniques		Marketing Problems		Success
Boolean Code:	P	Q	R	S	T	U	V	W	x	X	y	Y	Z
Response Options:	Subs/ Levy	Private Companies	Low Expend	Medium Expend	High Expend	Decrease Marketing	No Change Marketing	Increase Marketing	Limited Techniques	Extensive Techniques	Limited Problems	Extensive Problems	Output Value
New Industry:													
1	0	1	1	0	0	0	1	0	1	0	1	0	0
2	0	1	0	0	1	1	0	0	1	0	1	0	1
3	0	0	1	0	0	0	1	0	1	0	0	1	0
4	1	1	0	1	0	0	1	0	0	1	1	0	1
5	1	1	1	0	0	0	1	0	1	0	1	0	0
6	1	1	0	0	1	0	1	0	0	1	1	0	1
7	0	1	1	0	0	0	1	0	1	0	0	1	0
8	0	1	1	0	0	0	1	0	1	0	1	0	0
9	0	1	1	0	0	1	0	0	1	0	0	1	0
10	0	1	1	0	0	0	1	0	1	0	0	1	0
11	0	1	1	0	0	0	1	0	1	0	1	0	1
12	0	1	1	0	0	0	0	1	1	0	1	0	0
13	1	1	0	0	1	0	1	0	0	1	1	0	1
14	0	1	1	0	0	0	0	1	0	1	1	0	0
15	0	1	0	1	0	0	1	0	1	0	0	1	1
16	0	1	1	0	0	0	0	1	1	0	0	1	0
17	1	1	1	0	0	0	1	0	1	0	1	0	0
18	1	1	0	1	0	0	1	0	0	1	1	0	1
19	0	1	1	0	0	0	1	0	1	0	0	1	0
20	1	1	0	1	0	1	0	0	1	0	0	1	0
21	1	1	1	0	0	0	1	0	1	0	1	0	0
22	0	1	1	0	0	0	1	0	1	0	1	0	0

Data Table for "Financial Resources" Category

Variable:	Initial Finance			Initial Impact			Change In Finance			Current Finance			Current Impact			Success
Boolean Code:	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	Z
Response Options:	Low Initial Finance	Medium Initial Finance	High Initial Finance	Negative Impact	No Impact	Positive Impact	Decrease Finance	No Change Finance	Increase Finance	Low Current Finance	Medium Current Finance	High Current Finance	Negative Impact	No Impact	Positive Impact	Output Value
New Industry:																
1	1	0	0	0	1	0	0	0	1	1	0	0	0	1	0	0
2	0	0	1	0	0	1	1	0	0	0	1	0	0	1	0	1
3	1	0	0	1	0	0	0	1	0	1	0	0	1	0	0	0
4	1	0	0	0	1	0	0	0	1	0	0	1	0	0	1	1
5	0	1	0	0	1	0	1	0	0	1	0	0	1	0	0	0
6	0	1	0	0	0	1	0	0	1	0	0	1	0	0	1	1
7	1	0	0	1	0	0	0	1	0	1	0	0	1	0	0	0
8	1	0	0	1	0	0	0	1	0	1	0	0	1	0	0	0
9	1	0	0	1	0	0	0	1	0	1	0	0	1	0	0	0
10	1	0	0	1	0	0	0	1	0	1	0	0	0	1	0	0
11	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	1
12	1	0	0	0	1	0	0	1	0	1	0	0	0	1	0	0
13	1	0	0	1	0	0	0	0	1	0	0	1	0	0	1	1
14	1	0	0	0	1	0	0	0	1	0	1	0	0	0	1	0
15	0	1	0	0	1	0	0	1	0	0	1	0	1	0	0	1
16	0	1	0	0	1	0	1	0	0	1	0	0	1	0	0	0
17	1	0	0	1	0	0	0	1	0	1	0	0	1	0	0	0
18	1	0	0	1	0	0	0	0	1	0	1	0	0	0	1	1
19	0	1	0	0	1	0	1	0	0	1	0	0	1	0	0	0
20	1	0	0	0	1	0	0	1	0	1	0	0	0	1	0	0
21	1	0	0	0	1	0	0	1	0	1	0	0	0	1	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

NB: One of the industry organisations consulted did not wish to disclose their responses to these questions. Consequently, that industry has been omitted from the main Boolean analysis for this category, and their non-response is recorded as question marks above. Also, one industry studied did not have a formal industry organisation, therefore it is coded '0' on all possible responses and variables. That industry has also been omitted from the Boolean analysis for this category.

Data Table (Part 1) for "Research and Development" Category

Variable:	R&D Status		R&D Initiation		Cost Level			Cost Impact			Success
Boolean Code:	a	A	b	B	C	D	E	F	G	H	Z
Response Options:	No/Spasmodic RandD	Continual RandD	No/Limited Initiation	Extensive Initiation	Low Cost	Medium Cost	High Cost	Negative Cost	No Impact Cost	Positive Cost	Output Value
New Industry:											
1	1	0	1	0	1	0	0	1	0	0	0
2	0	1	1	0	0	0	1	0	0	1	1
3	1	0	1	0	1	0	0	1	0	0	0
4	1	0	1	0	1	0	0	0	1	0	1
5	1	0	0	1	0	1	0	1	0	0	0
6	0	1	0	1	0	1	0	0	0	1	1
7	1	0	1	0	1	0	0	1	0	0	0
8	1	0	1	0	1	0	0	1	0	0	0
9	1	0	1	0	1	0	0	1	0	0	0
10	1	0	1	0	0	0	1	1	0	0	0
11	1	0	0	1	1	0	0	0	1	0	1
12	1	0	1	0	0	1	0	1	0	0	0
13	0	1	0	1	0	1	0	0	0	1	1
14	0	1	1	0	1	0	0	0	1	0	0
15	1	0	0	1	1	0	0	1	0	0	1
16	1	0	1	0	0	1	0	1	0	0	0
17	1	0	1	0	1	0	0	1	0	0	0
18	0	1	0	1	0	1	0	1	0	0	1
19	1	0	1	0	1	0	0	1	0	0	0
20	0	1	1	0	0	1	0	1	0	0	0
21	0	1	0	1	1	0	0	0	1	0	0
22	0	1	1	0	0	1	0	0	1	0	0

Data Table (Part 2) for "Research and Development" Category

Variable:	Level of Genetic Engineering			Level of Pest and Disease Control R&D			Contribution of R&D			Success
Boolean Code:	I	J	K	L	M	N	O	P	Q	Z
Response Options:	No/Low GE	Medium GE	High GE	No/Low P&D Control	Medium P&D Control	High P&D Control	Negative Contribution	No Impact Contribution	Positive Contribution	Output Value
New Industry:										
1	1	0	0	1	0	0	0	1	0	0
2	1	0	0	0	0	1	0	0	1	1
3	1	0	0	1	0	0	0	1	0	0
4	1	0	0	1	0	0	0	0	1	1
5	1	0	0	0	1	0	0	1	0	0
6	1	0	0	0	0	1	0	0	1	1
7	1	0	0	1	0	0	1	0	0	0
8	1	0	0	1	0	0	1	0	0	0
9	1	0	0	1	0	0	1	0	0	0
10	1	0	0	1	0	0	0	0	1	0
11	1	0	0	1	0	0	0	1	0	1
12	1	0	0	1	0	0	1	0	0	0
13	1	0	0	1	0	0	0	0	1	1
14	1	0	0	0	0	1	0	0	1	0
15	0	0	1	0	0	1	0	0	1	1
16	1	0	0	1	0	0	1	0	0	0
17	1	0	0	1	0	0	1	0	0	0
18	1	0	0	0	1	0	0	1	0	1
19	1	0	0	1	0	0	0	1	0	0
20	0	1	0	0	0	1	0	1	0	0
21	1	0	0	0	1	0	0	0	1	0
22	1	0	0	1	0	0	0	1	0	0

Data Table (Part 1) for "Government Regulations and Controls" Category

Variable:	Initial Regulations			Initial Impact			Change in Regulations			Current Regulations			Success
Boolean Code:	A	B	C	D	E	F	G	H	I	J	K	L	Z
Response Options:	No / Low Initial Regulations	Medium Initial Regulations	High Initial Regulations	Negative Initial Impact	No Initial Impact	Positive Initial Impact	Decrease Regulations	No Change Regulations	Increase Regulations	No / Low Current Regulations	Medium Current Regulations	High Current Regulations	Output Value
New Industry:													
1	0	1	0	0	1	0	1	0	0	0	1	0	0
2	1	0	0	0	1	0	0	0	1	0	1	0	1
3	0	1	0	1	0	0	0	1	0	0	1	0	0
4	0	1	0	1	0	0	1	0	0	1	0	0	1
5	1	0	0	0	1	0	0	1	0	1	0	0	0
6	0	1	0	1	0	0	1	0	0	1	0	0	1
7	0	1	0	1	0	0	1	0	0	1	0	0	0
8	1	0	0	0	1	0	0	1	0	1	0	0	0
9	1	0	0	0	1	0	0	0	1	0	1	0	0
10	0	1	0	1	0	0	0	1	0	0	1	0	0
11	0	1	0	1	0	0	1	0	0	1	0	0	1
12	1	0	0	0	1	0	0	0	1	0	1	0	0
13	0	0	1	1	0	0	1	0	0	1	0	0	1
14	1	0	0	0	1	0	0	1	0	1	0	0	0
15	1	0	0	0	1	0	0	0	1	0	1	0	1
16	0	1	0	1	0	0	0	1	0	0	1	0	0
17	1	0	0	0	1	0	0	1	0	1	0	0	0
18	0	1	0	1	0	0	1	0	0	1	0	0	1
19	0	1	0	1	0	0	0	1	0	0	1	0	0
20	1	0	0	0	1	0	0	1	0	1	0	0	0
21	1	0	0	0	1	0	0	0	1	0	1	0	0
22	1	0	0	0	1	0	0	1	0	1	0	0	0

Data Table (Part 2) for "Government Regulations and Controls" Category

Variable:	Current Impact			Government Response			Level of Satisfaction					Success
Boolean Code:	M	N	O	P	Q	R	S	T	U	V	W	Z
Response Options:	Negative Current Impact	No Current Impact	Positive Current Impact	Low Govt Response	Medium Govt Response	High Govt Response	High Dissatisfaction	Mild Dissatisfaction	Ambivalent	Mild Satisfaction	High Satisfaction	Output Value
New Industry:												
1	0	1	0	0	1	0	0	0	0	1	0	0
2	1	0	0	1	0	0	1	0	0	0	0	1
3	1	0	0	1	0	0	1	0	0	0	0	0
4	0	1	0	1	0	0	1	0	0	0	0	1
5	0	1	0	1	0	0	0	0	1	0	0	0
6	0	0	1	0	1	0	0	1	0	0	0	1
7	0	1	0	1	0	0	0	1	0	0	0	0
8	0	1	0	0	0	0	0	0	1	0	0	0
9	1	0	0	1	0	0	1	0	0	0	0	0
10	0	1	0	1	0	0	0	0	1	0	0	0
11	0	1	0	1	0	0	0	0	1	0	0	1
12	1	0	0	1	0	0	0	0	1	0	0	0
13	0	1	0	0	1	0	0	1	0	0	0	1
14	0	1	0	0	1	0	0	0	1	0	0	0
15	1	0	0	0	0	1	0	0	0	0	1	1
16	1	0	0	1	0	0	0	1	0	0	0	0
17	0	1	0	0	0	0	0	0	1	0	0	0
18	0	0	1	0	1	0	0	1	0	0	0	1
19	0	1	0	0	1	0	0	0	0	1	0	0
20	0	1	0	0	0	1	0	0	0	0	1	0
21	0	1	0	1	0	0	0	0	1	0	0	0
22	0	1	0	0	0	0	0	0	1	0	0	0

Data Table (Part 1) for "Processing" Category

Variable:	Initial Type		Level of Investment			Impact Of Initial Costs			Current Processing		Processing Location		Success
Boolean Code:	A	a	B	C	D	E	F	G	H	h	j	J	Z
Response Options:	New Initial Processing	Adapted Processing	No / Low Investment	Medium Investment	High Investment	Negative Impact	No Impact	Positive Impact	New Current	Adapted Current	Centralised Processing	Producer Specific	Output Value
New Industry:													0
1	0	1	1	0	0	1	0	0	0	1	1	0	1
2	0	1	1	0	0	0	1	0	0	1	1	0	0
3	0	1	1	0	0	1	0	0	0	0	0	0	1
4	0	1	1	0	0	0	1	0	1	0	0	1	0
5	1	0	0	1	0	0	1	0	1	0	1	0	1
6	0	1	1	0	0	1	0	0	1	0	1	0	0
7	1	0	0	1	0	1	0	0	1	0	1	0	0
8	0	1	1	0	0	1	0	0	0	1	1	0	0
9	0	1	1	0	0	0	1	0	0	1	1	0	0
10	0	1	1	0	0	0	1	0	0	1	1	0	1
11	0	1	1	0	0	1	0	0	0	1	1	0	0
12	1	0	0	1	0	0	1	0	1	0	1	0	1
13	1	0	0	1	0	1	0	0	1	0	1	0	0
14	1	0	0	1	0	1	0	0	1	0	1	0	1
15	0	1	1	0	0	1	0	0	1	0	1	0	0
16	0	1	0	1	0	0	1	0	1	0	0	1	0
17	0	1	1	0	0	0	0	1	0	1	0	1	1
18	0	1	1	0	0	1	0	0	0	1	1	0	0
19	0	1	0	1	0	0	1	0	1	0	0	1	0
20	1	0	0	1	0	1	0	0	0	1	1	0	0
21	1	0	1	0	0	0	1	0	1	0	1	0	0
22	1	0	0	1	0	1	0	0	1	0	0	1	

Data Table (Part 2) for "Processing" Category

Variable:	Level of Technology			Change in Costs			Current Cost Impact			Supply - Capacity Ratio			Success
Boolean Code:	K	L	M	N	O	P	Q	R	S	T	U	V	Z
Response Options:	Low Technology	Medium Technology	High Technology	Decrease Costs	No Change Costs	Increase Costs	Negative Costs	No Impact Costs	Positive Costs	Under Supply	Sufficient Supply	Over Supply	Output Value
New Industry:													
1	0	1	0	1	0	0	0	1	0	1	0	0	0
2	0	0	1	0	1	0	0	1	0	1	0	0	1
3	1	0	0	0	1	0	1	0	0	1	0	0	0
4	1	0	0	0	1	0	0	1	0	0	1	0	1
5	0	1	0	0	0	1	1	0	0	0	0	1	0
6	0	0	1	1	0	0	0	1	0	0	1	0	1
7	1	0	0	0	1	0	1	0	0	0	0	1	0
8	0	1	0	0	1	0	1	0	0	1	0	0	0
9	1	0	0	0	0	1	1	0	0	1	0	0	0
10	0	1	0	0	1	0	0	1	0	0	1	0	0
11	1	0	0	1	0	0	0	1	0	0	1	0	1
12	0	1	0	0	1	0	0	1	0	1	0	0	0
13	0	0	1	1	0	0	0	1	0	1	0	0	1
14	0	1	0	0	1	0	1	0	0	1	0	0	0
15	0	1	0	0	1	0	1	0	0	0	1	0	1
16	1	0	0	0	1	0	1	0	0	0	0	1	0
17	1	0	0	0	0	1	1	0	0	1	0	0	0
18	0	1	0	0	1	0	1	0	0	0	1	0	1
19	0	1	0	1	0	0	0	1	0	1	0	0	0
20	0	1	0	0	1	0	1	0	0	1	0	0	0
21	0	1	0	0	1	0	0	1	0	1	0	0	0
22	0	1	0	0	1	0	1	0	0	0	1	0	0

Data Table for "Satisfying the Markets" Category

Variable:	Quality Comparison			Price Comparison			Improvement Process		Improvement Initiation		Quality Control		Success
Boolean Code:	A	B	C	D	E	F	g	G	h	H	j	J	Z
Response Options:	Above Std	Equal Std	Below Std	Above Competitors	Equal to Competitors	Below Competitors	No/Spasmodic Improvements	Continual Improvements	No/Limited Initiation	Extensive Initiation	Ltd QC	Multi QC	Output Value
New Industry:													
1	1	0	0	1	0	0	0	1	1	0	1	0	0
2	0	1	0	1	0	0	0	1	0	1	0	1	1
3	0	0	1	1	0	0	1	0	1	0	1	0	0
4	0	1	0	0	0	1	1	0	1	0	1	0	1
5	1	0	0	0	0	1	1	0	1	0	1	0	0
6	1	0	0	1	0	0	0	1	0	1	0	1	1
7	0	1	0	0	1	0	1	0	1	0	1	0	0
8	1	0	0	1	0	0	1	0	1	0	0	1	0
9	1	0	0	1	0	0	1	0	1	0	0	1	0
10	0	1	0	1	0	0	1	0	1	0	1	0	0
11	0	1	0	0	1	0	1	0	1	0	0	1	1
12	1	0	0	1	0	0	1	0	1	0	1	0	0
13	1	0	0	1	0	0	0	1	1	0	0	1	1
14	1	0	0	1	0	0	0	1	1	0	1	0	0
15	1	0	0	1	0	0	0	1	1	0	0	1	1
16	0	1	0	0	1	0	0	1	0	1	1	0	0
17	1	0	0	0	1	0	1	0	1	0	0	1	0
18	0	1	0	1	0	0	0	1	0	1	1	0	1
19	0	1	0	0	1	0	0	1	1	0	0	1	0
20	0	1	0	0	1	0	0	1	1	0	0	1	0
21	1	0	0	1	0	0	1	0	0	1	1	0	0
22	0	1	0	0	0	1	0	1	1	0	0	1	0

Data Table for "Current Issues" Category

Variable:	Current Issues			Level of Action			Success
Boolean Code:	A	B	C	D	E	F	Z
Response Options:	No / Low Threat	Medium Threat	High Threat	No / Low Action	Medium Action	High Action	Output Value
New Industry:							
1	1	0	0	0	1	0	0
2	0	1	0	0	1	0	1
3	0	0	1	1	0	0	0
4	1	0	0	0	1	0	1
5	0	1	0	0	1	0	0
6	0	1	0	0	0	1	1
7	0	0	1	1	0	0	0
8	0	1	0	1	0	0	0
9	0	0	1	1	0	0	0
10	1	0	0	1	0	0	0
11	0	1	0	0	1	0	1
12	1	0	0	1	0	0	0
13	0	1	0	0	0	1	1
14	0	1	0	0	0	1	0
15	0	0	1	1	0	0	1
16	0	0	1	0	0	1	0
17	0	0	1	1	0	0	0
18	0	1	0	0	0	1	1
19	0	1	0	0	1	0	0
20	0	1	0	0	1	0	0
21	1	0	0	1	0	0	0
22	0	1	0	0	1	0	0

Appendix 3: Boolean Algebraic Analysis

This appendix subjects the new land-based industry case information collated on the data tables included in Appendix 2 to Boolean algebraic analysis, which is a four-step process. First, the lists of success (n=7) and non-success (n=15) primitive expressions are presented in their full form. Second, the Boolean algebraic analysis then commences with the preliminary step of removing letter codes of the alternative, unused possible responses in mutually exclusive variables. Third, these refined primitive expressions are then used to construct truth tables, from which contradictory groups are eliminated prior to the commencement of the Boolean minimisation steps. Fourth, those minimisation steps, limited as they are, reduce the non-contradictory primitive expressions to prime implicants. In fact, these reduced primitive expressions are actually already essential prime implicants, because of the total lack of refinements through the essential prime implicant charts, and are therefore taken from these charts and presented as essential prime implicants in Chapter 4.

1. Origins and History of Industry

Primitive Expressions

Successful (n=7):		*Non-Successful (n=15):*		
ABCdefgH	AbcdEfgh	AbcdefgH	ABCdEfgh	AbcdeFgh
AbCdefGh	AbCdefGh	AbcDEfgh	ABCDefgH	ABcdefgH
AbCdEfgh	AbCdeFgh	AbcdefGh	AbcdeFgh	ABcdefgH
AbcdefgH		ABcdefgH	ABcdefgH	ABcdeFgh
		AbcdeFgh	ABcDEfgh	AbCdeFgh

Boolean Algebraic Analysis

Preliminary Step: Remove unnecessary letter codes in mutually exclusive variables.

Success = ABCdH + AbcdE + AbCdG + AbCdG + AbCdE + AbCdF + AbcdH

Non-Success = AbcdH + ABCdE + AbcdF + AbcDE + ABCDH + ABcdH + AbcdG
AbcdF + ABcdH + ABcdH + ABcdH + ABcdF + AbcdF + ABcDE + AbCdF

Step One: Group identical primitive expressions and create truth table.

Truth Table

Primitive Expressions	Number of Cases	Success / Non-Success	Output Value (Z)
ABCdH	1	1 / 0	1
AbcdE	1	1 / 0	1
AbCdG	2	2 / 0	1
AbCdE	1	1 / 0	1
AbCdF	2	1 / 1	?
AbcdH	2	1 / 1	?
ABCdE	1	0 / 1	0
AbcdF	3	0 / 3	0
AbcDE	1	0 / 1	0
ABCDH	1	0 / 1	0
ABcdH	4	0 / 4	0
ABcdF	1	0 / 1	0
ABcDE	1	0 / 1	0
AbcdG	1	0 / 1	0

Step Two: Eliminate contradictory groups and commence Boolean minimisation.

Success = ABCdH + AbcdE + AbCdG + AbCdE
= ABCdH + AbdE + AbCdG

Non-Success = ABCdE + AbcdF + AbcDE + ABCDH + ABcdH + ABcdF + ABcDE + AbcdG
= ABCdE + AcdF + AcDE + ABCDH + ABcdH + AbcdG

Step Three: Identify essential prime implicants by construction of EPI charts

Essential Prime Implicant Charts

Success

Prime Implicants	Primitive Expressions			
	ABCdH	**AbcdE**	**AbCdG**	**AbCdE**
ABCdH	1			
AbdE		1		1
AbCdG			1	

No further refinements are possible; therefore prime implicants are also essential prime implicants.

Non-Success

Prime Implicants	Primitive Expressions							
	ABCdE	**AbcdF**	**AbcDE**	**ABCDH**	**ABcdH**	**ABcdF**	**ABcDE**	**AbcdG**
ABCdE	1							
AcdF		1				1		
AcDE			1				1	
ABCDH				1				
ABcdH					1			
AbcdG								1

No further refinements are possible; therefore prime implicants are also essential prime implicants.

2. Product Characteristics and Environmental Requirements

Primitive Expressions

Successful (n=7):

aBCdefGh ABcDeFgh
aBCdeFgh aBCDefGh
ABcdeFgh aBCDefGh
aBcdeFgh

Non-Successful (n=15):

abCdeFgh aBCDefgH aBCDEfgH
aBCDEfgH abcdeFgh aBCDefgH
aBCdEFgh aBCdeFgh aBCDefgH
aBcdeFgh aBCdeFgh aBCdEFgh
aBCDEfGh aBcdeFgh aBCDEfgH

Boolean Algebraic Analysis

Preliminary Step: Remove unnecessary letter codes in mutually exclusive variables.

Success = aBCdeG + ABcDeF + aBCdeF + aBCDeG + ABcdeF + aBCDeG + aBcdeF

Non-Success = abCdeF + aBCDeH + aBCDEH + aBCDEH + abcdeF + aBCDeH + aBCdEF + aBCdeF + aBCDeH + aBcdeF + aBCdeF + aBCdEF + aBCDEG + aBcdeF aBCDEH

Step One: Group identical primitive expressions and create truth table.

Truth Table

Primitive Expressions	Number of Cases	Success / Non-Success	Output Value (Z)
aBCdeG	1	1 / 0	1
ABcDeF	1	1 / 0	1
aBCDeG	2	2 / 0	1
ABcdeF	1	1 / 0	1
aBcdeF	3	1 / 2	?
aBCdeF	3	1 / 2	?
abCdeF	1	0 / 1	0
aBCDeH	3	0 / 3	0
aBCDEH	3	0 / 3	0
abcdeF	1	0 / 1	0
aBCdEF	2	0 / 2	0
aBCDEG	1	0 / 1	0

Step Two: Eliminate contradictory groups and commence Boolean minimisation.

Success = aBCdeG + ABcDeF + aBCDeG + ABcdeF
= aBCeG + ABceF

Non-Success = abCdeF + aBCDeH + aBCDEH + abcdeF + aBCdEF + aBCDEG
= abdeF + aBCDH + aBCdEF + aBCDEG

Step Three: Identify essential prime implicants by construction of EPI charts

Essential Prime Implicant Charts

Success

Prime Implicants	Primitive Expressions			
	ABCdeG	**ABcDeF**	**aBCDeG**	**ABcdeF**
aBCeG	1		1	
ABceF		1		1

No further refinements are possible; therefore prime implicants are also essential prime implicants.

Non-Success

Prime Implicants	Primitive Expressions					
	abCdeF	**aBCDeH**	**aBCDEH**	**abcdeF**	**aBCdEF**	**aBCDEG**
abdeF	1			1		
aBCDH		1	1			
aBCdEF					1	
aBCDEG						1

No further refinements are possible; therefore prime implicants are also essential prime implicants.

3. Industry Organisation and Co-operation

Primitive Expressions

Successful (n=7):
AbCdeFGhijKlmNo
ABCdeFGHijKlmNo
ABCdeFGhijKlmnO
AbCdEfGhijKlmNo
ABCdeFGhijKlmNo
aBCdEfGhiJklmNo
aBCdEfGhijKlmNo

Non-Successful (n=15):
abCdEfghiJklmNo
abcDefghIjklMno
abCDefGhijKlmnO
abcDefGhIjkLmno
abcdEfGhiJklmnO
abcDefghijKlMno
ABCdEfGhiJklmNo
abCdEfGhiJklMno
abcdEfGhIjklmNo
aBCdEfGhiJklmNo
aBCdEfGhijKlmnO
abcdeFGhijKlmNo
aBCdeFGhiJklmNo
abcdEfGhiJklMno
abcDefghIjklMno

Boolean Algebraic Analysis

Preliminary Step: Remove unnecessary letter codes in mutually exclusive variables.

Success = AbCFGhKN + ABCFGHKN + ABCFGhKO + AbCEGhKN + ABCFGhKN + aBCEGhJN + aBCEGhKN

Non-Success = abCEghJN + abcEGhIN + abcDghIM + aBCEGhJN + abCDGhKO + aBCEGhKO + abcDGhIL + abcFGhKN + abcEGhJO + aBCFGhJN + abcDghKM + abcEGhJM + ABCEGhJN + abcDghIM + abCEGhJM

Step One: Group identical primitive expressions and create truth table.

Truth Table

Primitive Expressions	Number of Cases	Success / Non-Success	Output Value (Z)
AbCFGhKN	1	1 / 0	1
ABCFGHKN	1	1 / 0	1
ABCFGhKO	1	1 / 0	1
AbCEGhKN	1	1 / 0	1
ABCFGhKN	1	1 / 0	1
aBCEGhKN	1	1 / 0	1
aBCEGhJN	2	1 / 1	?
abCEghJN	1	0 / 1	0
abcEGhIN	1	0 / 2	0
abcDghIM	2	0 / 1	0
abCDGhKO	1	0 / 1	0
aBCEGhKO	1	0 / 1	0
abcDGhIL	1	0 / 1	0
abcFGhKN	1	0 / 1	0
abcEGhJO	1	0 / 1	0
aBCFGhJN	1	0 / 1	0
abcDghKM	1	0 / 1	0
abcEGhJM	1	0 / 1	0
ABCEGhJN	1	0 / 1	0
abCEGhJM	1	0 / 1	0

Step Two: Eliminate contradictory groups and commence Boolean minimisation.

Success = AbCFGhKN + ABCFGHKN + ABCFGhKO + AbCEGhKN + ABCFGhKN + aBCEGhKN
= ACFGhKN + ABCFGKN + ABCFGhKO + AbCEGhKN + aBCEGhKN

Non-Success = abCEghJN + abcEGhIN + abcDghIM + abCDGhKO + aBCEGhKO + abcDGhIL + abcFGhKN + abcEGhJO + aBCFGhJN + abcDghKM + abcEGhJM + ABCEGhJN + abCEGhJM
= abCEghJN + abcEGhIN + abcDghIM + abCDGhKO + aBCEGhKO + abcDGhIL + abcFGhKN + abcEGhJO + aBCFGhJN + abcDghKM + abEGhJM + ABCEGhJN

Step Three: Identify essential prime implicants by construction of EPI charts

Essential Prime Implicant Charts

Success

Prime Implicants	Primitive Expressions					
	AbCFGhKN	**ABCFGHKN**	**ABCFGhKO**	**AbCEGhKN**	**ABCFGhKN**	**aBCEGhKN**
ACFGhKN	1				1	
ABCFGKN		1			1	
ABCFGhKO			1			
AbCEGhKN				1		
aBCEGhKN						1

NB: Although both ACFGhKN and ABCFGKN prime implicants cover the primitive expression ABCFGhKN, both of these also cover one other but different primitive expressions. Consequently, no further refinements are possible; therefore prime implicants are also essential prime implicants.

Non-Success (Part One)

Prime Implicants	Primitive Expressions					
	abCEghJN	**abcEGhIN**	**abcDghIM**	**abCDGhKO**	**aBCEGhKO**	**abcDGhIL**
abCEghJN	1					
abcEGhIN		1				
abcDghIM			1			
abCDGhKO				1		
aBCEGhKO					1	
abcDGhIL						1

Non-Success (Part Two)

Prime Implicants	Primitive Expressions						
	abcFGhKN	**abcEGhJO**	**aBCFGhJN**	**abcDghKM**	**abcEGhJM**	**ABCEGhJN**	**abCEGhJM**
abcFGhKN	1						
abcEGhJO		1					
aBCFGhJN			1				
abcDghKM				1			
abEGhJM					1		1
ABCEGhJN						1	

No further refinements are possible; therefore prime implicants are also essential prime implicants.

4. Production Inputs and Capital Investments

Primitive Expressions

Successful (n=7):		*Non-Successful (n=15):*		
aBcDeFGhi	abCDeFgHi	abCdEfGhi	abCdeFgHi	aBcdefGhi
AbcDefGhi	aBcdeFgHi	abCDefgHi	aBcdeFGhi	abCDefghI
abCdeFgHi	aBcdefgHi	AbcDefGhi	aBcdefGhi	AbcdefGhi
aBcdEFGhi		aBcdefGhi	aBcDefGhi	aBcDefGhi
		AbcdefGhi	aBcdefGhi	abCDefgHi

Boolean Algebraic Analysis

Preliminary Step: Remove unnecessary letter codes in mutually exclusive variables.

Success = BDeFG + CDeFH + ADefG + BdeFH + CdeFH + BdefH + BdEFG

Non-Success = CdEfG + CdeFH + BdefG + CDefH + BdeFG + CDefI + ADefG + BdefG + AdefG + BdefG + BDefG + BDefG + AdefG + BdefG + CDefH

Step One: Group identical primitive expressions and create truth table.

Truth Table

Primitive Expressions	Number of Cases	Success / Non-Success	Output Value (z)
BDeFG	1	1 / 0	1
CDeFH	1	1 / 0	1
BdeFH	1	1 / 0	1
BdefH	1	1 / 0	1
BdEFG	1	1 / 0	1
CdeFH	2	1 / 1	?
ADefG	2	1 / 1	?
CdEfG	1	0 / 1	0
BdefG	4	0 / 4	0
CDefH	2	0 / 2	0
BdeFG	1	0 / 1	0
CDefI	1	0 / 1	0
BDefG	2	0 / 2	0
AdefG	2	0 / 2	0

Step Two: Eliminate contradictory groups and commence Boolean minimisation.

Success = BDeFG + CDeFH + BdeFH + BdefH + BdEFG
= BDeFG + CDeFH + BdeH + BdEFG

Non-Success = CdEfG + BdefG + CDefH + BdeFG + CDefI + BDefG + AdefG
= CdEfG + BefG + CDefH + BdeG + CDefI + AdefG

Essential Prime Implicant Charts

Success

Prime Implicants	Primitive Expressions				
	BDeFG	**CDeFH**	**BdeFH**	**BdefH**	**BdEFG**
BDeFG	1				
CDeFH		1			
BdeH			1	1	
BdEFG					1

No further refinements are possible; therefore prime implicants are also essential prime implicants.

Non-Success

Prime Implicants	Primitive Expressions						
	CdEfG	**BdefG**	**CDefH**	**BdeFG**	**CDefI**	**BDefG**	**AdefG**
CdEfG	1						
BefG		1				1	
CDefH			1				
BdeG		1		1			
CDefI					1		
AdefG							1

NB: Although both BefG and BdeG prime implicants cover the primitive expression BdefG, both of these also cover one other but different primitive expressions. Consequently, no further refinements are possible; therefore prime implicants are also essential prime implicants.

5. Marketing and Market Development

Primitive Expressions

Successful (n=7):
abCDEFGHijklMnOpQrsTUvwxy
aBCdEfGHijklMnOPQrStuVwXy
AbCdEfGhIjKlMnOPQrsTuVwXy
abcDEfghIjKlmnOpQRstuVwxy
AbCdEfGHIjKLMnOPQrsTuVwXy
aBCdEfGHIjklMnOpQrStuVwxY
AbcDEfGHIjklMnOPQrStuVwXy

Non-Successful (n=15):
aBcdEfghijklmNopQRstuVwxy
aBcdefghijklmnopqRstuVwxY
AbCdEfGHijklmnOPQRstuVwxy
aBCdEFghijkLMnopQRstuVwxY
AbcDEFGHijKlMnOpQRstuVwxy
aBCdEfGHIjkLmnOpQRstUvwxY
abCdEfGHIjklmNOpQRstuVwxY
abCdEFghijkLMNopQRstuvWxy
aBCdEFGhijKLMNopQRstuvWXy
aBCdEfghijkLmnopQRstuvWxY
abcDEfGHijKlMnOPQRstuVwxy
abCdEfGHijkLMnOpQRstuVwxY
AbcDEfGHijKlMnOPQrStUvwxY
AbCdEfghijkLMNoPQRstuVwxy
abcDEfGHijklMNOpQRstuVwxy

Boolean Algebraic Analysis

Preliminary Step: Remove unnecessary letter codes in mutually exclusive variables.

Success = abCDEFGHijklMnOpQTUxy + aBCdEfGHijklMnOPQSVXy +
AbCdEfGhIjKlMnOPQTVXy + abcDEfghIjKlmnOpQRVxy +
AbCdEfGHIjKLMnOPQTVXy + aBCdEfGHIjklMnOpQSVxY +
AbcDEfGHIjklMnOPQSVXy

Non-Success = aBcdEfghijklmNopQRVxy + aBcdefghijklmnopqRVxY +
AbCdEfGHijklmnOPQRVxy + aBCdEFghijkLMnopQRVxY +
AbcDEFGHijKlMnOpQRVxy + aBCdEfGHIjkLmnOpQRUxY +
abCdEfGHIjklmNOpQRVxY + abCdEFghijkLMNopQRWxy +
aBCdEFGhijKLMNopQRWXy + aBCdEfghijkLmnopQRWxY +
abcDEfGHijKlMnOPQRVxy + abCdEfGHijkLMnOpQRVxY +
AbcDEfGHijKlMnOPQSUxY + AbCdEfghijkLMNoPQRVxy +
abcDEfGHijklMNOpQRVxy

Step One: Group identical primitive expressions and create truth table.

Truth Table

Primitive Expressions	Number of Cases	Success / Non-Success	Output Value (Z)
abCDEFGHijklMnOpQTUxy	1	1 / 0	1
aBCdEfGHijklMnOPQSVXy	1	1 / 0	1
AbCdEfGhIjKlMnOPQTVXy	1	1 / 0	1
abcDEfghIjKlmnOpQRVxy	1	1 / 0	1
AbCdEfGHIjKLMnOPQTVXy	1	1 / 0	1
aBCdEfGHIjklMnOpQSVxY	1	1 / 0	1
AbcDEfGHIjklMnOPQSVXy	1	1 / 0	1
aBcdEfghijklmNopQRVxy	1	0 / 1	0
aBcdefghijklmnopqRVxY	1	0 / 1	0
AbCdEfGHijklmnOPQRVxy	1	0 / 1	0
aBCdEFghijkLMnopQRVxY	1	0 / 1	0
AbcDEFGHijKlMnOpQRVxy	1	0 / 1	0
aBCdEfGHIjkLmnOpQRUxY	1	0 / 1	0
abCdEfGHIjklmNOpQRVxY	1	0 / 1	0
abCdEFghijkLMNopQRWxy	1	0 / 1	0
aBCdEFGhijKLMNopQRWXy	1	0 / 1	0
aBCdEfghijkLmnopQRWxY	1	0 / 1	0
abcDEfGHijKlMnOPQRVxy	1	0 / 1	0
abCdEfGHijkLMnOpQRVxY	1	0 / 1	0
AbcDEfGHijKlMnOPQSUxY	1	0 / 1	0
AbCdEfghijkLMNoPQRVxy	1	0 / 1	0
abcDEfGHijklMNOpQRVxy	1	0 / 1	0

Step Two: Eliminate contradictory groups and commence Boolean minimisation.

Success = abCDEFGHijklMnOpQTUxy + aBCdEfGHijklMnOPQSVXy +
AbCdEfGhIjKlMnOPQTVXy + abcDEfghIjKlmnOpQRVxy +
AbCdEfGHIjKLMnOPQTVXy + aBCdEfGHIjklMnOpQSVxY +
AbcDEfGHIjklMnOPQSVXy

Non-Success = aBcdEfghijklmNopQRVxy + aBcdefghijklmnopqRVxY +
AbCdEfGHijklmnOPQRVxy + aBCdEFghijkLMnopQRVxY +
AbcDEFGHijKlMnOpQRVxy + aBCdEfGHIjkLmnOpQRUxY +
abCdEfGHIjklmNOpQRVxY + abCdEFghijkLMNopQRWxy +
aBCdEFGhijKLMNopQRWXy + aBCdEfghijkLmnopQRWxY +
abcDEfGHijKlMnOPQRVxy + abCdEfGHijkLMnOpQRVxY +
AbcDEfGHijKlMnOPQSUxY + AbCdEfghijkLMNoPQRVxy +
abcDEfGHijklMNOpQRVxy

Step Three: Identify essential prime implicants by construction of EPI charts

Essential Prime Implicant Charts

Success (Part One)

Prime Implicants	Primitive	Expressions
	abCDEFGHijklMnOpQTUxy	aBCdEfGHijklMnOPQSVXy
abCDEFGHijklMnOpQTUxy	1	
aBCdEfGHijklMnOPQSVXy		1

Success (Part Two)

Prime Implicants	Primitive	Expressions
	AbCdEfGhIjKlMnOPQTVXy	abcDEfghIjKlmnOpQRVxy
AbCdEfGhIjKlMnOPQTVXy	1	
abcDEfghIjKlmnOpQRVxy		1

Success (Part Three)

Prime Implicants	Primitive	Expressions
	AbCdEfGHIjKLMnOPQTVXy	aBCdEfGHIjklMnOpQSVxY
AbCdEfGHIjKLMnOPQTVXy	1	
aBCdEfGHIjklMnOpQSVxY		1

Success (Part Four)

Prime Implicants	Primitive Expression
	AbcDEfGHIjklMnOPQSVXy
AbcDEfGHIjklMnOPQSVXy	1

No further refinements are possible; therefore prime implicants are also essential prime implicants.

Non-Success (Part One)

Prime Implicants	Primitive	Expressions
	aBcdEfghijklmNopQRVxy	aBcdefghijklmnopqRVxY
aBcdEfghijklmNopQRVxy	1	
aBcdefghijklmnopqRVxY		1

Non-Success (Part Two)

Prime Implicants	Primitive	Expressions
	AbCdEfGHijklmnOPQRVxy	aBCdEFghijkLMnopQRVxY
AbCdEfGHijklmnOPQRVxy	1	
aBCdEFghijkLMnopQRVxY		1

Non-Success (Part Three)

Prime Implicants	Primitive	Expressions
	AbcDEFGHijKlMnOpQRVxy	aBCdEfGHIjkLmnOpQRUxY
AbcDEFGHijKlMnOpQRVxy	1	
aBCdEfGHIjkLmnOpQRUxY		1

Non-Success (Part Four)

Prime Implicants	Primitive	Expressions
	abCdEfGHIjklmNOpQRVxY	abCdEFghijkLMNopQRWxy
abCdEfGHIjklmNOpQRVxY	1	
abCdEFghijkLMNopQRWxy		1

Non-Success (Part Five)

Prime Implicants	Primitive Expressions	
	aBCdEFGhijKLMNopQRWXy	**aBCdEfghijkLmnopQRWxY**
aBCdEFGhijKLMNopQRWXy	1	
aBCdEfghijkLmnopQRWxY		1

Non-Success (Part Six)

Prime Implicants	Primitive Expressions	
	abCdEfGHijkLMnOpQRVxY	**abCdEfGHijkLMnOpQRVxY**
abCdEfGHijkLMnOpQRVxY	1	
abCdEfGHijkLMnOpQRVxY		1

Non-Success (Part Seven)

Prime Implicants	Primitive Expressions	
	AbcDEfGHijKlMnOPQSUxY	**AbCdEfghijkLMNoPQRVxy**
AbcDEfGHijKlMnOPQSUxY	1	
AbCdEfghijkLMNoPQRVxy		1

Non-Success (Part Eight)

Prime Implicants	Primitive Expression
	abcDEfGHijklMNOpQRVxy
abcDEfGHijklMNOpQRVxy	1

No further refinements are possible; therefore prime implicants are also essential prime implicants.

6. Financial Resources

NB: Because one new industry did not have a formal industry organisation this category was inappropriate, while a second new industry declined to disclose information on financial resources. There are, therefore, only 20 new industries analysed in this category, with six successful and 14 non-successful.

Primitive Expressions

Success (n=6):	*Non-Success (n=14):*	
abCdeFGhijKlmNo	AbcdEfghIJklmNo	AbcDefgHiJklMno
AbcdEfghIjkLmnO	aBcdEfGhiJklMno	AbcDefgHiJklMno
aBcdeFghIjkLmnO	AbcDefgHiJklMno	AbcDefgHiJklMno
AbcDefghIjkLmnO	AbcDefgHiJklmNo	AbcdEfgHiJklmNo
aBcdEfgHijKlMnO	AbcdEfghIjKlmnO	aBcdEfGhiJklMno
AbcDefghIjKlmnO	AbcDefgHiJklMno	aBcdEfGhiJklMno
	AbcdEfgHiJklmNo	AbcdEfgHiJklmNo

Boolean Algebraic Analysis

Preliminary Step: Remove unnecessary letter codes in mutually exclusive variables.

Success = CFGKN + AEILO + BFILO + ADILO + BEHKO + ADIKO
Non-Success = AEIJN + ADHJM + BEGJM + ADHJM + ADHJM + ADHJM + ADHJN + AEHJN + AEIKO + BEGJM + ADHJM + BEGJM + AEHJN + AEHJN

Step One: Group identical primitive expressions and create truth table.

Truth Table

Primitive Expressions	Number of Cases	Success / Non-Success	Output Value (Z)
CFGKN	1	1 / 0	1
AEILO	1	1 / 0	1
BFILO	1	1 / 0	1
ADILO	1	1 / 0	1
BEHKO	1	1 / 0	1
ADIKO	1	1 / 0	1
AEIJN	1	0 / 1	0
ADHJM	5	0 / 5	0
ADHJN	1	0 / 1	0
AEHJN	3	0 / 3	0
BEGJM	3	0 / 3	0
AEIKO	1	0 / 1	0

Step Two: Eliminate contradictory groups and commence Boolean minimisation.

Success = CFGKN + AEILO + BFILO + ADILO + BEHKO + ADIKO

Non-Success = AEIJN + ADHJM + ADHJN + AEHJN + BEGJM + AEIKO

Essential Prime Implicant Charts

Success

Prime Implicants	Primitive Expressions					
	CFGKN	**AEILO**	**BFILO**	**ADILO**	**BEHKO**	**ADIKO**
CFGKN	1					
AEILO		1				
BFILO			1			
ADILO				1		
BEHKO					1	
ADIKO						1

No further refinements are possible; therefore prime implicants are also essential prime implicants.

Non-Success

Prime Implicants	Primitive Expressions					
	AEIJN	**ADHJM**	**ADHJN**	**AEHJN**	**BEGJM**	**AEIKO**
AEIJN	1					
ADHJM		1				
ADHJN			1			
AEHJN				1		
BEGJM					1	
AEIKO						1

No further refinements are possible; therefore prime implicants are also essential prime implicants.

Step Three: Identify essential prime implicants by construction of EPI charts

7. Research and Development

Primitive Expressions

Successful (n=7):
AbcdEfgHIjklmNopQ
abCdefGhIjkLmnopQ
ABcDefgHIjklmNopQ
aBCdefGhIjkLmnoPq
ABcDefgHIjkLmnopQ
aBCdeFghijKlmNopQ
ABcDeFghIjklMnoPq

Non-Successful (n=15):
abCdeFghIjkLmnoPq
aBcDeFghIjklMnoPq
abCdeFghIjkLmnOpq
abcdEFghIjkLmnopQ
AbCdefGhIjklmNopQ
abCdeFghIjkLmnOpq
AbcDeFghiJklmNoPq
AbcDefGhIjkLmnoPq
abCdeFghIjkLmnoPq
abCdeFghIjkLmnOpq
abCdeFghIjkLmnOpq
abcDeFghIjkLmnOpq
abcDeFghIjkLmnOpq
abCdeFghIjkLmnoPq
ABCdefGhIjklMnopQ

Boolean Algebraic Analysis

Preliminary Step: Remove unnecessary letter codes in mutually exclusive variables.

Success = AbEHINQ + abCGILQ + ABDHINQ + aBCGILP + ABDHILQ + aBCFKNQ + ABDFIMP

Non-Success = abCFILP + abCFILP + ABDFIMP + abCFILO + abCFILO + abCFILO + abEFILQ + abDFILO + AbCGINQ + abDFILO + AbCFILO + abCFILP + AbDFJNP + ABCGIMQ + AbDGILP

Step One: Group identical primitive expressions and create truth table.

Truth Table

Primitive Expressions	Number of Cases	Success / Non-Success	Output Value (Z)
AbEHINQ	1	1 / 0	1
abCGILQ	1	1 / 0	1
ABDHINQ	1	1 / 0	1
aBCGILP	1	1 / 0	1
ABDHILQ	1	1 / 0	1
aBCFKNQ	1	1 / 0	1
ABDFIMP	2	1 / 1	?
abCFILP	3	0 / 3	0
abCFILO	3	0 / 3	0
abEFILQ	1	0 / 1	0
abDFILO	2	0 / 2	0
AbCGINQ	1	0 / 1	0
AbCFILO	1	0 / 1	0
AbDFJNP	1	0 / 1	0
ABCGIMQ	1	0 / 1	0
AbDGILP	1	0 / 1	0

Step Two: Eliminate contradictory groups and commence Boolean minimisation.

Success = AbEHINQ + abCGILQ + ABDHINQ + aBCGILP + ABDHILQ + aBCFKNQ

Non-Success = abCFILP + abCFILO + abEFILQ + abDFILO + AbCGINQ + AbCFILO + AbDFJNP + ABCGIMQ + AbDGILP
= abCFILP + bCFILO + abEFILQ + abDFILO + AbCGINQ + AbDFJNP + ABCGIMQ + AbDGILP

Step Three: Identify essential prime implicants by construction of EPI charts

Essential Prime Implicant Charts

Success

Prime Implicants	Primitive Expressions					
	AbEHINQ	**abCGILQ**	**ABDHINQ**	**aBCGILP**	**ABDHILQ**	**aBCFKNQ**
AbEHINQ	1					
abCGILQ		1				
ABDHINQ			1			
aBCGILP				1		
ABDHILQ					1	
aBCFKNQ						1

No further refinements are possible; therefore prime implicants are also essential prime implicants.

Non-Success (Part One)

Prime Implicants	Primitive Expressions				
	abCFILP	**abCFILO**	**AbCFILO**	**abEFILQ**	**abDFILO**
abCFILP	1				
bCFILO		1	1		
abEFILQ				1	
abDFILO					1

Non-Success (Part Two)

Prime Implicants	Primitive Expressions			
	AbCGINQ	**AbDFJNP**	**ABCGIMQ**	**AbDGILP**
AbCGINQ	1			
AbDFJNP		1		
ABCGIMQ			1	
AbDGILP				1

No further refinements are possible; therefore prime implicants are also essential prime implicants.

8. Government Regulations and Controls

Primitive Expressions

Successful (n=7):
AbcdEfghIjKlMnoPqrStuvw
aBcDefGhiJklmNoPqrStuvw
aBcDefGhiJklmnOpQrsTuvw
aBcDefGhiJklmNoPqrstUvw
abCDefGhiJklmNopQrsTuvw
AbcdEfghIjKlMnopqRstuvW
aBcDefGhiJklmnOpQrsTuvw

Non-Successful (n=15):
aBcdEfGhijKlmNopQrstuVw
aBcDefgHijKlMnoPqrStuvw
AbcdEfgHiJklmNoPqrstUvw
aBcDefGhiJklmNoPqrsTuvw
AbcdEfgHiJklmNoPqrstUvw
AbcdEfghIjKlMnoPqrStuvw
aBcDefgHijKlmNoPqrstUvw
AbcdEfghIjKlMnoPqrstUvw
AbcdEfgHiJklmNoPqrstUvw
aBcDefgHijKlmNoPqrsTuvw
AbcdEfgHiJklmNoPqrstUvw
aBcDefgHijKlmNopQrstuVw
AbcdEfgHiJklmNopqRstuvW
AbcdEfghIjKlMnoPqrstUvw
AbcdEfgHiJklmNoPqrstUvw

Boolean Algebraic Analysis

Preliminary Step: Remove unnecessary letter codes in mutually exclusive variables.

Success = AEIKMPS + BDGJNPS + BDGJOQT + BDGJNPU + CDGJNQT + AEIKMRW + BDGJOQT

Non-Success = BEGKNQV + AEHJNPU + BDHKMPS + BDHKNPU + AEHJNPU + AEHJNPU + BDGJNPT + BDHKNQV + AEHJNPU + AEHJNRW + AEIKMPS + AEIKNPU + BDHKMPT + AEHJNPU + AEIKMPU

Step One: Group identical primitive expressions and create truth table.

Truth Table

Primitive Expressions	Number of Cases	Success / Non-Success	Output Value (Z)
BDGJNPS	1	1 / 0	1
BDGJOQT	2	2 / 0	1
BDGJNPU	1	1 / 0	1
CDGJNQT	1	1 / 0	1
AEIKMRW	1	1 / 0	1
AEIKMPS	2	1 / 1	?
BEGKNQV	1	0 / 1	0
AEHJNPU	5	0 / 5	0
BDHKMPS	1	0 / 1	0
BDHKNPU	1	0 / 1	0
BDGJNPT	1	0 / 1	0
BDHKNQV	1	0 / 1	0
AEHJNRW	1	0 / 1	0
AEIKNPU	1	0 / 1	0
BDHKMPT	1	0 / 1	0
AEIKMPU	1	0 / 1	0

Step Two: Eliminate contradictory groups and commence Boolean minimisation.

Success = BDGJNPS + BDGJOQT + BDGJNPU + CDGJNQT + AEIKMRW

Non-Success = BEGKNQV + AEHJNPU + BDHKMPS + BDHKNPU + BDGJNPT + BDHKNQV + AEHJNRW + AEIKNPU + BDHKMPT + AEIKMPU

Step Three: Identify essential prime implicants by construction of EPI charts

Essential Prime Implicant Charts

Success

Prime Implicants	Primitive Expressions				
	BDGJNPS	**BDGJOQT**	**BDGJNPU**	**CDGJNQT**	**AEIKMRW**
BDGJNPS	1				
BDGJOQT		1			
BDGJNPU			1		
CDGJNQT				1	
AEIKMRW					1

No further refinements are possible; therefore prime implicants are also essential prime implicants.

Non-Success (Part One)

Prime Implicants	Primitive Expressions				
	BDGJNPT	**AEHJNPU**	**BDHKMPS**	**BDHKNPU**	**BDGJNPT**
BDGJNPT	1				
AEHJNPU		1			
BDHKMPS			1		
BDHKNPU				1	
BDGJNPT					1

Non-Success (Part Two)

Prime Implicants	Primitive Expressions				
	BDHKNQV	**AEHJNRW**	**AEIKNPU**	**BDHKMPT**	**AEIKMPU**
BDHKNQV	1				
AEHJNRW		1			
AEIKNPU			1		
BDHKMPT				1	
AEIKMPU					1

No further refinements are possible; therefore prime implicants are also essential prime implicants.

9. Processing

Primitive Expressions

Successful (n=7):
aBcdeFghjklMnOpqRsTuv
aBcdeFgHJKlmnOpqRstUv
aBcdEfgHjklMNopqRstUv
aBcdEfghjKlmNopqRstUv
AbCdEfgHjklMNopqRsTuv
aBcdEfgHjkLmnOpQrstUv
aBcdEfghjkLmnOpQrstUv

Non-Successful (n=15):
aBcdEfghjkLmNopqRsTuv
aBcdEfghjKlmnOpQrsTuv
AbCdeFgHjkLmnoPQrstuV
AbCdEfgHjKlmnOpQrstuV
aBcdEfghjkLmnOpQrsTuv
aBcdeFghjKlmnoPQrsTuv
aBcdeFghjkLmnOpqRstUv
AbCdeFgHjkLmnOpqRsTuv
AbCdEfgHjkLmnOpQrsTuv
abCdeFgHJKlmnOpQrstuV
aBcdefGhJKlmnoPQrsTuv
abCdeFgHJkLmNopqRsTuv
AbCdEfghjkLmnOpQrsTuv
ABcdeFgHjkLmnOpqRsTuv
AbCdEfgHJkLmnOpQrstUv

Boolean Algebraic Analysis

Preliminary Step: Remove unnecessary letter codes in mutually exclusive variables.

Success = aBFhjMORT + aBFHJKORU + aBEHjMNRU + aBEhjKNRU + ACEHjMNRT + aBEHjLOQU + aBEhjLOQU

Non-Success = aBEhjLNRT + ACEHjLOQT + ABEhjKOQT + aBFhjLORU + ACFHjLPQ + aBGhJKPQT + ACEHjKOQV + aCFHJLNRT + ABEhjLOQT + ACEhjLOQT + aBFhjKPQT + ABFHjLORT + aCFHJKOQV + ACEHJLOQU + ACFHjLORT

Step One: Group identical primitive expressions and create truth table.

Truth Table

Primitive Expressions	Number of Cases	Success / Non-Success	Output Value (Z)
aBFhjMORT	1	1 / 0	1
aBFHJKORU	1	1 / 0	1
aBEHjMNRU	1	1 / 0	1
aBEhjKNRU	1	1 / 0	1
ACEHjMNRT	1	1 / 0	1
aBEHjLOQU	1	1 / 0	1
aBEhjLOQU	1	1 / 0	1
aBEhjLNRT	1	0 / 1	0
ACEHjLOQT	1	0 / 1	0
aBEhjKOQT	1	0 / 1	0
aBFhjLORU	1	0 / 1	0
aCFHJKOQV	1	0 / 1	0
ACFHjLPQV	1	0 / 1	0
aBGhJKPQT	1	0 / 1	0
ACEHjKOQV	1	0 / 1	0
aCFHJLNRT	1	0 / 1	0
ACEHJLOQU	1	0 / 1	0
aBEhjLOQT	1	0 / 1	0
ACEhjLOQT	1	0 / 1	0
aBFhjKPQT	1	0 / 1	0
ABFHjLORT	1	0 / 1	0
ACFHjLORT	1	0 / 1	0

Step Two: Eliminate contradictory groups and commence Boolean minimisation.

Success = aBFhjMORT + aBFJKORU + aBEHjMNRU + aBEhjKNRU + ACEHjMNRT + aBEHjLOQU + aBEhjLOQU

= aBFhjMORT + aBFJKORU + aBEHjMNRU + aBEhjKNRU + ACEHjMNRT + aBEjLOQU

Non-Success = aBEhjLNRT + ACEHjLOQT + aBEhjKOQT + aBFhjLORU + aCFHJKOQV + ACFHjLPQV + aBGhJKPQT + ACEHjKOQV + aCFHJLNRT + ACEHJLOQU + aBEhjLOQT + ACEhjLOQT + aBFhjKPQT + ABFHjLORT + ACFHjLORT

Step Three: Identify essential prime implicants by construction of EPI charts

Essential Prime Implicant Charts

Success (Part One)

Prime Implicants	Primitive Expressions			
	aBFhjMORT	**aBFJKORU**	**aBEHjMNRU**	**aBEhjKNRU**
aBFhjMORT	1			
aBFJKORU		1		
aBEHjMNRU			1	
aBEhjKNRU				1

Success (Part Two)

Prime Implicants	Primitive Expressions		
	ACEHjMNRT	**aBEHjLOQU**	**aBEhjLOQU**
ACEHjMNRT	1		
aBEjLOQU		1	1

No further refinements are possible; therefore prime implicants are also essential prime implicants.

Non-Success (Part One)

Prime Implicants	Primitive Expressions				
	aBEhjLNRT	**ACEHjLOQT**	**aBEhjKOQT**	**aBFhjLORU**	**aCFHJKOQV**
aBEhjLNRT	1				
ACEHjLOQT		1			
ABEhjKOQT			1		
aBFhjLORU				1	
aCFHJKOQV					1

Non-Success (Part Two)

Prime Implicants	Primitive Expressions				
	ACFHjLPV	**aBGhJKPQT**	**ACEHjKOQV**	**aCFHJLNRT**	**ACEHJLOQU**
ACFHjLPQV	1				
aBGhJKPQT		1			
ACEHjKOQV			1		
aCFHJLNRT				1	
ACEHJLOQU					1

Non-Success (Part Three)

Prime Implicants	Primitive Expressions				
	ABEhjLOQT	**ACEhjLOQT**	**aBFhjKPQT**	**ABFHjLORT**	**ACFHjLORT**
ABEhjLOQT	1				
ACEhjLOQT		1			
aBFhjKPQT			1		
ABFHjLORT				1	
ACFHjLORT					1

No further refinements are possible; therefore prime implicants are also essential prime implicants.

10. Satisfying the Markets

Primitive Expressions

Successful (n=7):

aBcDefGHJ AbcDefGhJ
aBcdeFghj AbcDefGhJ
AbcDefGHJ aBcDefGhJ
aBcdEfghJ

Non-Successful (n=15):

AbcDefGhj abCDefghj AbcdeFghj
aBcdEfghj AbcDefghJ AbcDefghJ
aBcDefghj AbcDefghj AbcDefGhj
aBcdEfGHj AbcdEfghJ aBcdEfGhJ
aBcdEfGhJ AbcDefgHj aBcdeFGhJ

Boolean Algebraic Analysis

Preliminary Step: Remove unnecessary letter codes in mutually exclusive variables.

Success = BDGHJ + ADGhJ + BFghj + ADGhJ + ADGHJ + BDGhJ + BEghJ

Non-Success = ADGhj + CDghj + AFghj + BEghj + ADghJ + ADghJ + BDghj + ADghj + ADGhj + BEGHj + AEghJ + BEGhJ + BEGhJ + ADgHj + BFGhJ

Step One: Group identical primitive expressions and create truth table.

Truth Table

Primitive Expressions	Number of Cases	Success / Non-Success	Output Value (Z)
BDGHJ	1	1 / 0	1
ADGhJ	2	2 / 0	1
BFghj	1	1 / 0	1
ADGHJ	1	1 / 0	1
BDGhJ	1	1 / 0	1
BEghJ	1	1 / 0	1
ADGhj	2	0 / 2	0
CDghj	1	0 / 1	0
AFghj	1	0 / 1	0
BEghj	1	0 / 1	0
ADghJ	2	0 / 2	0
BDghj	1	0 / 1	0
ADghj	1	0 / 1	0
BEGHj	1	0 / 1	0
AEghJ	1	0 / 1	0
BEGhJ	2	0 / 2	0
ADgHj	1	0 / 1	0
BFGhJ	1	0 / 1	0

Step Two: Eliminate contradictory groups and commence Boolean minimisation.

Success = BDGHJ + ADGhJ + BFghj + ADGHJ + BDGhJ + BEghJ
= BDGJ + ADGJ + BFghj + BEghJ

Non-Success = ADGhj + CDghj + AFghj + BEghj + ADghJ + BDghj + ADghj + BEGHj + AEghJ + BEGhJ + ADgHj + BFGhJ
= ADhj + CDghj + AFghj + BEghj + BDghj + ADghj + BEGHj + AEghJ + BEGhJ + ADgHj + BFGhJ

Step Three: Identify essential prime implicants by construction of EPI charts

Essential Prime Implicant Charts

Success

Prime Implicants	Primitive Expressions					
	BDGHJ	**ADGhJ**	**BFghj**	**ADGHJ**	**BDGhJ**	**BEghJ**
BDGJ	1				1	
ADGJ		1		1		
BFghj			1			
BEghJ						1

No further refinements are possible; therefore prime implicants are also essential prime implicants.

Non-Success (Part One)

Prime Implicants	Primitive Expressions			
	ADGhj	**ADghj**	**CDghj**	**BEghj**
ADhj	1	1		
CDghj			1	
BEghj				1

Non-Success (Part Two)

Prime Implicants	Primitive Expressions			
	AFghj	**BDghj**	**ADghj**	**BEGHj**
AFghj	1			
BDghj		1		
ADghj			1	
BEGHj				1

Non-Success (Part Three)

Prime Implicants	Primitive Expressions			
	AEghJ	**BEGhJ**	**ADgHj**	**BFGhJ**
AEghJ	1			
BEGhJ		1		
ADgHj			1	
BFGhJ				1

No further refinements are possible; therefore prime implicants are also essential prime implicants.

11. Current Issues

Primitive Expressions

Successful (n=7):

aBcdEf aBcdeF
AbcdEf abCDef
aBcdeF aBcdeF
aBcdEf

Non-Successful (n=15):

AbcdEf abCDef aBcdEf
abCDef aBcDef abCDef
AbcDef AbcDef aBcdeF
abCdeF abCDef aBcdEf
aBcdEf AbcDef aBcdEf

Boolean Algebraic Analysis

Preliminary Step: Remove unnecessary letter codes in mutually exclusive variables.

Success = BE + BF + AE + CD + BF + BF + BE

Non-Success = AE + CD + BE + CD + BD + CD + AD + AD + BF + CF + CD + BE + BE + AD + BE

Step One: Group identical primitive expressions and create truth table.

Truth Table

Primitive Expressions	Number of Cases	Success / Non-Success	Output Value (Z)
BE	6	2 / 4	?
BF	4	3 / 1	?
AE	2	1 / 1	?
CD	5	1 / 4	?
BD	1	0 / 1	0
AD	3	0 / 3	0
CF	1	0 / 1	0

Step Two: Eliminate contradictory groups and commence Boolean minimisation.

Success = No non-contradictory prime implicants for success

Non-Success = BD + AD + CF

Step Three: Identify essential prime implicants by construction of EPI charts

Essential Prime Implicant Chart

Non-Success

Prime Implicants	Primitive Expressions		
	BD	**AD**	**CF**
BD	1		
AD		1	
CF			1

No further refinements are possible; therefore prime implicants are also essential prime implicants.