# Towards a model of decision-making of flower growing systems

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*In defining current science- and grower-based knowledge of cutflower crops, questions were raised of how the resulting information could be used to enhance production systems. A descriptive model of decision-making in the flower-growing industry was proposed as a means of answering some of these questions. Agricultural management and decision-making literature was reviewed. No models specific to entire cutflower production systems were found but some of the models cited were used as a basis for the model. Some data of a general and anecdotal nature were available, and to augment this, qualitative data were also gathered from growers.*

*It is concluded that current management and decision-making models failed to make sufficient allowance for the complexity of growers' goals in a dynamic operating environment. It may be that the developers of science-based models also do not adequately understand the dynamic nature of agricultural-based production system decisions and therefore can not adequately meet growers' needs.*

## Introduction

Cutflower growers in New Zealand must contend not only with the complexities of the natural elements, but also with a highly volatile fashion industry and competitive marketing of their product, where they are price takers. This paper identifies and describes the diversity of individual grower's decisions, the processes they perform to make these decisions and their reasoning for these. The resulting information will assist the participants in the cutflower value chain to gain a better understanding of decision-making behaviour of cutflower growers, so they are better equipped to service growers' needs. It will also allow cutflower growers an insight into the types of decisions they make and the reasoning behind them.

Models and descriptions of agricultural decision making have often been based on normative approaches [Öhlmér, et al. (1998)]. Such traditional approaches may indicate that the developers of science-based models and their descriptions do not adequately understand the dynamic nature of agricultural-based production system decisions and therefore can not adequately explain growers' behaviour. Öhlmér [1998] lists examples of management services and tools are not being used by farmers to the extent expected.

## Background

Decision making is such a common activity that rarely is any thought devoted to discovering it's reality. Jabes [1982] considered the person who makes a decision, and defined decision making as "a complex process, unique for each individual in

accordance with his perceptual, motivational and value makeup". The decision maker is one of the components of any decision situation, the environment within which the decision is made is the other component [Hardaker, et al. (1970)].

Keen & Morton [1978] have classified the literature on decision-making processes into five paradigms, ranging from entirely normative to entirely descriptive. Each approach highlights key issues and often directly contradicts some other approach. There have also been many attempts to analyse the decision-making process. One of the earliest was made by Wallis [1926] in his book, *The Art of Thinking* cited in Mayer [1977], where he suggested four phases. During the 1970's many more decision-making models based on empirical studies were developed by a number of agricultural management researchers who found that decision makers do not follow a linear process. These models were an advance on those described in farm management texts. These texts either stated explicitly, or seemed to imply, that for every decision, the steps should be followed in order. A number of such examples are cited in Öhlmér et al. [1998].

Real-life decision making is far more complex than shown in the steps described in many decision-making models, as human emotions and attitudes are part of a dynamic and uncertain environment. Virtually none of these authors has attempted to describe the "real face" of the decision maker, even though during the same time period numerous studies have been carried out on decision-making behaviour, and the environment in which decisions are made.

From a practical point of view scientists in research institutions generate detailed information which producers may use to assist them in making technical decisions. For this information to be of use to growers it must be relevant and in an appropriate format. To deliver information in the most appropriate form, researchers have to understand how and why growers require the information, as they are highly discerning. Surveys cited in Parker [1999] suggest that farmers are willing to adopt a technology if it offered to them in a useable, useful and cost effective form for improving their decision making. This will only come about through understanding the grower and their decision-making behaviour. Understanding the decision-making behaviour of the grower to allow for effective delivery of information was the impetus behind this work.

**The New Zealand cutflower industry**
The New Zealand cutflower industry is made up of ~3000 highly diverse, competitive individuals and transient businesses. Many belong to a regional or product organisation, which come under the umbrella of the national cutflower growers' organisation, FloraFed. These growers are spread throughout New Zealand, but the highest concentrations are in the Auckland region. Growers can be usefully categorised in the following ways as: full-time or part-time growers, new growers or established growers, and by the number of generations the family has been growing. All growers fall into several categories.

Virtually all growing operations are run as family units, and many have other sources of income. A large proportion of these growers produce a highly diverse range of cutflower crops in relatively unsophisticated growing structures. The New Zealand

cutflower industry is made up of a high proportion (~80%) of small growers, but the larger growers produce the majority of the export flower crop. Just twenty full-time members of the New Zealand Exporters Association produce more than 95% of the total export turnover of cutflowers [de Graaf (1998)]. This has not changed a great deal in 17 years, as in 1981, fewer than 10 full-time growers collectively exported ~80% of the cutflower crop [Ivess (1981)]. Although there is a stable core of growers, survival of individual growers' businesses is considered to be tenuous, as there is a high attrition rate. It is commonly considered that two out of five growers will not be operating three years after they have started growing.

**Grower Survey**
Standard telephone interview techniques [Dillman (1978)] were used to conduct a survey, on a random sample of 50 known members of a flower growers' group. It was decided to limit the survey to 26 interviews as no more information was being added. All the growers interviewed had succeeded in remaining in business for the first crucial three years.

**Survey Findings and Discussion**
The New Zealand cutflower industry is made up of a highly diverse group of people. Those who took part in the telephone survey were no less dissimilar. Some were second generation growers; others were new growers who had changed from other professions or because they had retired. Most of the growers grew a range of crops, on a range of different sized operations, and had been growing for an average of just over 16 years (range: 3-50+ years).

From among the paradigms described in Catley, et al. [unpublished], analysis indicates that New Zealand cutflower growers fall most easily into *"the individual differences approach"* paradigm described by Keen & Morton [1978]. These growers behave very much as individuals (or partners). Simon's approach, *"the satisfacing, process-oriented view"* describes the goals of a decision-maker as making a good decision, but not necessarily the best possible decision. This description most closely resembles the approach taken by growers, given their constraints of time, money and uncertainty.

**The Decision-Maker's Environment**
Every cutflower grower is different but information gathered from the survey indicates that New Zealand cutflower growers have very similar decision-making drivers to those described by Öhlmér, et al. [1998] - their goals, values and beliefs. These goals are based on their preferences between monetary and non-monetary factors; their feelings about risk and uncertainty [Hardaker et al. (1970)]; their abilities to filter and assimilate large volumes of information given the limitations of human processing [Hogarth (1980)]; and their experience in cutflower growing, and what they have learnt about past decision-making experiences. Individually these drivers are as numerous as the number of growers surveyed, except for one goal – in making a profit. Even so, some growers are more profit driven than others are.

The growers interviewed listed many goals. For example, "I want to leave something for my wife and the kids", "I wanted an independent life, to be self-employed and to make the best of it", and "I want to be debt-free in x years". The personal

circumstances of the growers and their age influenced formulation of these goals. Many of those who were growing flowers on a part-time basis were less profit driven than the younger full-time growers. Several part-time growers said that they would make quite different decisions, particularly on the crops they were growing, if they were full-time growers, but other part-time growers were activity striving to grow economically viable crops of the highest quality.

The few values that growers cited were not financial orientated. For example: "I want to leave my land in a better state than I bought it in". A number of growers had views that were strongly influenced by how long they had been growing flowers. Some of those that had been growing for some time did not like new growers or people who were buying 10-acre blocks and planting flowers just to get around local body planning permission. For example, "There is a lot of competition, because lots of people have small blocks", and "There are too many hobbyists and part-timers, and a lot of retired people. They swamp the markets and tend to produce inferior quality", and "There is more production around especially of fodder crops that erode the price of others away. They are competing against your flowers". In contrast, newer growers said, "Established growers didn't like to talk as they thought you were threatening their patch", and "Growers are very secretive".

Several growers suggested that planning was the hardest part of growing. Of the 26 growers interviewed, 19 had a long-term plan. Only some of these growers had formal written down long-term plans and goals. Most of these growers were those who had taken over family businesses or had changed career paths to go into cutflower growing. These plans were developed by a formal process over a period of time. "You have got to be flexible. Know your overall goal, but sometimes you have to shift the pieces around to get there. Things change and you have to go with it, you have to be flexible in changing varieties", and "The plan changes all the time but the direction is the same". Other growers found it difficult to formulate a formal long-term plan, had not seriously thought about long-term plans, or had plans in their minds. "I try to have goals and aims…but they are often hard to attain because things happen that you don't expect to happen, especially in my sort of business". "I don't have any goals and objectives because things change all the time", "No, I just hope that I am growing something", "I have a very good picture in my mind of where I am and where I am going". Many of these growers could not see that changing their short-term goals would leave their long-term goals intact.

The environment in which growers make decisions also has a profound effect on a grower's decision-making behaviour. It confounds the decision-making process by the existence of competing alternatives, uncertainty, and other decision makers. Making decisions as a cutflower grower is fraught with uncertainty. Complete and/or reliable information is rarely available, particularly in a rapidly changing market. "Nobody could tell me what I was going to make off this…I couldn't really even do any budgets or anything because I had no idea what I'd be earning…". Nearly all of the growers interviewed also had a partner in the business. For these partnerships to be successful many businesses had specific roles for each partner. "I deal with the money side of things and the picking and my wife does the grading, packing and delivery of the flowers. We both sort out how we will market things". Compromises were made to suit individuals' needs. "She doesn't operate that way so there have to be

compromises", "We have had to adjust to short-term goals as my wife and I have different long-term goals", "One of us needs more social contact than the other so we have to accommodate that".

**Problem detection and Prospecting**
According to Kay & Edwards [1994], there are three types of problems that are found in agriculture and horticulture. These are: *what* to produce, *how* to produce, and *how much* to produce. Cutflower growers also have to make decisions about *when* to produce. When a person decides to enter the cutflower growing business, answers to each of these questions will influence their decisions on the location and type of land they will eventually grow on. Their answers will formulate short and long-term goals.

Holyoak [1990] states a problem arises when someone has a goal - a state they want to achieve. To resolve a problem, it must be perceived. Even then, a person may not act on solving it immediately or at all. Dropping profits of cutflower growers is a good example of this. Growers said they either suddenly became aware of dropping profits even though it had been occurring for some time, or they were aware that profits were dropping off but they decided not to do anything about it until they dropped below a certain level.

Identification of a problem may not be the only impetus in wanting to make a decision. Many of the cutflower growers interviewed were always on the lookout for opportunities by continually assessing and trialing the crops they considered could be the best to grow in the future even though they had no perceived problem with their current suite of crops. Their past experience had told them that the prices of their current suite of crops would eventually drop, and that they had to start looking for new opportunities rather than waiting until it became a problem.

**Problem framework and definition**
A problem, according to Sitkin & Pablo [1992], can be viewed by a decision maker in either a positive or negative light, as an opportunity or a problem; or viewed by one person as an opportunity but by another as a problem [Wilson & Morren (1990)].

The greatest variation in the types of decisions made to solve a problem by growers interviewed was in making strategic decisions. This is not surprising, as their backgrounds were often quite different from one another. To start growing, eleven interviewees had to buy land – four bought established properties, and six bought bare land with the express desire to grow flowers. For these people this was a conscious decision, "I want to grow cut flowers, and I have to find a means of doing this". One of these growers had no specific use in mind for the land that they bought. Nine growers already had the land when they decided to enter the flower growing industry. All of these people were running some other form of land-based business, such as farming. Some of the reasons given by them for entering this industry were: "I liked flowers and gardening and wanted to make some money out of it", "I wanted to work from home", and "I needed to offset the agricultural downturn".

A total of five growers did not have to make land-type decisions because they moved into an established, family-run enterprises. Four of these growers did not join their

family businesses immediately. They either went overseas or started out on other career pathways, but eventually decided to go home and work in the family business. After establishing where the crops were to be grown, choosing what crops to grow was the next biggest decision. Crop choice was the decision that all growers spent the most time talking about. Demand for flowers is dictated by fashions that change rapidly. Many of the growers surveyed realised this and wanted to grow flowers that are in demand, but they had great difficulty in predicting what the trends would be and the returns for growing a new crop.

There was a great deal of variation in how many of the interviewed growers aimed to achieve their long- and short-term goals. Some growers were very fixed in the crops they had planted or planned to plant up to several years in advance, even though a new opportunity may have arisen. "You couldn't afford to chop and change the whole time". Other growers took the opposite view. "You have to be adaptable to the conditions that prevailed", as demand for flowers is fashion-based. Many growers also had the flexibility of utilising unused land if they desired. Deciding to grow a new crop was made easier for these growers, as they did not necessarily have to drop one of their current crops for a new one.

## Acquisition of information

In making decisions all growers knew that they required information to help them, but how people tried to gather that information and how much they gathered varied considerably. To make decisions, information is vital, but many of the growers interviewed found it was very difficult to identify who could help them, or where they could get the required information.

This was particularly apparent when a person had just entered the industry. They found once they made one or two contacts, information was a bit easier to find but part of the problem was being able to make those initial contacts. Most new growers wanting to buy land or wanting to buy an existing business tried to acquire as much information as possible. They found it very difficult to get information from other growers about how to get into floriculture and/or what to grow because they were regarded as potential competition, and several growers now believe they were given inaccurate or corrupt advice. These growers realised later, that the information provider could see they lacked experience, so they believed they were taken advantage of. This situation was made worse because they did not seek information from a sufficiently wide range of sources. These growers did not gather more information for a number of reasons: they did not know where to get it; were turned away by other growers they asked; or didn't think it was necessary to ask anyone else.

As growers became more experienced, they found that they were seeking different types of information – information that was more specialised and either more difficult to locate or not available at all. This more specialised information was commonly cited as cultural information about a new crop that a grower was contemplating growing or one that they had decided to grow. New Zealand is known for growing new and novel niche products. Information on these crops is often non-existent or only available overseas and commonly in a foreign language. This scenario was repeatedly played out by a number of interviewed growers. Talking to other growers was often cited as a good means of overcoming a lack of useful information. In these situations

though, growers often resorted to a "trial and error" approach because they didn't want other growers to know what new crops they were considering to grow.

The interviewed growers used a very wide range of sources of information: local and international magazines, books, the Internet, government researchers, private consultants, exporters and other marketers, other growers, conferences, grower meetings, and property visits. Consultants were considered by many of the growers interviewed to be the ones who should be able to best bridge the gap between theory and practice, though growers had mixed views of them. Those who had had a major disaster or problem often said that they should have gone to a consultant, but those who had gone to a consultant often said that they were ineffectual or gave them incorrect advice. Talking to other growers has regarded by many as the best way to solve an operational problem, "rather than talking to the so-called experts". Many of the growers interviewed mentioned what other growers had done about a certain problem, reinforcing this as an important means by which growers made their decisions. Others refined this by saying that watching and observing was more important, and other growers said that "learning is more than observing- it's done by doing." Whatever sources of information were used, many of the more experienced growers confirmed their information from a number of sources. New growers often said that they quickly learnt this was the approach that they also had to take.

**Consideration of alternatives**
After a problem has been acknowledged and identified, a range of alternatives needs to be formulated for considering in making a decision. Shepard [1964] suggests that the need to choose between alternatives often creates conflict for the decision makers, and they are not sure how to trade off one attribute for another, nor which attributes mattered most, particularly when there are no guaranteed outcomes, as in cutflower growing.

Many decisions made by cutflower growers are unstructured, because they are subject to many random or changeable events or involve many unknown factors. Tactical and strategic unstructured and semi-structured decisions [Keen & Morton (1978)] are considered to be the most difficult to make and these types of decisions are perpetually being made by the cutflower growers interviewed. They have to make decisions on what crops to grow in an environment of uncertain prices and demand. All of the growers surveyed grew a suite of species or cultivars. They considered that this reduced their risk if they had crop failures and slumps in prices, and it evened out their production and labour demands. Decisions of this type are even more difficult when the crop may not be ready for harvest until several years after it is planted. Growers also considered that there also needed to be a differentiation between crop species and cultivars. Both the crop species and cultivar type have to be right, as flower colour and shape are probably more important than the actual crop species. For example, all rose cultivars will sell most of the year, but for Valentines Day only red ones will do.

Many growers interviewed were constantly on the lookout for something that they considered would be a winner. Whatever new species or cultivar was being considered, many growers had set criteria for each new crop. A number of criteria were considered: expected returns/$m^2$, colour, scent, production/$m^2$, stem length, liking the crop, having the right climatic and soil environment to grow the crop in,

how it would fit into the current suite of crops, it's natural flowering time, post harvest qualities, sustainability, and ease of crop establishment and time to flowering. Growers also had to consider whether they wanted a crop for the export or local market, whether they wanted to grow annual or perennial crops, and what time of year they wanted to flower a crop.

Most of the growers surveyed considered that there is no point heating a glasshouse over winter because the extra returns do not compensate for the extra costs involved. These same growers said that florists do not seem to appreciate the extra cost that had gone into producing such a product, and would not pay more. As a result of this growers endeavoured to grow a suite of crops in their natural growing seasons that dovetailed into each other so that they had a continuous stream of different flowers. This has the major advantage of providing a constant year-round income, as well as providing staff with year round work, and enabling the grower to employ better skilled staff. A number of growers indicated that they had difficulty maintaining a good cashflow in the winter, because they had not adequately identified these winter flowering crops. For them it was a matter of trial and error.

Cutflower growers must also consider alternative marketing outlets and practices, as do other groups of primary producers. Many of the growers interviewed realise that they are price takers if they do not sell their flowers directly. One grower put it aptly, "I want to sell flowers rather than putting them on the market". Many growers are not in a position to sell directly but there are a number who are and have set up their own marketing channels with great success.

When growers were asked what problems they had had in the last year, they all cited operational problems, for example, pest and disease problems. Prioritising operational decisions was not regarded as a decision problem, nor were tactical or strategic decisions other than setting long-term goals. Even in growing a single crop, there are many decisions on timing and activities that have to be made. These choices are compounded when more crops are grown as each has its own cultural requirements that must be assimilated and prioritised. An indication of the number of decision choices that may have to be made is graphically illustrated by Wossink, et al. [1992]. They identified 1400 cropping variables based on economic, environmental and technological choices in growing two cultivars of potatoes.

The complexities of decisions, which are often simultaneous, that have to be made involving crop types, scheduling and cultural requirements create a formidable task particularly given the limitations of human processing, and the limited amount of new information that people can absorb. These situations are potential opportunities for packaging refined information with data manipulations, using techniques such as linear programming, as decision support packages, to complement and support the decision-maker.

**Choice**
Whatever choice decisions were made by the growers interviewed, there was great variation in the processes to make and implement them, as well as whether the grower was happy with the outcome at a later time.

Even with a list of criteria to consider, choosing crops to grow was a major dilemma for all the growers interviewed. The growers took a number of approaches in solving this problem. Most were highly aware that their margins were a lot narrower, so these decisions had to be right even though there was not enough good information. Some growers took a very quantitative approach to selecting new crops, while others solely grew crops they liked. Several growers made instant, uniformed decisions on growing a new crop, "I bought the bulbs on the spot". Quick but informed decisions on growing a new crop were made when an opportunity arose, by both growers who took a quantitative approach, as well as those who did not. Ultimately, all the growers based their decisions on the perceived risk of failure, but in some cases the risk associated with a crop had not been established, so the risk was considered to be low. Many of the growers initially used criteria to reduce their alternatives, but based their final choice on "gut feelings", "trusting their feelings" and "good feelings", and tempered by their judgement and past experience, and weighing up all the pros and cons.

Many growers considered that if they were going to grow a new crop they had to start doing so "before word gets out about it". Some growers, those who were more experienced, considered that if plant material was difficult to source, and/or it had a long crop cycle, and/or was expensive to buy (many perennial crops), or was difficult to grow, it would be a good crop to seriously consider. In contrast other growers (eg new entrants) interviewed, considered that the crop had to be easy to grow.

**Implementation and Checking**
The growers interviewed implemented their decisions in a number of ways. When they had decided on what crop to grow, some chose to trial small areas of a crop, while others went straight into growing a crop on a large scale, so they could got a good feel for it's market potential. Some also did simulated transportation trials and/or post harvest trials, but all considered it was important to learn how to grow the crop, and or to see how it fitted in with their current crops.

Those growers who sold directly to their customers grew some of the most diverse ranges of crops, and trialed the most new crops. They are experienced growers who know which crops are the most profitable for them, because they have good record-keeping systems. They also have close contacts with the customers, who give them quick and accurate feedback on what they wanted.

Other growers had record keeping systems to monitor the profitability of their crops and their businesses. Some had custom-made or off-the-shelf computer packages and others had manual recording systems. Some did not have any recording systems even though they knew they should do but just hadn't got around to doing so.

Many of the growers also constantly monitored trends on cutflower prices by other means. They used publications, the Internet, observed the markets and talked to other growers. These methods provided them with the best available information on how their individual crops and businesses were performing. Knowledge gained from evaluating outcomes of their past decisions is used by of many of the growers to give them confidence or not to use the same process again. This type of feedback is

important as many growers knew that they "could have been better at managing their whole business", by "managing their crops better" and "spreading their risks".

**A Model of Decision-Making Behaviour**
Figure 1 indicates the possible phases in a range of decision-making situations that have been described throughout the text in this paper. These are highly iterative. Firstly, it describes decisions made under all degrees of uncertainty and risk. Decision problems of less uncertainty and perceived risk will be less iterative in nature. Secondly, this diagram describes the decisions made over a range of decision types using specific examples of decisions that cutflower growers have to make. Virtually all of the models reviewed for this paper did not do this. The outcomes of a phase are quite variable because of the different approaches the growers took to making decisions. All the phases are highly dependent on a number of factors, including the goals and aspirations of the decision maker, preferences, and external factors which influence their views and actions in the world, and the degree of risk and timeframes they are making their decisions under. Not all these phases will necessarily be used. Although these steps are sequential or consequential, growers have been observed to start at any part of the cycle. Some growers spend a lot more time on a particular step than others do and this quite often changes the outcome of a decision.
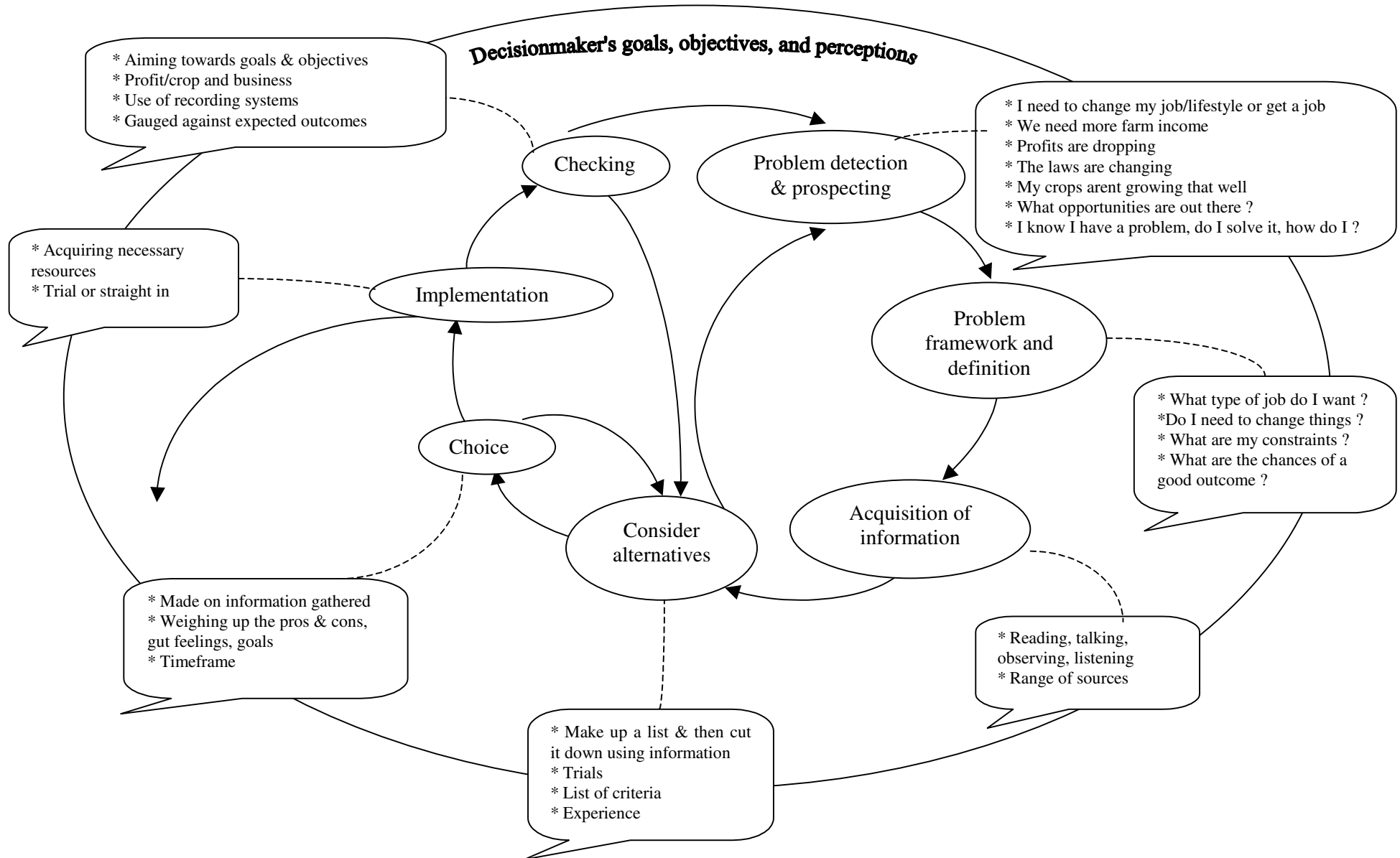
**Conclusion**
Decision making and decision-making models have been described in many disciplines over the last 75 years. Much has been learnt about decision making over this period of time, but it has only been in recent times that decision makers have been recognised as being highly individualistic, and who can be swayed in the decision-making process by many interacting complex personal and environmental factors. This has come about as the result of increased empirical studies rather than making theoretical assumptions about decision making and decision makers.

Unfortunately there are still gaps between those who develop and use systems models in science or decision-making, and those who endeavour to understand why decision makers behave the way they do. This paper is an attempt to bridge these gaps, through consideration of the "whats", "hows" and "whys" of decision making using the New Zealand cutflower industry as an example. It also raises many theoretical and empirical questions for researchers in this area to consider and develop.

How can the information developed here be used to enhance production systems? For scientific information to be of use to growers it must be relevant, timely and in an appropriate format. To increase the chances of the decision support package being a success, scientists must allow for the variety and complexities of grower's goals in a dynamic operating environment. If researchers are to deliver information in the most appropriate form, they must understand how and why the grower requires the information. This will only come about through understanding the grower and their decision-making behaviour. Studies such as this enhance the understanding of growers and their decision-making behaviour.

**Figure 1.** A Model of Decision-Making behaviour

Decisionmaker's goals, objectives, and perceptions

* Aiming towards goals & objectives
* Profit/crop and business
* Use of recording systems
* Gauged against expected outcomes

* I need to change my job/lifestyle or get a job
* We need more farm income
* Profits are dropping
* The laws are changing
* My crops arent growing that well
* What opportunities are out there ?
* I know I have a problem, do I solve it, how do I ?

* Acquiring necessary resources
* Trial or straight in

Checking

Problem detection & prospecting

Implementation

Problem framework and definition

Choice

* What type of job do I want ?
* Do I need to change things ?
* What are my constraints ?
* What are the chances of a good outcome ?

Consider alternatives

Acquisition of information

* Made on information gathered
* Weighing up the pros & cons, gut feelings, goals
* Timeframe

* Reading, talking, observing, listening
* Range of sources

* Make up a list & then cut it down using information
* Trials
* List of criteria
* Experience

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