

# **Agribusiness Decision Tools Curriculum**

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## **SUMMARY**

In today's agribusiness world, the need for analytical systems thinking, quantitative analysis and knowledge of information technology is well recognised. The authors developed a set of undergraduate papers that met employer needs in the above critical areas. The curriculum developed took into account the rural background and uneven mathematical, statistical and computer science skills of the students. The curriculum was introduced to 105 students in 1999.

## **PROBLEM STATEMENT**

The two goals of the Agribusiness program at Massey University are to:

- 1) provide students the conceptual and applied knowledge required in today's highly competitive agribusiness environment, and
- 2) prepare students to manage in the dynamic agribusiness environment of the future.

The Agribusiness program recognises that for firms to achieve their desired business goals, they require employees who can provide innovative internal and chain integrated solutions to business problems.

Massey students are well educated in agri-food production technologies, economics, marketing, consumer behaviour and other important agribusiness topics. To be successful managers in the constantly changing global market, they need additional skills in integrated decision making and in the use of information technology.

The authors' goal was to develop a set of papers for undergraduate agribusiness students that would provide them with the required skills mentioned above.

## **BACKGROUND**

New Zealand is a small (~3.7 million population) agriculturally based economy, remote from all export markets. The majority of New Zealand agribusinesses may be defined as small

or medium sized enterprises. Most of the country's agricultural production is pastoral based. Agribusinesses in New Zealand have made significant shifts from their traditional commodity based orientation to focus on their role in consumer-oriented chains. Agribusinesses throughout New Zealand are in different stages of adapting to the deregulation process that began in the early 1980s. Nevertheless, in varying degrees, they all are market driven.

The agricultural economy is export oriented. The key to success for New Zealand agribusinesses is their ability to evaluate and respond to global market changes, regardless of domestic constraints.

## **OBJECTIVES**

To develop a set of papers for undergraduate students:

- To develop their analytical systems thinking;
- To become aware of the decision tools available for agribusiness problem analysis;
- To receive training in computer modelling of agribusiness problems;
- To have the opportunity to apply both methods and tools to problems unique to food and agricultural industries.

A three step teaching methodology was designed to integrate the different levels of the decision making process – practical, analytical and conceptual – into the decision tool curriculum.

## **TEACHING METHODS**

The structure of the teaching methods used in the agribusiness decision tools curriculum is presented in Figure 1. Each step of the three-step teaching methodology is placed into separate columns. The left side of Figure 1 presents the different levels of the decision-making process: practical, analytical and conceptual.

### ***Step 1. Classroom discussions***

The introduction of the general decision tool concept (the orange box in the center of the first column) begins with a set of practical agribusiness problems: a combination of examples, case studies and business games. The problems used are representative of New Zealand agribusinesses. During class discussions, all relevant material is analyzed with the goal of finding the general characteristics of the cases/examples. Upon completion of this task, the next step is to introduce the general concept of the appropriate decision tool and to define the

class of agribusiness problems that may be solved with the help of this tool. The general concept is further discussed and illustrated by application to the agribusiness problems introduced at the beginning of the class. Problems are formalized to fit the terminology of the selected decision tool. Formal procedures are then constructed. The yellow box in Figure 1 depicts these actions. Achieved results are described in terms of the original agribusiness problem. The last goal for classroom discussions is preparation of a list of potential management decisions, based on answers derived with the help of the decision tool being studied.

Step 1, therefore, starts with classroom discussions on the formulation of the agribusiness problem that is to be solved and finishes with an array of potential decisions for that problem. In this process, the general decision tool concept, represented by the orange box, has a central position and is applied to specific problems.

At the end of the Step 1 of the three-step teaching process, students are required to fully understand the following issues:

- The general class of problems that may be solved by the decision tool;
- The general decision tool concept;
- The class of agribusiness problems that may be solved with the help of the decision tool;
- How to structure agribusiness problems so that the decision tool may applied.

### ***Step 2. Software presentation***

During the second step of the teaching process the general decision tool concept is ‘translated’ into the requirements of the particular software, starting with the formal rules required to enter information, followed by the installation of parameters, ending with a solution and interpretation of results.

To demonstrate software applications, a particular agribusiness problem is selected. The students are provided with a computer guide that represents the detailed step-by-step instructions they have to follow for the software to provide results.

At the end of the Step 2, students are required to be familiar with:

- Availability of software solutions;
- Advantages/disadvantages of computer applications.

### ***Step 3. The Assignment***

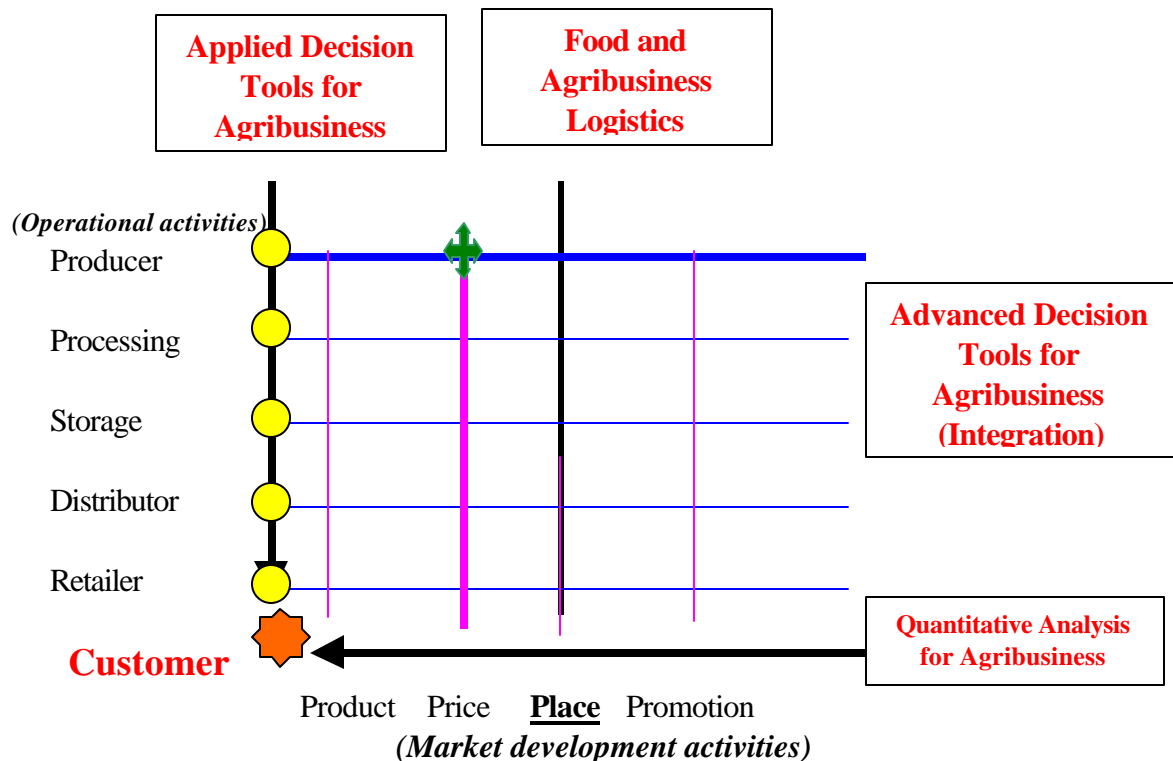
To reinforce the material discussed in Steps 1 and 2, students are required to independently complete an assignment on the material presented. Each student receives an agribusiness problem and must follow the sequence of the decision-making process discussed in the classroom. The yellow square in the third column represents the application of the selected software.

## INTEGRATION OF THE CURRICULM

Most New Zealand agribusinesses are involved in agri-food export chains. As a result, their level of inter-business integration is, by necessity, high. The markets for New Zealand agri-food products are remote and diverse. As are most businesses throughout the world, New Zealand agribusinesses are constantly striving to improve their customer-focused management strategies. New Zealand agribusinesses have begun to recognise that their ability to succeed in the volatile world of agricultural production that is focused on diverse overseas customers depends on the use of analytical decision making tools.

The correlation of the teaching of those required analytical skills with agribusiness issues is presented in Figure 2, below.

**Figure 2. Correlation of the Decision Tool Papers**



The final customers for agri-food products are located at the origin of the two dimensional graph, Figure 2. Movement along either axis toward the origin represents the customer focus of all agribusiness activities.

Each agribusiness in Figure 2 is defined through the core operational activities on the vertical axis, i.e. production, processing, etc. The operational relationships of these different activities are linked together to form supply chains. Supply chains provide the flow of materials and services from the original producers, through the different operational activities, to the final customers. In Figure 2, the yellow circles represent agribusinesses linked into the supply chain under discussion. The pink vertical lines represent other supply chains that are competitors of the selected supply chain.

The horizontal axis represents the different marketing stages of the integrated marketing mix: Product, Price, Place and Promotion. The blue horizontal line represents the market development activities for different operational activities.

The green cross defines the particular producer who makes management decisions in the competitive environment at his/her operational stage. The blue bold line represents other producers, who are competitors. Agricultural production from the selected farm reaches the final customer through the supply chain (pink bold line). The farmer's management decisions should, therefore, take into consideration opportunities and requirements imposed by other chain-members.

To incorporate the above relationships into a curriculum for decision tools, three new papers were introduced in 1999:

- "Applied Decision Tools for Agribusiness" (first semester, second year);
- "Quantitative Analysis for Agribusiness" (second semester, second year);
- "Advanced Decision Tools for Agribusiness" (first semester, third year).

In addition, an existing second year paper "Food and Agribusiness Logistics" was modified to incorporate the material introduced in the other new papers.

The aim of the first paper "Applied Decision Tools for Agribusiness" is to introduce general decision tool concepts and apply those concepts to operational activities within agri-food supply chains. The topics covered in this paper are decision process, theory, and analysis, linear programming, forecasting, simulation, and material and distribution requirement planning. Each topic is discussed in the context of the decision making process for producers, processors, distributors, service providers and other operational activities for the diverse range of agri-food products. Significant attention is also devoted to data collection and analysis techniques.

"Applied Decision Tools" establishes the conceptual basis required for the second paper in the curriculum – "Quantitative Analysis for Agribusiness".

The second paper focuses on quantitative methods appropriate to agribusiness market development activities (the horizontal line in Figure 2). The following topics are covered: production decisions, market analysis, purchasing decisions, pricing decisions, distribution decisions, promotional decisions and sales analysis. The basic tools introduced in the first paper of the curriculum are supplemented with additional methods and tools required for analysis of market development activities.

The third paper of the curriculum is “Advanced Decision Tools for Agribusiness”. The goal of this paper is to give students additional concepts and tools to assist in the application of decision making on a systems level. This paper integrates the operational activities within the supply chain with the market development activities within the industry. The topics covered are network models, project management, Markov analysis and game theory.

The fourth paper “Food and Agribusiness Logistics” emphasises Place utility, in the integrated marketing mix. The paper discusses the importance and role of logistics and supply chain management to New Zealand agribusinesses. Topics covered include global logistics, management of import/export shipments, customer service and methods to control logistics performance. Several field trips to local agribusiness firms are used as case studies for class discussion.

Material for all papers is presented in a similar sequence. Each week, students receive three hours of lecture and one hour of computer laboratory instruction. Each week the students are also given exercises to be solved independently. All study materials – readings, case studies and applications, supplemental material for each topic, problems and solutions – are available in printed reference material and on the Massey University Agribusiness Web-site. Students receive additional exercises before mid-term and final examinations. Each paper also requires independent computer based projects that are based on New Zealand agri-food case studies containing problems to be solved using techniques and tools studied in class.

Computer laboratories are an important part of the curriculum. As with lectures, laboratories are taught in a consistent sequence: software demonstration followed by exercises independently completed.

In addition to lectures and computer laboratories, the Massey University Agribusiness Web-site (<http://agribusiness.massey.ac.nz>) is an integral part of the curriculum. Each student enrolled in the above papers receives an access code. However, access to class material is limited to students enrolled in a particular class. In addition to providing study material, the Web-site also contains:

- Food Review – a monthly electronic journal publishing material from staff and students;
- Class and assignment grades, including problem solutions;
- A News desk for announcements about class activities;
- Information about new publications, book reviews and conferences.

All of the files required for assignments, including software-oriented files, may be downloaded from the Web. This approach gives students opportunities for remote study. One student was able to study while in the hospital and successfully passed the final examination. E-mail is available for inquiries and consultation.

## **RESULTS**

In 1999, a total of 105 students completed the Agribusiness Decision Tools Curriculum:  
A total of 105 students completed the papers:

Paper Name	Number of Students
Applied Decision Tools for Agribusiness	34
Quantitative Analysis for Agribusiness	27
Advanced Decision Tools for Agribusiness	16
Food and Agribusiness Logistics	28

During the 1999 academic year (February 1999 – October 1999), there were 3,261 entrances to the Agribusiness Web-site.

Students were surveyed at the beginning of the year to determine their level of knowledge of the material to be introduced during the year. At the start of the year, 60% of the students were unfamiliar with basic software and 80% graded their level of mathematical and statistical knowledge as “insufficient”.

At the end of the year, second year students reported they had a good knowledge of Excel, including Solver and Goal Seek, the basics of Access, and viewed the Internet as their preferred source of information.

Several students listed the topics covered in their job applications. Employers indicated the subject matter was very useful for their hiring needs and , in some cases, central to being hired.

## CONCLUSIONS

The new curriculum has enhanced the analytical skills of agribusiness students. The use of a combination of educational tools to present material in a structured and sequential manner achieved the curriculum goals established.

Feedback from students and employers indicate they view the analytical decision tool topics covered by the curriculum as playing an increasingly important role for the competitiveness of New Zealand agribusinesses.

The entire Decision Tools for Agribusiness curriculum is being taught again in 2000 with few modifications to the original concept.

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