

## **Project Cassandra: Future R&D Opportunity Scan**

Judy Marcure  
Marketing Manager

*“Forecasting has been called an impossible but unavoidable task.”  
John Clarke*

*“In 2015, foods will be produced in household replication units by using a few very basic proteins, carbohydrates, minerals and vitamin compounds. No central food store or delivery system will be needed. Homes will have sensors located in the pantry and fridge which automatically replace supplies when they run low. Orders will be altered by voice-activated command and people will ask the computer to display pictures of goods, which will be delivered at a convenient time and payment made from the person's bank account”  
Jordan, aged 12.*

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## **Executive summary**

This report outlines a set of R&D opportunities which may address challenges currently facing Australia's food processing industry, or likely to face it, over the next 5-15 years. The report has been written after extensive external consultation, concerned with the desirability of food-related innovation, within the context of an activity called Project Cassandra. The project was an input into CSIRO's research planning activities for the period 2000-2003. This report collects the results of the Project Cassandra exercise that are relevant to the food processing industry and industries with which it is allied.

Project Cassandra activities included:

- Desk research
- Six focus groups involving over 70 food processing industry participants;
- Interviews with Australian and international food industry experts;
- Consumer attitude research.

Discussion of opportunities led to descriptions of potential innovations that might benefit industry and/or consumers. Industry focus groups emphasised in particular the desirability of R&D to produce innovations which would help industry respond better to business imperatives, including:

- Improved understanding of consumer perceptions; preferences and behaviour;
- More flexible, 'smart' manufacturing processes;
- Better value/cold chain management systems (e.g., navigation, freight control, input and stock management information systems);
- Cost-effective responses to standards (e.g., safety, packaging, production, labeling, quality control);
- Value-added products and services (especially related to food safety, human health, and convenience).
- Packaging was seen as major opportunities for industry to add value to products.

A program of consumer attitude research was conducted via a 23-page survey (response rate 48.7% of 2400 consumers). This survey yielded insights into consumers' perceptions of food innovations, including:

- Respondents' receptiveness to innovations was not often correlated to sex, education level or income; it was often inversely correlated to age;
- Innovations that provided convenience benefits were generally less attractive to consumers than innovations yielding health, food safety or environmental sustainability benefits.
- However, respondents who found convenience-related innovations attractive were more often willing to pay a premium (+15%) for them than for other categories of innovations.
- Innovations that provided health, food safety or environmental benefits were often rated as highly desirable.
- However, health safety or environmental innovations were more often seen to be the responsibility of industry to resource and provide.
- In general, most survey respondents wanted health and safety innovations; younger respondents were more likely than other groups to prefer convenience innovations; older respondents were more likely to prefer innovations delivering value for money;
- Respondents resoundingly disapproved of innovations that undermined the social function of family meals;
- There is some evidence to suggest that when they dominate the market, very young consumers (currently <20 years) may not display the same degree of 'technology aversion' of some older consumers.

## SECTION 1. PROJECT CASSANDRA AIMS, SCOPE AND METHODOLOGY

### 1.1 What is Project Cassandra?

Twenty years ago, few professionals in the food processing industry were prepared for the influence the microwave oven came to have on consumer food purchases and preparation. Ten years ago, many food industry professionals failed to anticipate the growth of consumer interest in ‘functional foods’ or ‘nutraceuticals’—those foods deemed to have human health benefits, such as probiotic products including yogurt drinks with lactobacilli. It is likely that the innovators who introduced these new products were responding to market trends which were measured by market researchers and census data collectors. They almost certainly used this information, coupled with their knowledge of their industry and their customers’ needs, to back up ‘hunches’ that turned into major commercial successes.

Industries and the scientific research organisations that serve them are increasingly seeking to anticipate opportunities, challenges, technologies, and changes in their operating environments. They hope this information will better position them and their partners to compete in a complex marketplace influenced by globalisation of markets and information, intense competition, short product life cycles, converging technologies, more demanding customers, often volatile political and economic conditions, and regulatory constraints, among other challenges. R&D opportunity scans, through forecasting and other methods, are increasingly undertaken in an effort to create major new opportunities for industry while at the same time, to help planners avoid being blindsided by unanticipated revolutionary changes to their industries.

Project Cassandra, the subject of this report, is an R&D market opportunities scan for Australia’s food processing industry. It was an initiative of the Food Processing Industry Sector (FPS) of CSIRO<sup>1</sup>, Australia’s largest scientific research organisation, and was conducted in 1998-1999.

Forecasting, the activity at the heart of this project, is a notoriously inexact exercise. It typically comprises a mix of *projections*, which extrapolate future scenarios based on collected data and observations of existing trends—ideally underpinned by rigorous statistical computations—and *predictions*, which enjoy less ‘scientific’ support and can be less confidently defended. Despite the relatively greater objectivity of projections, they rarely capture the revolutionary—often completely unexpected—changes which so often comprise major business opportunities. This exercise draws from both predictions and projections to distinguish some research opportunities which may be realised through application of CSIRO’s research capabilities.

Throughout the project, every effort has been made to apply expert advice and sound filtering processes to the selection of potential ‘opportunities’ for further exploration; however there is no question but that much of the information in this report is speculative. Despite the speculative nature of the exercise—an attribute which is traditionally anathema to scientists—we have seen a number of science and technology forecasting exercises emerge in the recent past. Some are national in scope, such as ASTEC’s “Future Needs 2010” study (ASTEC 1996); some focus on a single industry, such as New Zealand’s “Strategic Directions for R&D for the New Zealand Food and Beverage Industry (NZFBEC 1996)”. These studies recognise that forecasting is inexact—but that some speculative scenario development is necessary if we are to anticipate change and shape a desirable future. For the food industry, where the new product development process is risky and expensive (e.g. a new product could cost as much as US\$5m to plan, develop and launch in 1988; McLaughlin and Rao 1988 p.69) and product failures may reach as high as 90%

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<sup>1</sup> The term ‘Sector’ is used in CSIRO to indicate a grouping of R&D Divisions which work with a common industry or group of related industries. CSIRO’s Food Processing Sector is a cluster of CSIRO research Divisions serving the Australian Food Processing Industry. The cluster includes Food Science Australia and the CSIRO Divisions of Human Nutrition, Animal Health, Manufacturing Technology, Mathematical and Information Sciences, and Plant Industry.

in some categories, effective strategic planning is critical. Not without cause is forecasting sometimes called “an impossible but unavoidable task” (Clark, p 1).

In recognition of the difficulties of undertaking an exercise of this nature, the project has been named ‘Cassandra’. As classicists know, Cassandra was the Homeric propheticess whose accurate predictions, most notably her warning about the dangers of accepting the gift of the Trojan horse from the Greeks besieging Troy, were ignored by her fellow citizens– with famously disastrous results. The choice of name reflects CSIRO’s desire to learn, not only about innovations consumers want, but also about those innovations consumers do *not* want to hear about. That is, Project Cassandra is concerned with the future of food-related innovation consumers want. An understanding of that future must include an inquiry into the future consumers would chose to reject.

#### *1.1.1. CSIRO strategic planning activities*

CSIRO’s research programs, strategic directions and funding allocations are reviewed every three years. In mid-1998, the organisation’s Executive Committee asked CSIRO Sector Coordinators to define the issues and priorities to be addressed in planning and managing research activities for the 2000 to 2003 period. Managers in Sectors were instructed to develop strategies for enhancing their contributions to the industries which those Sectors serve. The planning process they were to pursue was to be iterative, forward-looking, transparent, and most importantly, based heavily upon industry consultation.

This report describes a program of industry consultation and review. Six industry and scientific focus groups and a series of expert interviews involving over 70 participants provided insights into the challenges and opportunities Australia’s food processing industry is likely to confront in the next five to fifteen years. These expert observations have been further clarified through a process of desk research and consumer attitude research. The results of this research are being used by CSIRO Food Processing Sector scientists and their colleagues in industry to inform the planning of CSIRO’s and its client industries’ research activities.

#### *1.1.2. Planning stages and acknowledgments*

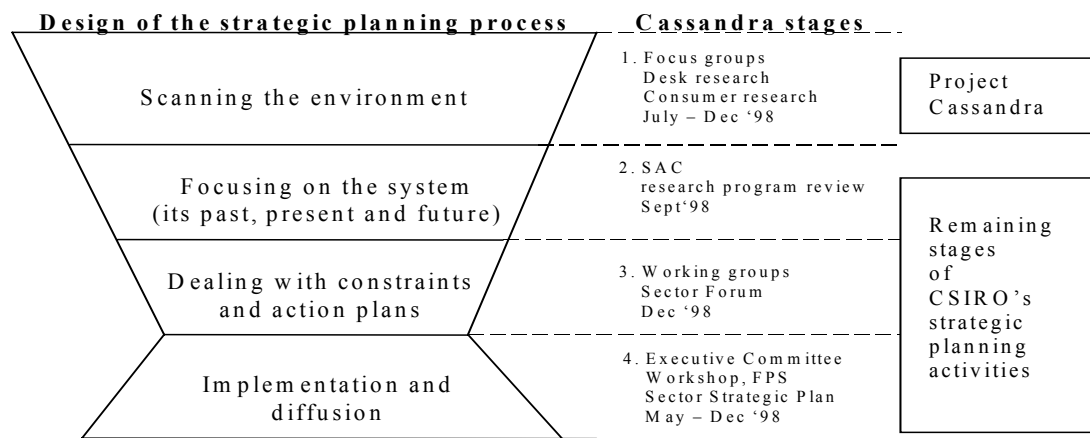
Stages in the CSIRO’s strategic planning process have been based upon a planning methodology developed by ANU professors, Drs Emery and Purser. In this methodology, information gathering is structured in a funnel-like manner, with broad-ranging data collection, aimed at reviewing the operating environment for the food industry, at the earliest stage. This is followed by a more intensive review, which is in turn followed by activities intended to deal with constraints and develop action plans to be implemented and disseminated. Figure 1 shows the stages in the strategic planning process, relating them to activities within the Cassandra project.

The first stage of Project Cassandra has focused on identification of opportunities for the food processing industry. As indicated above, the Project Manager<sup>2</sup> used a combination of desk research, interviews with experts from a variety of disciplines, focus groups, and consumer research to identify these opportunities. This report summarises the results of this research.

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<sup>2</sup> Project Cassandra has been managed by Judy Marcure, Marketing Manager, CSIRO and Food Science Australia, under the guidance of the then Sector Coordinator, Dr Richard Head.

Other stages of CSIRO's strategic planning have been omitted from this report as these are not relevant to a wider industry audience. However, Food Science Australia and CSIRO wish to acknowledge the good will and efforts of its Sector Adviser Committee (SAC) members. This Sector Advisory Committee<sup>3</sup> has helped CSIRO assess the value and relevance of CSIRO capabilities and projects for the food processing industry as well as provide insights into the opportunities described in this report.



(Source: Emery and Purser, p 13)

Figure 1. CSIRO's strategic planning activities including Project Cassandra

### 1.1.3. Nature of the food processing industry in Australia

Although much of the target audience for this report comprises Australian food industry experts, some readers will have backgrounds in related industries or in specialist scientific and technical disciplines. Some of the data comes from countries other than Australia. To assist non-food industry experts in assessing the prospects for take-up of some of the opportunities identified, a snapshot of the industry appears in Appendix 1.

It should be noted that some of the comparative data and models for this paper come from much larger markets, in particular the USA and to a lesser degree, the UK. Resources available for the project have not made it possible to take into account the full range of potentially relevant overseas models. It is recognised that these overseas models, while valuable, need to be applied with care to Australia. In addition to cultural differences, the large distances, relatively high labour costs and small, unevenly distributed markets in Australia may also limit scope for some innovations implementable elsewhere.

## 1.2 A framework for food industry insights

Emery and Purser, Australian National University-based developers of an internationally used methodology for strategic planning (1996), have suggested a model to aid planning for the future of any given industry. The model provides a framework for organizing the rich set of insights of interviewed food industry experts and Project Cassandra focus group participants.

<sup>3</sup> The CSIRO Food Processing Sector Advisory Committee members are Mr Stephen Marshall, Goodman Fielder Limited (Chair); Dr Geoff Annison, Australian Food Council; Dr Simon Brooke-Taylor, Australia New Zealand Food Authority; Prof Ken Buckle, University of New South Wales; Dr Paul Donnelly, Dairy Research & Development Corporation; Dr Alan Grant, Kraft Foods Ltd; Dr Roger MacBean, QUF Industries Ltd; Dr Jan Mahoney, Dept of Natural Resources VIC; Mr Hans Sidler, Woolworths Supermarkets; Mr Dan Southee, Nestle Australia Ltd; Mr Peter Wallace, National Heart Foundation; Dr Peter White, Dept of Primary Industries & Energy QLD; and Mr Robert Wotzak, Arnotts Biscuits Ltd.

Emery and Purser argue that every business system is directly and indirectly influenced by a number of factors in the environment in which it operates. Macro-trends operate in the ‘contextual environment’, within which the political and economic climate, demographic changes, and other factors influence, and are influenced by, the business system. The dynamic interaction of influences is shown in Figure 2 below.

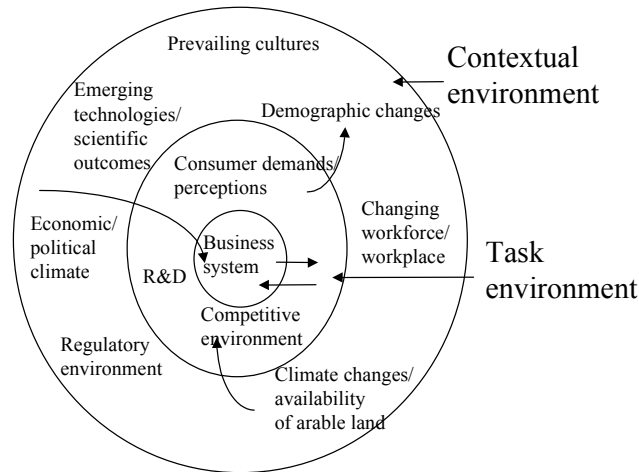


Figure 2. Mapping a turbulent operating environment (Emery & Purser 1996)

Within the contextual environment is the ‘task environment’, which includes the more immediate, local set of external forces and business system stakeholders. Again, these factors—including consumer demands and perceptions of the industry, specific R&D inputs, and the prevailing competitive environment—influence and are influenced by the business system (Emery and Purser 1996, p 48). This model of a business system operating in a turbulent environment is used below to develop broad-brush snapshots of the food industry. The snapshots have been developed by the Project Manager, based upon desk research and focus group insights. These snapshots will be followed by a more detailed treatment of opportunities in Section 2.

### 1.2.1 Mapping an operating environment for the food industry

Many industry experts have focused on major trends impacting the food industry. For example, Professor Philip Kotler, viewed by many as the father of modern marketing science, has recently (1998) nominated a set of trends which he believes is affecting a broad range of industries—including, and in some cases, notably, the food industry—in many developed countries. These macro-trends include industry convergence, non-store competition, digitization, dis-intermediation, customization, and rapid technological changes. These trends are defined and developed in Section 2.

Macro trends influencing the food industry may be mapped onto Emery’s and Passers’ model as shown in Figures 3-6. These figures make it clear that change may come from a number of directions concurrently. Project Cassandra was founded on the premise that by understanding the interaction of affective factors, decision makers can help plan and secure a competitive position for the food industry well into the next century.

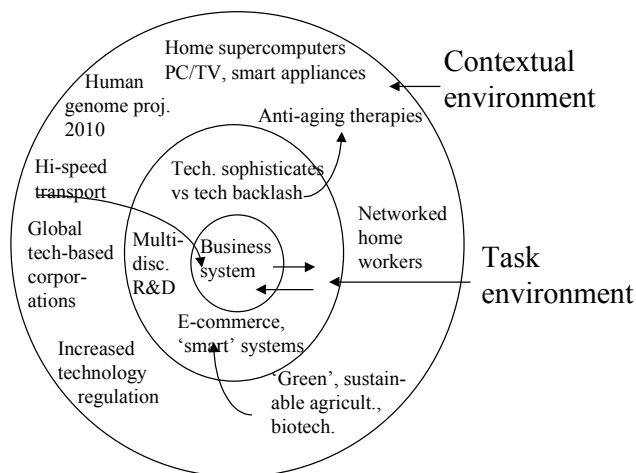


Figure 3. New technologies impacting the food industry

### 1.2.2 Impact of new technologies on the food industry

Figure 3 applies the framework to the likely impact of new technologies on the food industry. For obvious reasons, the figure includes a considered selection of technologies that desk research and expert advisers suggest will be most influential in the near future, not all technologies with any influence on the business system.

To begin at 12:00 o'clock for the contextual environment, the food industry will be increasingly impacted by:

- the convergence of digital technologies, with home computers becoming faster and integrated with more home appliances, such as TV for entertainment, and other appliances for 'smart' food preparation and processing functionality;
- Science will contribute to a greater understanding of the aging process in humans, resulting in development of anti-aging products & therapies, of increasing interest in view of the by-now-familiar demographic shifts to aging populations in developed countries;
- Developments in communications technologies such as networks and groupware will increasingly permit more people to work from home;
- We will have a better understanding of requirements for environmental sustainability and 'green' agricultural production, such as reduced use of pesticides underpinned by advances in biotechnology;
- With the application of technology to emotive domains such as agricultural production and food processing, industry will experience increased consumer concern and technology regulation, which will be tested through application of assays and audits;
- Information technology developments will contribute to the emergence of global technology-based corporations which develop and own intellectual property underpinning products for markets from Broome to Prague, from Helsinki to Capetown;
- Increased investment in high-speed transport and supporting infrastructure will emerge in developed countries, with the food industry being able to make greater use of magnetic-levitation trains, supersonic planes and high-speed ships;
- The conclusion of 'big Science' projects like the Human Genome project will offer insights into human genetic predisposition to disease, potentially managed by better diets.

The next layer of the model the task environment gives us insights into stakeholder influences on the business system. In the area of technology, some of the trends identified include.

- Development of greater technology sophistication among consumers, resulting in more demand for increasingly sophisticated products, some underpinned by technologies from multiple disciplines;
- At the same time, and particularly among older consumers, technology backlash (resulting in part from a rush to market by some manufacturers of technology-based products) will impact industry;
- The influence of information technology on transactions will result in increased reliance upon E-commerce (such as internet trading, virtual shopping malls, and electronic funds transfers);
- There will be a greater blurring of boundaries between scientific disciplines, and more need for companies to draw from multi-disciplinary research, to deliver the products consumers demand.

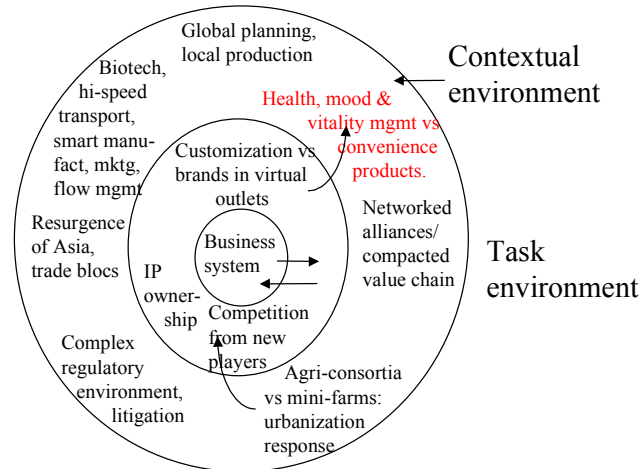


Figure 4. The food industry in 2010

### 1.2.3 Snapshot of the food industry in 2010

Technology is only one of several major sets of impacts set to influence each stage of the food processing business system. Some major factors likely to influence the food processing business system by, say, 2010, include the following (again beginning at 12:00):

- Food companies will need to plan globally, while producing products for local markets. To compete, Australian food companies will need to take into account attitudes and perceptions of very different consumer groups;
- Two major new product opportunities are likely to arise from changing demographics in developed countries: (1) food products contributing to health, mood and vitality management and (2) convenience-related food products and services;
- Industry will experience more consolidation to dominate markets, with more vertically structured alliances of industry players resulting in a compacted value chain;
- ‘Big agriculture’ consortia will emerge, balanced by the emergence of niche ‘mini-farms’ as boomers retire and retreat from growing urbanization;
- Industry will face more complex regulatory environments and increased litigation by consumer groups, making life harder in particular for small players;
- There will be strong resurgence of Asian economies and recovery of demand for prestige food products, balanced by a growing emphasis on trading blocs in many parts of the world, with barriers raising for non-members;
- Technologies changing the face of food industries will include biotechnology, high speed transport, and information technology applied to manufacturing, marketing, processing, transport and retail activities.

At the task environmental level, critical trends for the food industry in 2010 will include:

- Increasingly heterogeneous consumer demands and perceptions, with increased consumer demand for product customization;
- Increased dependence on product branding as a guarantee of quality for consumers shopping in virtual supermarkets;
- Competition from new players increasing throughout the food industry as non-food industries leverage their access to consumers by selling food products;
- At the level of R&D inputs, many new product development opportunities will be dominated by multinationals who own intellectual property critical to development, such as biotechnology, potentially impeding competition by smaller players.

#### 1.2.4 New product opportunities: health and vitality enhancement

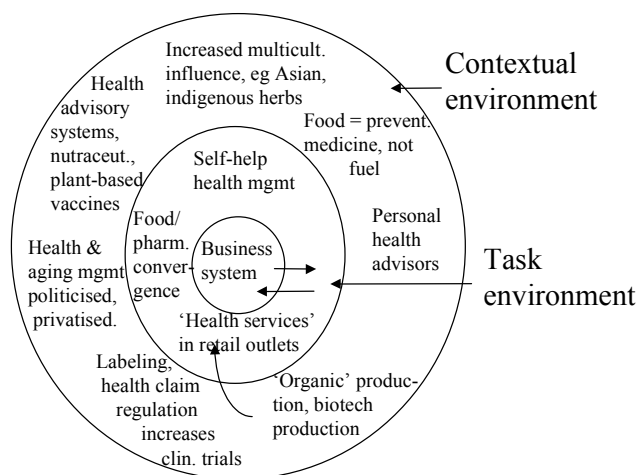


Figure 5. Major new product opportunities – health

The demographics of developed countries like Australia suggest enormous opportunities for the development of food products which have health and vitality-enhancing properties. A snapshot can be developed which shows the climate for new product development in this arena. Again, when we start at 12:00 in Figure 5, opportunities for the food industry arise as a result of the following trends:

- More consumer interest in Asian, herbal and alternative health and vitality products will emerge as societies become more multicultural;
- A shift in consumer perception of food as fuel to food as preventative medicine has been identified by many experts;
- Consumer interest will grow in personal health advisors, both human and digital;
- Greater emphasis is emerging on ‘organic’ production of ingredients as a source of competitive advantage for many food companies;
- Health claims on food products the subject of increased regulation;
- With much of the population requiring increased health services and payment for these services straining the public purse, we will see increased privatisation and politicisation of health care;
- New technologies, such as health advisory systems and nutraceuticals are emerging as the focus of a food industry ‘bandwagon’.

At the task level, we see:

- Consumers expressing increased interest in ‘self-help’ health management, advisors and advisory systems;
- Health services and information increasingly appearing in retail outlets;
- Regulation speeding the convergence of food and pharmaceutical industries which have mutual interests in nutraceutical product development and substantiation.

### 1.2.5 New product opportunities: convenience

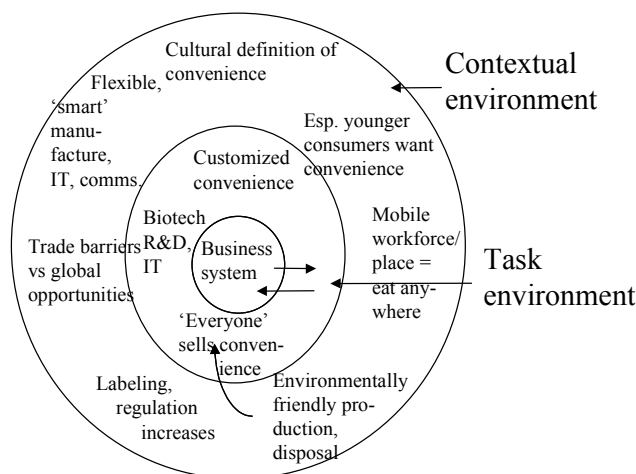


Figure 6 Major new product opportunities – convenience foods

The second major new product opportunity area arising out of major trends impacting the food industry is related to increased convenience benefits of products and services. When we map the trends contributing to this set of opportunities into a snapshot in Figure 6, we see:

- ‘Convenience’ will be increasingly defined differently by different people.
- Multicultural societies and increased access to global travel will lead to more heterogeneity in definitions of convenience and increased demand for more choice of convenient foods;
- Urbanization of society in many cultures means there will be fewer people living on the land and more people leading fast-paced urban lives. In particular, younger people will demand more convenience-related products and services;
- Information technology will increasingly permit people to work anywhere. A mobile workforce will require convenience of access to food as well as convenience in food products;
- Packaging of convenience food will come under increased scrutiny and regulation. Just as greater emphasis is emerging on environmentally friendly production of foods, environmentally friendly disposal of packaging is becoming a priority;
- Labeling standards will become increasingly stringent for convenience foods as well as for other product categories;
- Trade barriers will be strained by emergence of global demands for convenience foods, as in other product areas.

## SECTION 2. FOCUS GROUP CONCLUSIONS

### 2.1 Future food industry opportunities for innovation

The snapshots in Figures 3-6 set the stage for focus groups to discuss how to translate trends into business opportunities for the food industry.

This section describes in detail focus group conclusions on opportunities for industry that might be captured through R&D or other processes of innovation. As these opportunities have been identified from the demand side—that is, from the perception of industry experts and consumers of what industry will need and the consumer will want—opportunities are not described in technical terms, but rather as focus groups participants described them. Because participants focused on what they believed industry and the consumer would require in the future; it should not be expected that the opportunities they identified will reflect the food industry’s current competitive strengths. On the contrary, it is more likely to reflect potential gaps or weaknesses. Summaries of focus group discussions are followed by opportunities (in text boxes) which industry experts believe may be of greatest interest to the food industry.

#### 2.1.1. *Rising customer expectations, customisation*

According to focus group participants, consumer expectations of the food industry are high and rising. Food safety is an issue of paramount concern to consumers when they consider new innovations in food products and services. Other priority requirements are quality, freshness and convenience. These attributes are perceived differently by different consumers. Some international marketers believe it has never been more difficult to define customer needs and to segment markets according to those needs.

Supporting this view, international marketing expert Dr Peter Wilton of the University of California Berkeley (1998) says that extensive use of data input devices like scanners and development of customer databases have provided valuable sources of information about customer preferences. These tools will increasingly permit companies to develop products according to the *customer’s* definition of what constitutes value for money, physical appeal, and quality, among other attributes. He believes this trend will penetrate even low-margin, high-volume product ranges such as many in the food processing industry. In his view, customers will increasingly want these attributes at the same prices as they paid in the past for the ‘standard’ product. He also believes those vendors able to provide ‘customised’ products first will secure a relatively stable competitive advantage in their chosen markets.

**OPPORTUNITIES:** Information about consumers will be increasingly important in addressing the trend toward customisation. A recent OECD study has predicted that ‘**new tools of information technology** will be used to **examine consumer behaviour**’ and also to **provide consumers with more information on food products**. With barcodes and loyalty cards, for example, firms will be able to gather data on and analyse consumption patterns for ever smaller groups of consumers, and eventually individuals (OECD 1998, p 12), potentially resulting in **consumers’ personal brands**.

**Consumer information which allows retailers and property developers to segment markets for retail outlets** in a meaningful manner will also become increasingly valued. Segments are likely to be based on **lifestyle preferences** rather than simple demographics. **Understanding food choice** has also become more complex by ‘attitudes to diet’ and cultural differences (OECD p 96). **Better tools for understanding consumer perceptions and behaviour and the psychology of choice**, drawn from social sciences such as psychology and anthropology, will be applied to these issues.

Objective measures for texture have eluded food scientists interested in quality assessments of products. Rheology, the study of deformation and flow of matter, may be applied to **sensory studies** of consumer texture preferences..

**Flexible production processes and equipment to produce smaller, 'customised' product batches** in the manufacturing plant, in the retail outlets, and in the home, will also be required to address the trend to product customisation. R&D opportunities exist in the establishment of **networked producer information systems** which enable traditional retail outlets to source high quality fresh produce at any time, regardless of climate or location. Access to **virtual reality supermarkets** coupled with **home delivery systems** will appeal to affluent, time-poor consumers.

### 2.1.2 Non-food industry competition

In recent years, the food industry has become accustomed to the emergence of food retail outlets in petrol stations, convenience stores or in discount stores. In many industries, retailers are seeking to extend their business activities by meeting new consumer needs when the consumer accesses the vendor's core suite of services. Food is a natural choice for many vendors, as the need arises so predictably. Entertainment and lifestyle activities are good examples of areas where food has come to play a focal role. The trend for increased non-food industry competition can only be expected to continue as consumers increasingly expect their needs to be met anywhere, at any time of the day.

Traditional retail outlets may expect competition to result in lower margins, particularly for fresh foods—although this is an area where traditional retailers may be able to compete better for market share than will some non-traditional outlets. Retail outlets have responded to competition creatively in many instances, for example, by offering food services and meals for consumption in the home. Nevertheless, the market share of non-traditional outlets may be expected to grow, with increasing competition from specialty stores, convenience stores, home delivery systems, vending machines, and portable outlets. Many food service providers are also focusing more on home meal solutions to expand business operations (Cheeseman and Breddin, 1995, pp v-vii), although the waste associated with providing a wider range of choices suggests vendors will specialise in narrower product ranges.

**OPPORTUNITIES:** More variation may be expected in **shopping/entertainment/information facilities**. It is likely that IT or entertainment companies will increasingly attempt to access younger shoppers through facilities which appeal to young people's interests in technology, sports and entertainment. For shoppers with more traditional cultural interests, the shopping centre may offer opera or orchestral opportunities. For older shoppers, the shopping centre may increasingly perform a function as a **surrogate community centre** or **source of health care information** (Wyke, p 26).

### 2.1.3. Industry convergence

Vertical integration by multinationals, whereby they expand into business areas related to their core business functions, is on the increase. As indicated above, the entertainment industry is already engaged in the food business to a significant degree.

Technology-based firms like pharmaceutical companies are entering the food industry. We can expect such firms to be an important source of 'functional' food products in the future. Life sciences companies will counter consumer objections to biotechnology offering benefits to consumers, particularly, health and vitality-management benefits, that are compelling enough to outweigh perceived disadvantages.

It is highly likely that other non-food industries will also enter the food industry, operating at different stages of the business system as they seek to leverage established systems and customer access points. For example, appliance companies which develop 'smart' kitchen appliances, may move into developing the food product 'mixes' that may be processed at home. Cigarette and other FMCG (Fast Moving Consumer Goods) outlets will increasingly move into the snack food area.

There are a range of flow-on implications of such convergence. For example, if industries, like the biotechnology and appliance industry, which are accustomed to higher levels of technological innovation or which have in place sophisticated information and logistics management systems, begin to enter the food industry, the competitive environment for the food industry may change dramatically.

**OPPORTUNITIES:** Innovative food companies are responding to competitive challenges by creating **strategic planning units** which bring increasingly together marketers, R&D staff, and industry analysts, some from related industries such as appliances, in recognition of the increasingly complex forces affecting the industry (Peterson, 1998).

More **strategic alliances** will develop between food and non-food companies. As a result of industry convergence, **new information systems** developed for other industries will be used to increase the efficiency of food-related operations, like **logistics management, ingredient sourcing, freight navigation**, among others.

#### *2.1.4. Globalisation*

Increased contact among different cultures of the world, resulting in greater familiarity with international products and practices, is often expressed as 'globalisation'. Globalisation affects industry in many ways. For example, it has long been recognised that the globalisation of culture via international media results in 'global brands', product brands that are recognised throughout the world, like Coco-Cola for example. Brand names have existed for 4000 years, and they have served to differentiate products by suggesting quality and performance attributes or to convey to consumers certain cultural characteristics, such as status, values and personality (Jones and Morgan 1994, p 24). Food companies invest heavily in promotional activities to create brand awareness, but food industry experts are divided over their future effectiveness: on the one hand, although brand domination is likely to continue in some prestige food product categories, the trend toward customisation is likely to challenge the dominance of branding for other categories. On the other hand, as consumers shop in virtual supermarkets, they will rely on known brands for attributes they desire.

The emerging domination of store brands has complicated the picture and the brand marketing investment decision for the food industry. The delivery mechanism for food products will dictate the effectiveness of brands to a significant degree. It is likely that the numbers of product brands will decline while dominant 'provider' or 'channel' brands will emerge.

On another front, growing use by consumers and food companies of computer networks is increasingly making many business functions location-independent, including R&D, marketing, input sourcing, manufacturing, distribution, and market research, among others.

**OPPORTUNITIES:** Information and communications technologies may offer companies access to **global networks of information, products and professionals** with which to aid problem solving. For example, food companies traditionally face considerable costs in product launches, particularly when international launches are planned; **virtual test marketing**, whereby consumers may assess new products in **simulated retail environments**, could save a substantial proportion of the high costs associated with traditional launches conducted in retail or other outlets.

#### 2.1.5 Digitization, disintermediation

Consumers are becoming accustomed to interaction with machines, through use of vending machines and ATMs, even for fulfilling complex needs. For some consumers, a digital intermediary may offer a more consistent level of service than a tired or stressed human. Information technology guru, Dr Nicholas Negroponte of MIT, believes consumers will increasingly source goods, including food products, on the Internet. Home mail boxes will be converted into large refrigerator storage compartments for delivery when consumers are not at home. Online ordering and home delivery services will replace much supermarket shopping in the US, he believes—unless the supermarkets offer additional attractions, such as entertainment or information. For people who want products rather than a shopping experience, he believes the middleman will be eliminated, in a widely occurring process called ‘disintermediation’ (Negroponte 1998, p 184). Section 2.1.93 on information technology expands on this trend.

**OPPORTUNITIES:** Information systems may be applied to customer interface functions, such as **product information kiosks** and **ordering systems**. For network shoppers, **intelligent Internet ‘agents’** are already able to search the Web for desirable products or service produced anywhere in the world.

As a result of disintermediation, and fuelled by consumer demands for **minimally or un-processed foods** which in some cases will result in **direct links between producers and consumers**, the food industry business system is likely to be more compacted in future. Significant impacts may be expected in the processing, transport and retail sectors with an increase in **direct-to-consumer delivery services**.

#### 2.1.6. Changing demographics

With its strong traditional emphasis on market research, the food industry is well aware of major demographic trends. Frequently cited demographics include household size, workforce composition, and household income allocation. Many of these trends are global. For example, the share of single-person households is expected to climb in 2010 from its current level of 30 per cent to around 36 percent in the European Union, and in Japan from 23 per cent to 28 per cent.

High levels of female participation in the workforce and a rising share of elderly people in developed countries will augment the demand for convenience food and eating outside the home, as well as for services such as delivery and catering (OECD p 12). Trends such as the rapid entry of women into the workforce and emergence of smaller households have been met by the food industry with the introduction of convenience foods, home meal solutions, microwavable food products, and smaller and/or individual packaging. There is no sign that these trends are on the wane.

Also very well recognised by the food industry are the implications of the aging of the population and the prospect of a continued domination of the economy by baby boomers for the next thirty years. As a result, concerns about disease prevention, anti-aging, energy maintenance, and disease immunity are likely to lead the list of consumer desires to which food companies will respond. Consumer interest in ‘food as medicine’ is on the increase, according to a recent survey

(*FoodTechnology*, p 42). It suggested that 52% of Americans believe that foods can replace the use of drugs and 33% regularly use food for treatment.

Other global population trends receive less attention, in part because processed food products are purchased by more affluent consumers. High incomes are associated with increases in the demand for value-adding food services, such as processing and packaging, and food choice moves toward more expensive calories and protein. As a result, some trends in global demographics, which suggest opportunities to develop volume products for lower income markets, have received less attention from food companies.

The UN has published global population projections, which range from 7.2-8 billion by 2020. (OECD, p 57). Much of this population growth will occur in developing countries which have less access to many food products and/or are likely to experience nutrition or health crises in the future. Developing countries (and to a lesser degree, developed countries) are experiencing enormous growth of urban populations as many rural workers move to the cities. There are clear implications for food production and distribution as a result of this population shift.

**OPPORTUNITIES: Convenience foods** will continue to be a growth area. Already, food purchase profiles are being influenced by the children of working mothers. These generations have been being raised with microwaves and snacks, video games and computers, and frequently they have not been exposed to food preparation skills either in the home or in schools. These consumer groups will demand **meals for home consumption, attractive, heatable and recyclable containers, home delivery, hand-held foods, and creative distribution mechanisms** (*Food Technology*, p 42).

As convenience foods and meals proliferate and delays and temperature changes occur between meal preparation and consumption, **guarantees of food safety** will increase in importance for consumers. **Packaging that ensures temperature stability** or that integrates **sensors** that change colour when contamination or spoilage occurs are probable responses to this opportunity.

We can expect to see more food **products with taste but less sodium content, less fat and saturated fat, properties to lower cholesterol levels**, as well as more **fortified foods** with minerals such as calcium, vitamins. **Functional foods, (also called ‘nutraceuticals’) probiotics, phytochemicals, fibre, resistant starches** and other products specifically formulated for an aging population are other new product growth areas. **Information about the relationship between health and food** will be eagerly sought after by food companies courting this growing market as well as by consumers who will take an increasingly active role in managing their own health care, vitality and well-being.

As indicated above, large volume, low overhead markets for food products are rarely tapped by food processing companies. Although traditional retail outlets may not have the channels in place to access these volume markets, new industry players, such as pharmaceutical or life sciences companies, are likely to take an interest in these opportunities. **Biotechnology** is being applied increasingly to **improve crop yields**, among other areas. Another area of growing interest is work being done on **integrating vaccines in plant products**, a development which may be particularly interesting for countries with populations in areas which make it difficult to implement effective traditional immunisation programs (Sasson, 1998, p 94).

### 2.1.7. Environmental changes

With the increase in consumer awareness and interest in environmental issues such as sustainable agricultural production methods, manufacturers will increasingly be required to provide information about how the product was produced. Early examples of this included the ‘dolphin-free tuna’ slogan which appeared several years ago on tinned fish products and the ‘not tested on animals’ information on personal products. Many consumers will wish known more about production issues such as animal welfare, organic and non-organic agricultural production methods, use of genetic engineering techniques, management of pesticides, nitrates, resident wildlife, soil erosion, non-renewable energy and other resources. Other issues which may become marketing (dis-) advantages include: energy conservation in processing; noise and air pollution in processing; and water pollution, among others (Dalzell, 1994, pp 41-43).

**OPPORTUNITIES:** Consumer awareness of extraneous packaging is on the increase. In Europe, for example, increasingly stringent regulations are imposed on manufacturers to take responsibility for the re-use or disposal of the packaging on their products. Packaging options and **disposal of used packaging, recycling and biodegradable plastics** represent opportunities to enhance the brand image of food products.

**Audits of production processes** which eliminate some environmental hazards and **provide information about techniques used in production** are likely to offer at least significant public relations benefits to food processors—and in all probability eventually to be required by national regulatory bodies.

### 2.1.8. Complex regulatory environment

Food industry regulation is likely to proliferate, and “if excessive, compliance may generate excessive costs, discourage research and development or be quite simply ineffective. Lack of regulation, on the other hand, can lead to a loss of consumer confidence”, according to the OECD (1998, p 18). Only through active monitoring of international regulations and aggressive involvement in standards establishment can any national food industry stay globally competitive.

**OPPORTUNITIES:** Small market countries are extremely vulnerable to market exclusion via trade barriers and unattainable standards. **Active monitoring activities and participation in international standards bodies** are critical to an ability to continue to access global markets. This is an issue where industry-wide collaboration and support is essential to the food industry’s future prosperity.

### 2.1.9 Rapid technological change

Technological innovation in many industries is increasingly drawn from a range of scientific and engineering disciplines. Although it is impossible to pinpoint exactly which technologies will be most likely to affect the food industry of the future, a few major technological areas experiencing rapid change may be highlighted with confidence. Some of these have been referred to in preceding sections of this report.

#### 2.1.9.1. Genomics

Advances in human genomics are likely to balance the current emphasis on treatment of disease with a complementary emphasis on health care on disease prevention. By the year 2005, the Human Genome Project, which aimed at mapping and sequencing the entire genetic composition of the human body, will have established the location of about 100,000 human genes and their exact sequence. This will allow comparisons between the genetic composition of normal and abnormal cells. The knowledge that someone has a genetic susceptibility towards a specific disease can allow steps to be taken to minimise the risk of the disease occurring, or at least to

delay its development. In the future, preventative medicine is likely to focus more attention on the genetic differences between people, i.e. their biochemical individuality and how to respond to individual predisposition to disease (Wingerson 1990, p 151).

Public health care cost benefits are considerable. In Australia, about 1.5 million people suffer from asthma, 600,000 have diabetes, 500,000 suffer the symptoms of heart disease, and 2.5 million have high blood pressure. Measures which help reduce the costs of health care have enormous benefits, both economically and personally. In 1993/94, the Australian health budget was \$46 billion, of which \$23 billion was spent on treating degenerative disease. Evidence now exists that with the wide application of preventative medicine, the incidence of degenerative disease could be reduced by around 50%, leading to a saving of \$12 billion per year. The World Health Organisation (WHO) has stated that in the industrialised countries, an average of 88% of a country's total health budget is spent on treating chronic illness. (Florence and Setright, p 1). Foods that may address genetic predisposition to disease will receive increased attention, not only from individuals and food companies, but also from public health agencies and health insurance companies.

**OPPORTUNITIES:** Good nutrition will be increasingly emphasised in medical institutions, public health agencies, as well as in consumers' homes, as one important method for preventing illness. As a result, the field of **human nutrition** is likely to offer many new research and clinical employment opportunities in the future (Florence and Setright, 1994, p. 366). The facts that there is no average individual and that diet and dietary supplements need to be designed on an individual basis suggests that '**nutritional advisers**' will be in demand, both privately and working in association with food companies to design new products. Increased demand for advisers will result in both **research and educational opportunities**. Private health insurance companies may offer incentives for clients who adhere to a healthy foods plan.

Health claims for food products will be increasingly subjected to **regulations which will require monitoring and compliance programs**. Opportunities exist for organisations to provide the scientific knowledge necessary to **substantiate such health claims**.

If current restrictions on products which claim medical properties continue to apply, there may be increasing scope for **strategic alliances** between food companies and life science and pharmaceutical companies with experience in **managing clinical trials**.

#### 2.1.9.2. Biotechnology

Despite consumer ambivalence to many applications, biotechnology is emerging as one of the most promising fields of food-related research. Aging populations are likely to show increased interest in new food products attributed with health-promoting properties. Other areas of particular interest include improving the quality of commodities (including yield enhancement, reduction in chemical inputs, adaptation to specific natural conditions and plant disease management ( OECD, p 9). The market for such quality improvements is large: according to some forecasters, it is very likely to amount to about 20 per cent of plant protection expenditure by the year 2010 (OECD, p 86). To achieve this success, however, general public concerns on a range of health, biodiversity, and ethical issues must be addressed (Nottingham 1998, Ch 11).

**OPPORTUNITIES:** Significant opportunities for the application of biotechnology to processed foods include development of **antibodies** and **nucleic acid probes** for animal health diagnosis for **assessment of bacteriological quality** and **traceability of food products**; natural **hormones and cell mediators** for stock breeding and **product** (e.g. milk) **yields**; more effective, specific and safer **synthetic vaccines**; industrial (e.g. milk, oil or fat) **enzymes**; **biomacromolecules**; **micro-organism transformation techniques** (e.g. thermostability, phage resistance); **soil microbiology** and in plant protection; and **transgenic species of crops and livestock** (OECD p 80).

#### 2.1.9.3. Information technology

Computing and communications technologies have advanced so quickly in the six or so decades of their existence that the notion of a 'smart kitchen' now seems almost commonplace. Among the furnishings mooted for such a kitchen are PCs with the power of supercomputers, integrated computers and televisions, stoves or other 'smart appliances' with recipes stored in memory, and intelligent network 'agents' able to handle routine shopping via online shopping malls (Cetron and Davies, pp 2-27).

Advances in information and communication technologies, including development of the Internet, are already having a major effect on the food industry. Peapod.com, the Internet-based virtual grocery, has filled over 1,000,000 orders in the US, delivering directly to customers. In Europe, a rise in the popularity of 'teleshopping' in many countries is predicted; for example, experts believe it could account for 10-15 per cent of packaged groceries in France, Germany and the United Kingdom in ten year's time (OECD, p. 12). Agricultural decision support systems are providing guidance to producers, and management systems are being applied to Just-In-Time manufacture, cold chain temperature control, logistics management, and navigation systems for distributors.

**OPPORTUNITIES:** Many potential applications of information technology to the food industry will be similar to those in other manufacturing sectors. A few opportunities will be covered here which may be particularly relevant to the food industry. New tools of information technology will be used to examine **consumer behaviour**. **Advisory systems** will provide consumers with more information on food products, including information on nutritional benefits of food which may be tailored to an individual's health 'profile'. **Scanners** will read '**information rich**' labels on food products to determine which adhere to the consumer's health and preference profile.

The potential for applying information technology to **managing manufacturing processes** is great. For example some of the more intractable problems of **food rheology** may be the focus of information technology applications. Rheological characteristics of food materials frequently present process engineers with difficult **handling and pumping** problems (Encyclopedia of Food Science, Technology and Nutrition, pp 3577-3582).

**Modelling tools** will be applied increasingly to production and new product design activities.

#### 2.1.9.4. High speed transport and logistics management technologies

Technological innovations in transportation and communication will continue to reduce transportation costs and time for most products and regions. In contrast to the recent past, many developed countries, including the US and Europe, are investing in high speed rail and shipping links which will cut shipping time for food products. High Speed Rail is already capable of speeds up to 500 kph while air cushion cargo ships can travel over long distances in a manner very similar to how high-speed hydrofoils travel over shorter ones. Road transport will also be made more efficient through navigation systems; for example, Motorola in the USA has already developed a Global Positioning System, which relies on an array of navigation satellites to define the most effective route for a vehicle (Cetron and Davies p 127-129).

**OPPORTUNITIES:** Opportunities include advanced **network services** which allow more **efficient management of stocks and input flows**. The Internet is permitting the development of **virtual commodity markets** in agriculture (OECD p 174).

**Geographical positioning systems** (OECD p 11) and better **communication technologies for freight planning** are needed to allow shippers to tailor freight volumes and delivery dates for shipments of perishable goods to the precise needs of importers. They may also be used to shift rapidly among alternative routes and modes to avoid congestion, to **track electronically the progress of the shipment** to avoid loss or delay and to coordinate rapidly the associated information and payment flows among parties, as well as **to trace and manage the cold chain**.

## 2.2. Future Food Pty Ltd: the new millenium business system

The preceding section presented focus group views on emerging opportunities which address macro-trends affecting many industries in many countries. Industry focus groups applied these trends to the particular requirements of the food industry in Australia. They identified opportunities that may arise at each stage of the business system. The aim was to create some possible scenarios for a 'new millenium food industry business system' for Australia.

Business system stages overlap, so there is some overlap in the material on challenges and opportunities distinguished for each stage. This report focuses primarily on those developments and opportunities most likely to have significant flow-on effects for the food *processing* industry. Because of this focus, there is relatively little information on the highly relevant area of food production.

### 2.2.1. On the farm

Environmental issues were viewed as likely to be of increasing concern for the Australian producer, with the prospect of further degradation of arable land likely. Producers responding to increased consumer and regulatory demands for sustainable agricultural production will of necessity pass on higher costs for their products to food processing firms. Some smaller producers will find it difficult to operate under increased regulatory pressure or to comply with quality assurance requirements for traceability.

Consolidation within farming cooperatives and corporations is highly likely. In particular, buy-in of Australian farms by multinationals with well-developed information systems may increase the likelihood of their introducing more competitive stock and input management systems, putting pressure on small producers to compete. To survive, smaller producers will look for niches in luxury or alternative health products and eco-tourism.

Another challenge lies in the trend toward economically divergent consumers. Australia, like many countries, increasingly experiences a gap between the economic 'haves' and 'have-nots' (ABS, 1997, pp 113-117). As indicated above, the food processing industry has traditionally emphasised offering value-added attributes to relatively more affluent consumers. This orientation may require some revision if the industry's traditional affluent market erodes in size.

In recent years, the Australian food processing industry has expanded its focus from an almost exclusive emphasis on the local market to increased export activity, particularly to its Asian neighbours. Recent currency and market corrections in Asia have negatively affected some processed food exports to some Asian countries (especially Korea and Indonesia); however, a number of factors, including high levels of education and a committed work force, make recovery in these countries little more than a matter of time. As this recovery occurs, Australia can only

benefit from flexible export strategies to leverage natural advantages and enhance the country's capability to better tailor Australian-sourced products for a range of different export markets.

**OPPORTUNITIES:** Small business opportunities are likely to arise in **niche farms** (e.g. fish farms), cooperatives, and franchise opportunities. Management of smaller farms specialising in **biotechnology-based 'designer foods'** with properties perceived by consumers to offer health or 'organic' benefits could offer interesting alternatives for the small producer. The success of such enterprises will depend to a significant degree upon the success of the food industry in **educating the consumer** about the relative benefits of genetically engineered food products.

R&D opportunities arise in the areas of **sustainable agricultural processes, traceability for quality assurance, and transgenic crops** for niche farms. Niche crop **harvesting equipment** for specialised tasks such as **robotics for fruit-picking** represent another opportunity, according to focus group members.

Other opportunities include information systems to underpin agricultural cooperatives and **network producers** to guarantee quality products despite local conditions. Networked tools will also help producers access markets as well as improve their **knowledge of consumers, including cultural aspects of food choice**.

Export markets in Asia will recover their pre 'Melt-down' demand for **counter-seasonal produce, 'clean-green' products and prestige imports**.

### *2.2.2 Transport from farm gate to manufacturing plant*

The long distances many food ingredients and products travel to reach manufacturers and outlets in Australia puts great pressure on the cold chain, according to focus group participants. Quality standards implemented by transport companies may vary, not only at the shipping stage but also at holding points. Temperature control, packaging and logging systems may in some instances need upgrading to provide the guarantees of safety consumers demand.

**OPPORTUNITIES:** Major opportunities to address these challenges included **lightweight and advanced materials for pallet and container** construction and **navigation systems** to enhance road transport. (Related opportunities appear in Section 2.2.4 below.)

### *2.2.3 At the manufacturing plant*

Balancing the need to reduce costs and maintain high quality standards while at the same time supplying products which meet consumer demands for customised and 'unprocessed' foods was seen as the greatest challenge to manufacturers in Australia. In small markets like Australia, costs of replacing obsolete equipment and the difficulties of minimising equipment down time are difficult to manage in the face of market demands for high levels of product innovation. Despite rationalisation efforts such as the recent release of the Blair Report (1998), manufacturers also face increased regulation of production and packaging, as well as tariff barriers for those firms entering export markets (IBIS, p 7).

**OPPORTUNITIES:** New product innovation opportunities were distinguished, including **food for an aging population** and **health-enhancing products**, and food offering vitality, and cognition, and mood management benefits.

Packaging was the subject of great interest, with opportunities distinguished in the areas of **tamper-proof, returnable and/or recyclable packaging, thermal packaging for meal solutions, bulk packaging for food service markets, controlled atmosphere packaging** and integration of **‘smart’ temperature or microbial sensors** in packaging and **‘information-rich’** packaging containing data relevant to consumers and/or to enhance industry processing efficiently (e.g. sorting and distribution).

In the processing area, opportunities were distinguished in advances in the development of flexible, **multi-purpose manufacturing plants** and equipment, and in particular in the development of **small-outlet, boutique and/or home processing equipment**. Other opportunities were distinguished in **processing for distance shipments**, and the development of **methods for production waste treatment** and conduct of **waste management audits and compliance certification**.

Advances in robotics and computer modelling for new product design were also seen as research opportunities, as was information technology applied to **scanning for product defects** and **integrated manufacturing decision support systems**, as well as **computer modelling** for new product design.

An opportunity was also seen to market Australia as a **centre of food industry technical expertise** in the Asia Pacific region.

#### 2.2.4 Distribution

The difficulties of cost-effectively managing the cold chain over the long distances which shippers face in Australia has been raised in Section 2.2.1 above. In the view of focus group participants, factors complicating attempts to better manage the cold chain include consumer demands for ‘fresh’ unprocessed foods and the resistance of some consumers to shelf-life extension innovations, as well as the likelihood of increased packaging regulation. Both shippers and warehouses are under pressure to reduce costs through transport efficiencies and reduction of inventory and handling.

Although Australia’s food industry has made progress in handling efficiencies in recent years (MHD, p 6), in many cases, particularly among smaller companies, the information systems necessary to implement effective supply chain solutions are not in place. At the same time, channels are becoming more complex. Increasingly, distributors will have to supply a myriad of small markets reliably and flexibly. Distributors may face loss of business as processing firms develop direct links with consumers expand activities into catering and secondary retailing activities (OECD p 15).

**OPPORTUNITIES:** Major opportunities include development of packaging innovations to control shipment temperature fluctuations. **Information systems to facilitate product sorting and cross-docking** operations were seen as valuable to the food industry, as were **monitoring systems**, resistant to failure and secure from **intentional tampering**, for **remote shipment temperature control**.

### 2.2.5. At the retail outlet

Focus group participants believed that in the next 5 -15 years, dominant Australian food retailers would continue to expand their control of the industry value chain by selling shelf space to manufacturers while also continuing to develop premium and economy store brands. Smaller retailers, it was felt, would more sharply experience increased competition from non-traditional outlets, including home shopping and delivery service providers.

Current popularity among consumers of ready-to-eat home meal solutions and generic brands (Kerslake, 1998), was viewed as likely to continue, although greater specialisation would emerge, in view of unacceptable overheads on gourmet meals attracting small numbers of consumers. Consumer demands for convenience and value for money in these products would persist, but these requirements would be modified by demographic trends such as those indicated in Section 2.1.6.above.

For example, Australian consumers would also demonstrate increased interest in products that they perceived would offer health or vitality benefits. Foods with perceived mood-moderating benefits ('mood foods') would increasingly attract consumer interest in the wake of an increased 'self-help' approach to managing their health and well-being.

More stringent regulation of food labeling and health claims would be required of Australian retailers. Consumers, while in principle desirous of having access to the information, would experience information overload and demand more 'user-friendly' information about and guarantees of safety, health benefits, and environmentally sustainable production methods.

**OPPORTUNITIES:** Opportunities distinguished to improve retailer's business processes lay in **exploiting the Internet** and other information systems for **advertising, market research, disseminating educational and marketing** information such as recipes, and **sourcing products, suppliers and markets.**

Focus group participants believed that Australian consumers would expect advances in the form of **transparent and credible quality control standards** and **packaging to ensure the safety of home meal solutions.**

Labeling and **product information in an accessible** form, such as **bar coded product information readable through a personal scanner**, possibly capable of **screening products against the consumer's individual health or preference profiles**, was viewed as likely to be of interest.

Developers would rely on improved information about consumer preferences to launch a broader range of **multi-functional retail outlets** which offer entertainment or information services.

### SECTION 3. CONSUMER ATTITUDE RESEARCH

#### **3.1. What does the Australian consumer think of food innovations?**

Food product and service innovation may evoke strong reactions from consumers. In recent history, initial rejection by consumers of food-related innovations like pasteurisation, irradiation, and microwaves suggest that technologies applied to food readily arouse ‘technology angst’ among consumers. This appears to be substantiated by recent research, for example, by Dr David Buisson of the University of Otago, New Zealand (Buisson 1999) which identified consumer ‘neophobia’ about applications to food of biotechnology.

Product acceptance by consumers depends upon many factors, including rigorous advance market research into consumer attitudes. As part of the Cassandra Project, research was undertaken to shed light on how likely it was that consumers would accept some of the innovations proposed by focus groups.

The Project Cassandra consumer attitude study<sup>4</sup> used a survey as a mechanism to assess the desirability of *applications* of technology. The study results it did not provide many insights into consumer attitudes to underlying technologies or processes for the simple reason that technologies used to develop products may be ‘invisible’ to many consumers. Results of the consumer attitude study shed light on whether consumers will really want some of the innovations identified by focus groups. It also illuminates whether some consumer perceptions may need to be addressed if research projects based on opportunities identified were to proceed.

##### *3.1.1 Aims*

The aims of the consumer attitude study were to determine attitudes of typical Australian consumers to a set of 39 innovations distinguished by Project Cassandra focus groups. These innovations concerned:

- Food product attributes, including quality and safety
- Production processes and technologies
- Eating occasions
- New products and packagings
- The shopping experience (including changes to the retail environment).

The full text descriptions of all 39 innovations are provided in Appendix 3.

##### *3.1.2. Methodology*

A survey was prepared which attempted to distill from the recommendations and observations of the focus groups some innovations consumers might be able to access in 5-20 years’ time. In order to make the innovations meaningful to potential respondents, some assumptions had to be made about the environment within which shopping decisions would be made in the future. To set the scene, a short scenario was presented in the introduction to the survey:

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<sup>4</sup> This study was developed by Project Manager Judy Marcure with the advice of the Sector Coordinator Dr Richard Head and Dr Katrine Baghurst. Ms Sally Record of the Division of Human Nutrition managed the design and mailout of the questionnaire, as well as oversight of the data entry, as well as

*Try to imagine yourself ten years from now, in the year 2008...and you and your family are ten years older...*

*You are living in a world much like the one you live in today, but there have been some advances in the technology in your home. For example, your PC and television are integrated into a single appliance that gives you access to Internet services, films, documentaries, and of course, home shopping opportunities.*

*The appliances in your kitchen have computer chips which make it possible for them to recognise your verbal instructions. They can unfreeze the steak, start the coffee, or separate compostable waste at your command. They can also respond to your programmed instructions for preparation of your favourite recipes.*

*Major advances have been made in human health diagnostics. There is a shift in focus in medicine from disease treatment to disease prevention. Nutritionists know more about what foods will help you stay healthier and feel younger longer. They also know more about foods that can affect you and your family's moods and behaviour.*

*On the farm, despite developments enhancing productivity and sustainability of production, producers are still experiencing loss of quality land for producing products. Although many producers have integrated into big farming corporations, a significant number of people, many of them 'boomers', have left their desk jobs to establish mini-farms where niche products, both organic fresh products and home-produced specialist products, can be purchased. Computer networks link food producers and processors all over the world, and high speed trains, planes and ships and packaging advances make it possible for you to get fresh products from almost anywhere quickly...*

A random sample of 2400 consumers aged 18 or older (names taken from Australian electoral rolls) were mailed a 23-page questionnaire. Potential respondents were asked to answer the questions for themselves and their families as if the year were 2008 rather than today. Respondents were asked to give their rating, on a scale from 1 to 7, of the desirability of a number of innovations (where 1 was 'very undesirable' and 7 was 'very desirable'). Respondents were also asked to check 'Yes' or 'No' if they were willing to pay a premium (say 15%) for the product or service.

Respondents were asked to give some information about themselves to aid the data analysis. The survey included standard demographic and other identifiers to help analysts explore the possibility that certain attributes such as income, education, sex or age might be correlated with a consistent tendency to accept or reject certain categories of innovation in food, its processing, packaging and distribution. Tabulated results and the full text of all questions appear in Appendix 3. Some general conclusions are reported in Section 3.1.3 below.

### *3.1.3. General conclusions:*

The survey achieved a nearly 50% response rate<sup>5</sup>. Men comprised approximately 40% and women 60% of the 1011 respondents who returned surveys.

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<sup>5</sup> This relatively high rate of return was probably due to several factors: (1) CSIRO surveys often demonstrate an above average return rate, possibly because of the positive public perception of the organisation and the perception that the study did not directly benefit any single commercial organisation; (2) several respondents indicated they thought filling out the form was 'interesting' or 'fun', so thinking about the future may well have been perceived as a positive experience for some respondents; (3) an incentive was offered in the form of a \$2 donation to the Smith Family Christmas Fund for each returned form, and the timing of the survey mailout (it was sent out in October and returned in November) may have made the incentive particularly attractive to some respondents at this time.

Before summarising the main results in some detail, a few general observations should be made:

- For most innovations, no statistically significant correlation could be found between gender, income or education and positive responses to most questions. There did, however, appear to be a statistically significant inverse correlation between positive responses and age for many questions.
- Many consumers who were open to some innovations or even very enthusiastic about them were reluctant to pay extra for them. These innovations were apparently perceived as the price that vendors should pay to retain market share. This was particularly the case for innovations which offered **food safety** or **quality** benefits.
- Of those innovations that rated highest among respondents, nearly half offered health benefits.
- Of those innovations that were rated lowest by respondents, ten of fourteen offered convenience benefits.
- Younger respondents were generally more likely than older respondents to want convenience benefits.
- In nearly three-quarters of cases, younger people (< 40 years) were more willing to pay a premium than older people (> 40 years).

### 3.1.3.1. What innovations did consumers find desirable?

Respondents rated each innovation for desirability. Those that were rated above a mean of 4.5 were mixed in character: six fell into the category of food safety and quality, seven fell into the health category, five into the category of convenience, two fell into the category of environmental sustainability, one offered value-for-money benefits. The full text descriptions of the innovations which received a mean rating higher than 4.5 appears in the text box in descending ranked order, with the mean rating for all respondents indicated in parentheses. Many of the innovations that received the highest mean rating (5-7) offered, health, safety or environmental benefits. However, as will be clearer below, approval of consumers does not always translate into willingness to pay for the innovations!

20.	Manufacturers of recycled packaging must demonstrate that they have met strict new guidelines regarding the safety of their materials and non-migration of contaminants into food products .....(6.0)
28.	You can choose from a range of products which have clear warnings to people with food allergies, including warnings about all ingredients in the products .....(5.9)
9.	Your shopping trolley contains an in-built scanner which keeps a running tally of costs. You can check the subtotal at any time. When you get to the checkout stand, you can choose an 'express lane' and swipe your card so the money is transferred from your account without your having to wait in a queue.....(5.8)
14.	Nanosensors (tiny organic sensors) integrated into the packaging detect the presence of harmful micro-organisms. If for any reason, the product is not suitable for consumption, the packaging will change to a distinctive colour .....(5.8)
34.	One new manufacturer guarantees that all the products they produce are subjected to a rigorous detection system which identifies the source of all raw ingredients in products, rejecting any supplier who does not meet high standards regarding hygiene, safety and residue levels .....(5.7)
31.	Following a rigorous audit by the Global Food Regulatory Agency, a new manufacturer is able to guarantee that all the products developed under the brand will be produced with environmentally non-damaging and sustainable methods.....(5.6)
19.	The Global Food Regulatory Agency has just issued packaging standards which make it easy for consumers to compare contents and value for money of similar products .....(5.5)
29.	All the packaging on food products contains information about how they were produced. You can immediately tell whether the product was developed using biotechnology, organic or traditional methods of pest control, produced via intensive farming methods, and by whom and where the product was produced.....(5.5)
32.	A new manufacturer promises that a considerable proportion of the company's profits will be used to invest in and provide access to improved global environmental technologies .....(5.5)
16.	The Global Food Regulatory Agency has issued clear guidelines regarding health claims food manufacturers may make to consumers about the health benefits of their products .....(5.4)
22.	The Global Food Regulatory Agency has developed a rating system which must be printed on all food product labels. It rates major food brands on safety, quality, freshness, taste and value for money in the product category .....(5.3)
38.	You are invited to dinner with friends. They put on a banquet of several courses. Everything, from the crisps, pates, and marinated olives before dinner to pasta and bread during, and the cake and ice cream at the end, has been hand-made by your friends .....(5.2)
26.	You can choose from a range of products with the same taste as original foods but reduced in fat, sugar, salt or alcohol .....(5.0)

8. Your food shopping outlets offer safe entertainment facilities and activities for your children.....(4.9)
15. Prepared meals, chilled and other food products which may spoil are packaged in a special thermal pouch which is re-usable or recyclable .....(4.9)
12. Your personalised, portable shopping 'advisor' scans information digitally encoded on the packaging label, and recommends food products with nutritional or other properties which suit your personal health profile .....(4.7)
23. A new range of dessert substitutes is available, which tastes exactly like your favourite mud cake, crème caramel, or mousse, but has no calories.....(4.6)
33. Advances in biotechnology have made it possible to incorporate vaccines to most infectious diseases in plants. You can see to it that your family members receive their vaccines without having injections—in a single palatable food product .....(4.6)
10. Your shopping trolley also has a lightweight, strong, lift-out returnable shopping basket....(4.5)
11. You can choose in advance the portion size of all your food products; e.g., single, couple, family, (any number of) guests to dinner. .(4.5)
25. You can choose from a range of products with the same taste as original foods but enriched according to your dietary needs with fibre, proteins, vitamins, minerals and other supplements.....(4.5)

### 3.1.3.2. What innovations did consumers find undesirable?

Several innovations that received a low mean rating from respondents appear in the text box below. The innovations were ranked by all respondents at 4.0 or below. Full text of relevant questions appears in descending order, with an indication of the mean rating. Like the previous responses for desirable innovations, there was considerable variation in the types of innovations considered unattractive, but most appear to offer convenience benefits.

Some innovations suggested as desirable by distinguished in focus groups were clearly of very little interest to consumers, at least as expressed in the survey questions. Aromas, for example, as incorporated into scratch 'n sniff packaging (18), received a mean rating of only (3.0). Innovations which de-personalise the meal experience rated consistently lower than most innovations (3, 7, 35). Australian consumers also did not like the idea of hand-held 'freeway' foods which have found acceptance in some other countries, notably the USA.

4. A pantry 'sensor' in your home ensures your preferred products are automatically delivered to your home just as you run out .....(3.7)
21. You can register your 'own label' of foods products. 'Your label' features a profile of your personal preferences for attributes of food products (e.g., kilojoule content, cholesterol level, even countries or regions of origin which you find incompatible with your ethical beliefs) .....(3.7)
3. When you have approved the menu, you can have the ingredients or completed meal delivered to your home .....3.5
36. You are invited to dinner with friends. They offer you a menu, as extensive as that of any prestige hotel, of prepared meals from which you can choose .....(3.5)
6. Your food shopping outlets offer performances of your favourite live music (opera, classical, jazz, popular, etc.) or other artistic performances you enjoy .....(3.3)
1. You drive through a display where 'sample' food products may be viewed and you make a selection, which is boxed for you while you get petrol and have your car washed .....(3.1)
2. You can choose to receive menu suggestions and recipes via your PC/TV in the morning or via your car phone as you drive home in the evening .....(3.1)
35. The members of your family select from menus of their favourite meals, which arrive cooked but chilled in the morning. Each person chooses his or her meal for heating and eating whenever he or she wishes .....(3.1.)
18. A new range of baking mixes has been launched with a scratch 'n sniff patch, so you can tell exactly how the fresh bread or cake will smell in the oven .....(3.0)
37. You heat your meal choice together with your friends on a tabletop microwave, fondu-style...(2.9)
39. A new range of 'freeway fare' foods is released which is specially designed for eating convenience while commuting. If you wish, you can warm the food in your glove compartment...(2.8)
5. You can register a 'serendipity' preference in your shopping orders, so some of the foods delivered to you will be new to you or unexpected .....(2.4)

### 3.2. What makes an innovation (un-) acceptable to consumers?

For industry, knowledge about how desirable an innovation is clearly has limited value only. Innovations with higher approval ratings may well be less likely to arouse consumer anxiety. However, commercial organizations must know whether enough consumers are willing to pay for the innovation to make its development profitable. One way of establishing this is to ask consumers, as the Project Cassandra survey did, to indicate if they would be willing to pay. In the case of the Cassandra survey, respondents were asked to indicate if they would pay a premium of 15% over the price of a similar product or service without the innovative attribute.

Innovations for which a larger proportion of people indicate they will pay the premium may have a greater likelihood of commercial success. A well-known bias complicates the picture, however. Particularly for socially desirable activities, respondents will often say they will pay extra, when in fact they do not. Environmentally friendly products which are offered at a premium price are frequently cited examples of this phenomenon.

Table 1 below provides a tabular comparison of respondent ratings, percentage of total respondents who indicated they would be willing to pay extra, type of innovation, and two consumer attributes which are sometimes associated with ratings, age and gender. Dominant respondent comments are also provided for each innovation (indicated by number only; for full text of innovations, please see Appendix 3). The table suggests that:

- Some innovations (eg 3,4) were rated as only ‘moderate’ in desirability. However, over 30% of all respondents were willing to pay a premium for them. These innovations provide **convenience benefits** that appear to be attractive to a niche market, particularly **younger consumers**.
- Some innovations (eg 10, 17) rated ‘high’ in desirability. However, fewer than 15% of all respondents were willing to pay a premium for them. These innovations provided **convenience benefits**, but were perceived as a **service retailers should provide**.
- Some innovations (eg 16, 19, 20, 22) rated ‘very high’ in desirability. However, fewer than 22% of respondents were willing to pay extra for them. These innovations **provided health, food safety and quality benefits, or environmental benefits** that consumers believed should be expressed in **standards with which industry should be obliged to conform**.
- Some innovations (eg 15, 23, 25, 26, 33, 9, 14, 28, 31, 32, 34) rated ‘high’ or ‘very high’ in desirability. Between 30% to 45% of respondents were willing to pay extra for them. Benefits were in the areas of convenience, food safety and quality, but **health benefits dominated among the highest rating innovations**.

It seems likely that the final category of innovations offer the greatest likelihood of commercial success and market acceptability, subject to evaluations on other grounds (e.g. technical feasibility development costs, etc.)

#### 3.2.1. What do respondent comments tell us?

Survey respondents were given the opportunity to comment on each innovation. In many cases, comments provided useful insights into the reasons consumers disliked, or liked, the innovation in question. Space is too limited in this report to summarise all comments. Table 1 lists the dominant category of comments for each innovation. In parentheses it also lists comments which were not necessarily the most common but which appeared to shed light on why the innovation received the rating it did.

In some instances categories of comments appeared to be associated with categories of innovations. For example:

- For several ‘convenience’ innovations (e.g. Innovation nos. 1,2,4,5), respondents expressed the view that use of the innovation would **reduce their control** or **lead to loss of choice** in the shopping experience;
- For several ‘convenience’ innovations (e.g. 1,3, 35) respondents expressed moral/ethical objections to innovations on the grounds that they may **make people ‘lazy’**.
- For several innovations related to health-related packaging or product attributes (e.g. 23, 24, 25, 26, 27, 33), **chemicals and/or additives** were sources of concern to respondents.
- Several innovations offering information on the product or packaging about health or safety benefits (eg 16, 19, 22, 28, 34) were perceived as the **manufacturers’ responsibility and the consumer’s right** – consumers won’t pay!
- Three ‘convenience’ innovations (eg 35, 36, 37) received negative comments because they were perceived as **undermining the family meal**; one of these (35) received the highest number of comments in a single category, 128, as potentially contributing to **loss of family bonding**.
- A few ‘convenience’ innovations were liked for **reducing waste** (eg 10, 11,13 ) or disliked for **contributing to waste** or extravagance (eg 5).

Table 1. Comparison of consumer factors impacting the potential desirability of Project Cassandra innovations

Innovation	Interest level	% willing to pay extra	Category	Gender relevant?	Age relevant?	Why or why not liked? (Dominant comments) [Niche]
1. Shop from sample foods	Low		Convenience	Men	Younger - slight tendency	Loss of control, choice, variety [Makes people lazy.]
2. Menus, recipes from PC, phone	Low		Convenience	Women (+4 pts to correct for 60/40 gender bias)	Younger - under 44 yrs	Loss of control, choice, variety  [Prefer current low-tech way.]
5. Serendipity item in shopping	Low	5%	Convenience	No	Younger - under 24 years	Loss of control, choice, variety [Fun. Cost of unwanted products.]
18. Scratch 'n sniff packaging	Low	4%	Marketing	No	No	Unnecessary, impractical [Germs carried to others from sniffing.]
37. Table microwave at dinner	Low	6%	Convenience	No	Younger - slight tendency	Do not like. [Does away with good fellowship over home-cooked meal.]
39. Freeway fare heated in car	Some	14%	Convenience	No	Younger - under 34 years	Safety concerns. [Should stop for meals.]
3. Food delivered from recipe	Moderate		Convenience	No	Younger - under 34 years	Convenient sometime. Prefer home cooking, tableware. [Makes people lazy. Cost.]

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4. Pantry sensor orders food	Moderate	32%	Convenience	No	Younger - under 45 years	Loss of control, variety, choice. [Makes people lazy. Cost.]
6. Live music at food shop	Moderate	9%	Marketing	Men	Younger - under 45 years	50-50 like/dislike. [Too many different preferences.]
7. Educational classes	Moderate	36%	Marketing	Women	No	Like this idea, would try. [No time. Only if health-related. Teach young to cook.]
21. 'Own label' for products	Moderate	13%	Marketing (customization)	No	Older - over 65 years	Not necessary. [Impractical, unlikely.]
30. Bake mix in smart processor	Moderate	18%	Convenience	No	Younger - slight tendency - under 34 years	Like this idea, would try. [Not necessary.]
35. Individual menus for family members	Moderate	21%	Convenience	No	Younger - under 34 years	Loss of family bonding * (Most frequent comment - 128)  [Useful in some cases. Extravagant, lazy, self-indulgent]
36. Guests offered prestige menu	Moderate	16%	Convenience	Men	Younger - under 34 years	Prefer home cooking, tableware [Might as well go to hotel.]
8. Kids activities at food shop	High	44%	Convenience	No	Younger - under 45 years	Useful, would try, reduces hassels [Need professionals, great customer service, please advise if someone does this!]
10. Removable basket in trolley	High	15%	Convenience	No	Older - slight tendency - over 35 years	Reduces waste, packaging [Should be a service, impractical - heavy]
11. Variable portion sizes in food	High	18%	Convenience	Women	No	Reduces waste, packaging. Problems defining serve size. [Good idea, portion size varies, no leftovers!]
12. Personal 'adviser' scanner in nutrition & health	High	28%	Health	No	No	Like this, useful in some cases. Loss of control, variety [Can't trust labels, lazy, won't have to read in future]
13. Food in reusable containers	High	29%	Environment	No	Younger - slight tendency - under 44 years	Useful. Prefer home cooking, tableware. [Sometimes useful, reduces waste. Waste of resources.]

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15. Food in reusable thermal pouch	High	34%	Environment, safety	Women	No	Useful in some cases. Like this idea, would try. <i>[Cost too high?]</i>
17. Shops organised around menus	High	10%	Convenience	No	Older - over 45 years	Impractical, unlikely. <i>[Confusing, doesn't allow creativity, eliminates forgetting, helps plan meals.]</i>
23. Calorie free desserts	High	33%	Health, weight	Women	Younger - under 34 years	Like this idea. Concerns about chemicals. <i>[3rd highest comments, equal nos like, concerned about chemicals]</i>
24. Coating keeps food fresh 30 days	High	28%	Convenience, quality	No	No	Safety concerns. Quality of product, service. <i>[Revolting, wouldn't eat, chemicals, how can you tell if fresh?]</i>
25. Foods with personalised nutrients	High	33%	Health	Women	No	Like this idea. Natural, organic is better. <i>[Not necessary in balanced diet, original foods, no additives.]</i>
26. Good tasting food with low fat, etc	High	36%	Health	Women	Younger - under 44 years	Useful in some cases. <i>[Concerns about chemicals. 2<sup>nd</sup> highest comments.]</i>
27. Tasty food with organic salt, sugar substitutes	High	28%	Health	Women	No	Like this idea. <i>[Safety concerns, no checmicals]</i>
33. Vaccines in foods	High	45%	Health	Men - slight	Younger - slight - under 45 years	Impractical, unlikely. Like this idea, would try <i>[Safety concerns, many concerns]</i>
38. Dinner banquet handmade	High	25%	Convenience – reaction to	Women	No - except +65 years	Should not, would not pay. Like this idea - would try. <i>[Shows care, concern, shouldn't pay, 52]</i>
9. Shopping trolley tallies up costs	Very high	30%	Convenience	No	No	Like this idea, would try* <i>[second highest score; 81; stores will save money, costs absorbed by store]</i>
14. Sensors detect micro-organisms in food	Very high	44%	Health	No	No	Like this idea, would try. <i>[62 good idea; work in freezer? What about blind?]</i>
16. Guidelines for health claims	Very high	17%	Health	No	Older - over 25 years	Should be standard. <i>[Shouldn't have to pay.]</i>
19. Standardised label to facilitate food comparisons	Very High	18%	Quality	Men	No	Like this idea. Should be standard. <i>[Very valuable, shouldn't have to pay for this.]</i>

20. Standard for recycle packaging	Very high	22%	Environment	No	Older - over 35 years	Should be standard. [Shouldn't have to pay, manufacturer responsibility, consumer right.]
22. Food rating system for freshness, value	Very high	23%	Quality	No	Older - over 35 years	Like this idea, would try. [Manufacturer obligation, consumer right, impractical.]
28. Allergy warnings on foods	Very high	36%	Health	Women	No	Should be standard. [Should be compulsory, shouldn't have to pay.]
29. Labelling of production methods, GM foods	Very high	26%	Environment, quality	No	No	Should be standard. [Consumer right, information overload would result.]
31. Food manuf. Guarantee of environ. sustain	Very high	34%	Environment	No	No	Should be standard. [About time! Wishful thinking?]
32. Part profits benefit environment	Very high	30%	Environment	No	No	Ethics of supplier/shopper. [Should be compulsory. Can we believe them? Need controls.]
34. Controlled hygiene level, residues, ingred sources	Very high	32%	Safety, quality	Women	No	Should be standard. [Should be compulsory. Manufacturers may not be truthful.]

### 3.2.1 Innovation ratings and respondent characteristics

An analysis of Table 2 suggests that some innovations may be worth considering for development if a sufficiently large market can be identified for them. The consumer attitude research provided some insights into potential markets. For a number of innovations, there was a marked difference in the willingness of groups to pay the premium. Figure 7 shows mean desirability scores by age groups, (note the age groupings are rather large), and this chart displays innovations in an order different from the list above, because innovations were sorted by rankings for 'under 40's. Only the range 2-6.5 is shown because no innovation had a mean rating outside that range.

For mean desirability ratings, there appears to be relatively little variation by age of respondent. Compare this with Figure 8, which shows the distributions of groups willing to pay a premium for innovations by age. For highest rated innovations younger respondents seem more willing to pay extra. In some cases, this willingness was probably related to family issues younger people confront, such as the interest of younger people in activities for their children in retail outlets (33) or in convenience (3, 4).

People between 41 and 54 were more willing than other groups to pay a premium for health benefits (28, 12) and demonstrated a more consistent interest in environmental issues than other groups. Over 55's were more willing than other groups to pay a premium for only one innovation, a rating system which evaluates food products on standards of quality and value for money (22).

Willingness to pay a premium was also sorted by income group. Figure 9 shows the distribution by income. In this instance, the data is sorted by the highest household income group (+\$76,000 p.a.), even though this was the smallest group (11%) on the assumption that this was the group best able to pay for innovations. Interestingly, there appears to be less variation in willingness to pay a premium than one might expect, apart from the rather obvious fact that the lowest income

group consistently demonstrated the least willingness to pay extra. The disproportionate willingness to pay more of the group in the relatively low \$31,000-\$45,000 household income category may be related to the relatively younger ages of this group and the fact that they may have fewer financial burdens.

### *3.2.3 Some observations*

In general, it may be said that these consumer attitude survey results confirm the high priority consumers place on food safety and the increasing importance to them of health issues and environmental concerns. Variations in willingness to pay extra by age groups support the intuitive observation that older consumer groups may be more conservative in general, unless innovations promise benefits in health, safety, or value for money. Younger consumers are more likely than older consumers to want, and be willing to pay for, convenience innovations.

Figure 7. Mean desirability scores (by age group)

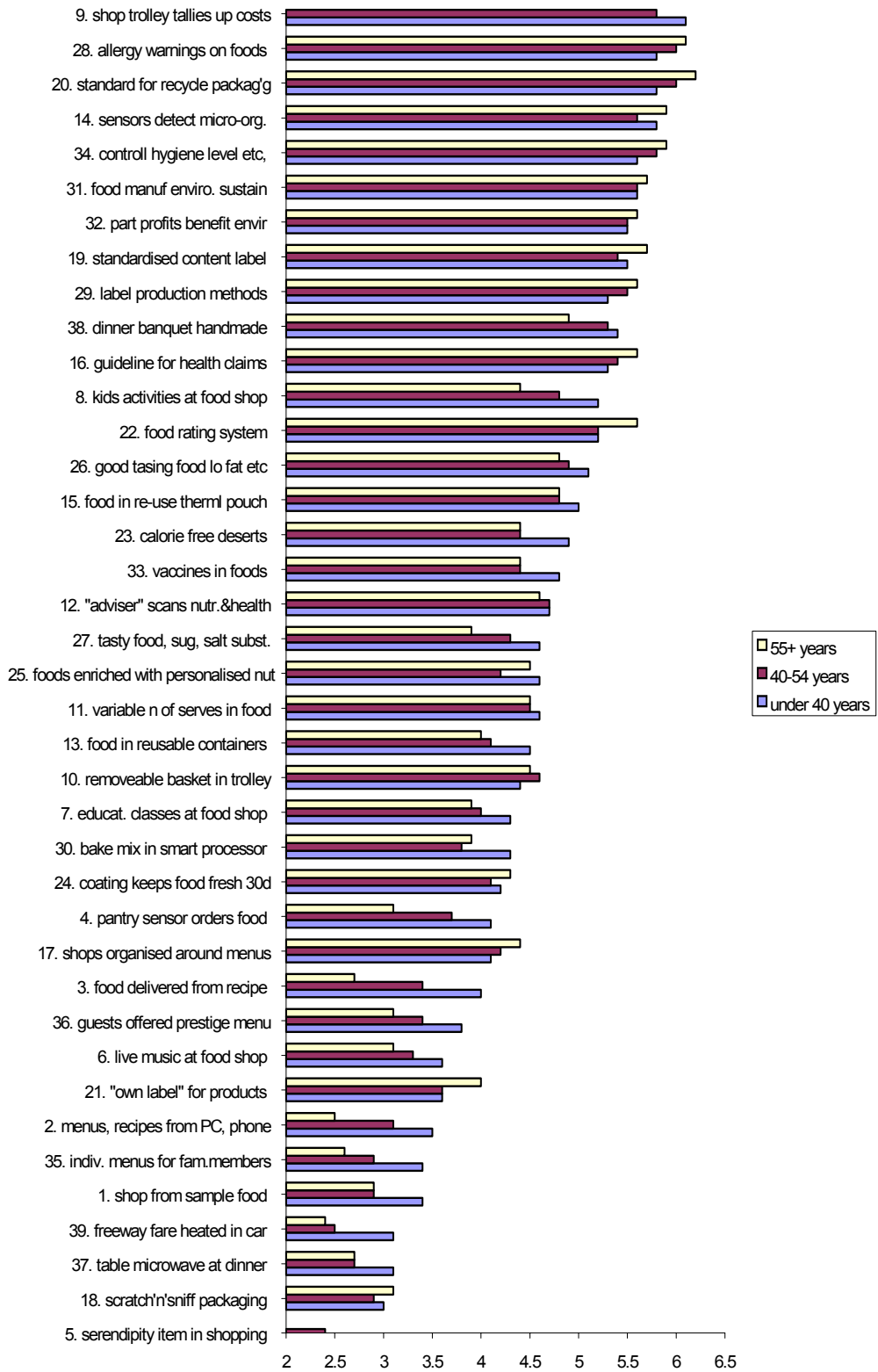


Figure 8. Percentage willing to pay extra (by age group)

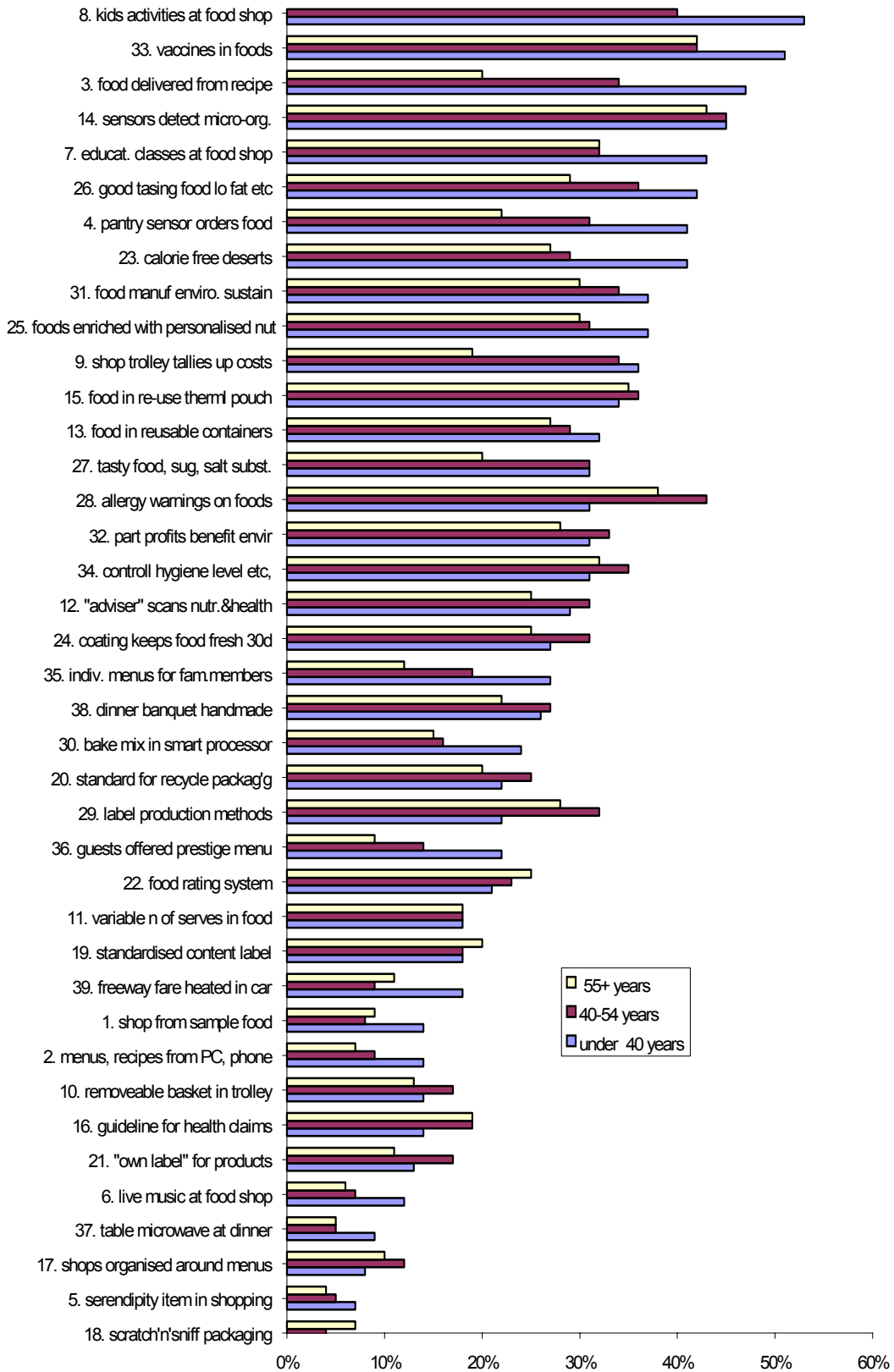
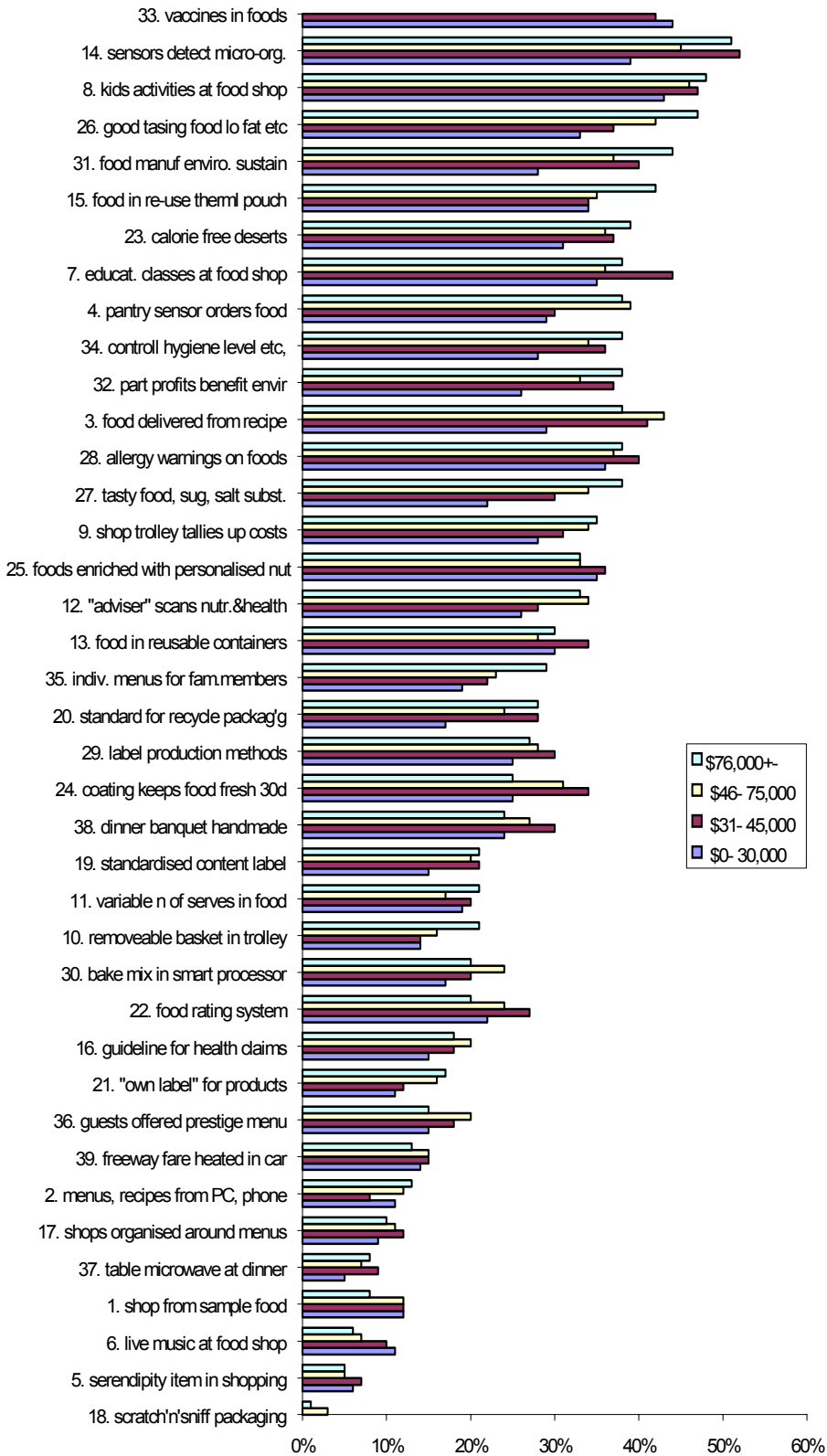


Figure 9. Willingness to pay more (by income groups)



### 3.3 What do ‘technotots’ say?

An exercise like Project Cassandra would provide insufficient insights if it failed to take into account the views of a consumer group whose exceptional upbringing and emerging economic power are bound to result in new consumption patterns. Young people under the age of 20 have grown up with working mothers, computers and video games, and the ready availability of convenience foods. The group which is younger still, under the age of 14, has been characterised variously as the ‘baby boomlet’ for their numbers and the prospect of their significant economic clout, and ‘techno-tots’ for their high levels of comfort with technology, especially computer technology (*FoodTechnology*, p 44).

To assess attitudes to innovation among young people, Project Cassandra sponsored a competition for readers of CSIRO’s science magazine for young people, *Helix*<sup>6</sup>. The competition required contestants to characterise what they believed would be the nature and contents of a shopping trolley in 2015. The quotation which opens this report comes from that competition. Entries demonstrate a relish in their authors for a technological future that older consumers do not show. Although attitudes will certainly change as these young people grow older and have their own families, it is quite possible that some reservations related to the desirability of ‘fresh’, ‘unprocessed’ foods may diminish as this group comes to dominate the market; it is very likely their comfort with technology will put them at ease with some innovations their older counterparts feared would lead to ‘laziness’.

Competition entrants independently identified innovations like virtual supermarkets, home delivery systems, pantry sensors and home food processors, genetically modified foods with health properties or customised food products, which were also distinguished by focus group participants. A selection of quotations follow which further demonstrate the creative insights of an emerging consumer group whose views on the future deserve attention:

*“Food will be delivered to the home in individual meal portions, pre-cooked for heating. Gas and electrical stoves will be kept for fun use when people want to ‘rough it’ like they did in the olden days (pre-2000).”*

Jordan, 12 years

*“We will probably shop [via] a ‘virtual supermarket’ on the [computer] screen and you’d be able to order the food by picking it off the shelf with the mouse. If you don’t like the ingredients, you can click on a little green card with the word ‘ingredients’ on it and you can add, change or delete any ingredients. Packaging would be bio-degradable and there’d be foods and drinks that had disease prevention drugs and drugs that help you think better.”*

Susannah

*“Some of the food in 2015 will be freeze-dried food and the rest will be in containers with chemical heaters built into them. These will be dispensed from vending machines. To make the dehydrated food into a meal, just add hot water. For the rest, the top of the package will be opened and the chemical heater started so the food heats up. The food will be genetically engineered to grow faster, produce a greater yield and resistance to disease. It will also be supplemented with vitamins and minerals.”*

Anthony

*“In 2015, [there will be] frost and drought resistant crops, high-yield pest-resistant grains,*

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<sup>6</sup> Readers of *Helix* are young people, typically between the ages of 10 and 17, who have some interest in science. Although not necessarily representative of the youth population, this group is likely to be comfortable with technology and to take an interest in future developments. The competition offered five sets of prizes (CD-ROM versions of Encyclopedia Britannica and freeze-dried ice-cream “pace food”) for the best suggestions about what a shopping trolley might comprise and contain in 2015.

*seedless fruits and vegies engineered to make their own preservatives, or with novel ripening methods that do not result in loss of flavour, seaweed/algae/plankton-based foods and food additives and greater variety of foods, especially in tropical and Australian native plants.*

*These properties will be achieved by the genetic engineering of plants and by back-crossing existing crops to their distant, wild ancestors to regain lost qualities. Shopping will be [via] Internet shopping or in convenient shopping centres which are wonderful and very enjoyable places to shop.”*

Shan

*“The food you buy will be pre-cooked and you can choose your own ingredients to suit yourself. If you’re an elderly, elderly food will be served. For instance, if you have a toothache, you can still have the same things, but the food will be softer or turned into liquid.”*

Raymond, 10 years.

And of course, some entrants came up with some innovations focus group participants completely overlooked, such as the following:

*In 2015, the Supersonic, Ultra-perceiving, Ever-ready Mind Ariel Recreating Kit Essential Tool is able to recreate the desired meal of the person ‘hooked up’. This is all possible thanks to a highly developed microchip processor which converts thought waves about food into solid, edible creations (with cutlery in most models). If by chance, the Supersonic, Ultra-perceiving, Ever-ready Mind Ariel Recreating Kit Essential Tool reads a food thought like “I wonder what it would be like to eat a slug with wings, it will create a slug with wings but these mistakes are easily removed.”*

Stephanie, 12 years.

## SECTION 4. TOWARD A FUTURE OF FOOD-RELATED INNOVATION

### 4.1 Setting priorities

This report contains a wide range of R&D opportunities which came out of Project Cassandra discussions; however, the list is by no means exclusive. Many others could be nominated. For example, and as indicated in the introduction, research areas where Australia is currently well-served may not appear among this list of opportunities, even though the future prosperity of the food industry may depend to some degree on their continuation. A number of considerations need to be reviewed when planning future investments. Consumer attitudes are only one of many inputs to strategic planning.

#### *4.1.1. Considerations in selecting innovations for investment*

Addressing the challenges of operating in a turbulent environment requires a business system to apply a balance of business strategies. Enhancing efficiency through more effective business (information) systems, intensive consumer research to increase the likelihood of commercial success for new products and services, continuous quality improvements and costs and waste minimisation are among the strategies being applied to these challenges in the food industry.

High rating innovations such as those in the final category seem suitable for serious consideration as part of a project prioritisation process. Consumer attitudes are the first stage in a multi-stage planning process. An excellent planning guide has been developed by Cooper et al (1998 pp 38-43), it advocates complementing consumer attitude research with additional assessments.

For example, technical R&D staff in companies considering innovations that appear to be desirable to consumer must assess those potential projects for:

- technical feasibility;
- development costs;
- projected time to market.

At the same time, marketing staff need to consider:

- the maturity of the target market;
- the competitive environment;
- the regulatory environment.

Strategic planners in the company need to consider

- Fit with corporate aims and strategies;
- Scope for ownership of intellectual property.

These considerations fall outside the scope of this report. It is worth mentioning however, that CSIRO's Food Processing Sector Advisory Committee has developed an overview of industry challenges and business responses, which suggests a strategic approach to managing some of the challenges and capturing some of the opportunities identified during the course of Project Cassandra activities. It appears in Appendix 4.

*Acknowledgements*

It is hoped that the information provided here will benefit Australia's food processing industry. CSIRO aims to assist industry by providing inputs to strategic planning as well as by providing the technical capabilities necessary to help industry realise their target innovations.

Above all, through exercises like Project Cassandra, CSIRO aims to ensure that the voice of the Australia public is brought into strategic planning for the future of food-related innovation.

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Ms Sally Record of CSIRO Health Sciences and Nutrition deserves special mention for having managed the enormous task of ensuring that over 23000 pages of data from consumer attitude surveys were rigorously distributed, processed and analysed.

*Judy Marcure  
December 1999*

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## **Appendix 1. Australian processed food industry overview**

### *1.1. The Australian Processed Food and Beverages Industry: characteristics*

The processed food sector comprises over 3,500 firms, ranging from small specialist food processors to large domestic and multinational food companies. Larger food firms employing 100 or more workers dominate the food industry. The industry is distributed throughout Australia, with about a quarter of food processing firms being located in New South Wales, with slightly fewer in Victoria. Queensland has 18 per cent of the industry, South Australia 12 per cent, Western Australia 10 per cent and Tasmania 4 per cent (DIST 1996).

According to the Australian Food Council, the Australian Processed Food industry:

- is the largest manufacturing sector in Australia;
- employs one in five of the manufacturing workforce;
- has an annual turnover in the order of A\$42 billion, of which two thirds is highly processed, packaged consumer products;
- exports around \$5 billion of highly processed consumer pack products, nearly half of total exports of processed food exports around \$11 billion in value;
- sources more than 90 per cent of its ingredients from an efficient Australian agricultural sector;
- together with agriculture, the agrifood industry is valued in the order of \$64 billion, accounting for 12 per cent of national GDP, 8 per cent of employment, and 23 per cent of the nation's exports.

The industry has a number of strengths, including:

- a reputation for food quality, hygiene and safety, and freedom from contaminants;
- an abundance of natural resources and a relatively benign climate that provides a readily accessible, generally cost-competitive, supply of raw commodities;
- leading edge technology, a highly focused and capable R&D network;
- a multi-cultural society whose demand for a diversity of food products equips the industry to meet the varied demands of export markets;
- geographical proximity to the most populous food markets of the world, particularly the Asia-Pacific (AFC 1998).

Although overall, the industry has demonstrated good levels of growth and profitability (e.g., the ten years to 1995-96 food company profits before tax increased by 118 per cent, compared with a rise of 102 per cent for total manufacturing), some sectors of the industry are more successful than others. Meat and Meat Processing constitute the largest industry sectors, accounting for 24 per cent of turnover. Other Food Manufacturing (including sugar, confectionery and seafood), and Dairy Products Manufacturing are the next largest sectors with 23 per cent and 16 per cent respectively (DIST 1996).

### *1.2. Transitions: adding value and targeting export markets*

Although the industry was handicapped for many years by a focus on the national market and on early stage processing (Centre for Technology and Social Change 1990), this is changing slowly. Recent studies have reported a consistent upward trend over the last decade in the proportion of firms engaged in high value-added production. According to estimates by the Australian Bureau of Statistics, value-added in the food and beverage industry reached \$12.7 billion in 1992-93, or 18.7 per cent of total manufacturing industry turnover. This is a 6.3 per cent increase on value-added in 1989-90. Industries which have recorded particularly strong increases in value-adding over the period 1989-90 and 1992-93 include flour and cereal foods (up 31.6%), dairy products (up 26.8%) and beverages and malt (up 11.2%) (reported in DIST 1996).

Asia has been an important export market for Australia's food products, both unprocessed and highly processed. Although Asian currency and market corrections have affected some sectors, since 1996, food exports to Asia have exceeded \$10 billion, to which highly processed foods contributed \$2.2 billion each year. This trend has coincided with an increased interest in Western foods in many Asian countries. During this period, simply or minimally processed foods, which is the main export category, declined somewhat.

Japan is Australia's largest export market—more than three times more valuable than the next largest and accounting for 35 per cent of processed food exports to Asia. Other important markets in order of importance are the Philippines; Malaysia; Hong Kong; Singapore; Taiwan; Thailand; Indonesia; Korea; and China (AFC, 1998).

Australia has performed strongly in early stage processed foods, especially fresh, chilled and frozen meats. The most important processed food exports include: dairy products (including milk, cream, cheese, butter and ice cream); pet food; chocolate and other confectionery; cereal products (including biscuits, breakfast cereals, pasta and bread pre-mixes); margarine; fruit juices; soups; sauces; and wine and other beverages.

### *1.3. Invention and innovation in the Australian food processing industry*

Despite its relatively good economic performance, the food processing industry is not among the most technologically innovative of the manufacturing industries. The food processing industry derives most of its competitive advantage from marketing activities and incremental improvements to products and processes, rather than to revolutionary technological change. Many food industry professionals believe that to attract consumers who are often conservative in their choice of food products, packaging, presentation, and increasingly, provision of information about ingredients and processing is critical to the success of a new product. Sandra Peterson, Vice President for R&D of Nabisco Inc, a US\$9 billion packaged goods company, has suggested that by far the greatest proportion of new product development 'spend' for food processing companies is not in R&D but in planning and implementing the launch of new products—core marketing functions (Peterson 1998, pp 16-20). Marketing managers in innovative food companies quite frequently play a major part in the decision to undertake R&D.

R&D activity in the Australian food processing sector is low by manufacturing industry standards. Although the figures are now somewhat dated, in 1986-87, expenditure on R&D was 0.7 percent of value compared to 1.5 percent for the manufacturing industry as a whole. Reasons for this were examined in a 1990 report 'Innovation and Competitiveness in the Australian Processed Food Industry' (CTASC 1990). This study examined the area of technology and industry development in detail, concluding that the low level of R&D activity was caused by a number of factors, most of which still pertain, including the observations that:

- The majority of large food firms are relatively conservative, market driven and short term in approach.
- Many of Australia's 3000 food processing establishments are small and lack resources for R&D;
- Foreign owned or controlled firms are likely to do their R&D overseas;
- The industry focuses on the domestic market (and mature products);
- Intense competition leading to unwillingness to pool resources for pre-competitive R&D: and
- Inadequate linkages exist between the industry and public sector R&D organisations.

These conclusions were supported by other studies, including a report of the Prime Minister's Science Council, "Food Processing" (1991) and a study undertaken for RIRDC into R&D opportunities for the food industry (1992). In addition to the factors distinguished in the CTASC report, the RIRDC study concluded that the food industry had weaknesses in that there was: (a) some evidence of a tendency to focus on impediments rather than opportunities;

- (b) uneven commitment to quality and best practice;
- (c) lack of long term strategies;
- (d) lack of emphasis on quality, brand image and advertising.

It also concluded that some impediments cited by industry were perceived rather than real; these included (a) Australian dollar fluctuations, (b) business regulations, (c) lack of investment capital and costs of plant and equipment, (d) waterfront management. (RIRDC 1994). Progress has certainly been made in addressing some of these weaknesses, although published evidence on the industry as a whole has not been easy to find.

#### *2.4. Innovation in the food industry internationally*

Although the consumer market focus of this industry may affect receptivity to and take-up of R&D outcomes in Australia, they may also reflect the character of the industry more broadly. There is, for example, considerable evidence to suggest that the food processing industry has demonstrated relatively low levels of technological innovation in other countries as well. In the USA, for example, R&D investment in the food industries is low, only 1.3% of total private sector R&D in 1991. Moreover, the R&D undertaken is highly concentrated in a few large companies, "...with only 131 companies maintaining separate R&D labs.... Over 83% of R&D funds in industry were expended by the top 20 food R&D programs, and...80% of all R&D was accounted for by those food processors with 10,000 or more employees in 1991." The type of R&D undertaken in US food companies was very consistent: "over 95% of industrially sponsored R&D of the applied or developmental types, geared toward product development, processing engineering and quality control" (Conner and Schiek, 1997, pp. 370-371).

US food companies often outsource R&D, and employment of scientists and engineers in food companies is low in comparison with other manufacturing industries. The number of patents granted in the food industry is also quite low relative to other industries. About half of all innovations applied in the food industry came from a wide array of technologically linked industries, e.g. machinery, paper, plastics and many others. Technological innovation from the food industry may arise from platform technologies developed in disciplines such as information technology, materials, manufacturing and logistics management, with spinoff applications being applied to the food industry. About 90% of patents and most innovations affecting food industry efficiency originate from a wide variety of sources outside the food processing industries. Likewise US studies have shown that awards for innovation appear to go to manufacturers other than food processors, "with increased numbers of awards going to instrument, control, and packaging manufacturers" in recent years (Connor and Schiek, p 380), many of these being small firms. Lack of time made it impossible to look to models in other countries such as the UK, which has a good reputation for innovation in food science.

While levels of technological innovation may be low relative to some other industries, levels of product innovation are very high in the food industry. The food industry responds via new product innovation to many new consumer trends in the search for 'added value' per kg of food products sold. An increasing proportion of this innovation comes in the form of medical claims for foods (e.g. oat bran and cholesterol reduction). As figures for the European Union illustrate, new food/drink product innovation has accelerated, growing from 6107 new product launches in 1986 to 16863 in 1995 (OECD p 94). As many product innovations are easily replicated, the processed food industry places a premium on confidentiality of development processes and secure development facilities. This tendency may make it difficult for food companies to cooperate on a strategic national food industry vision.

Such attributes have implications for where innovative food firms should look for new technologies and the sorts of partners R&D organisations may find are interested in commercialising technologies developed in the research laboratory.

## **Appendix 2. Focus group participants and advisors**

### **Focus Group 1. Young Scientist's Scoping Exercise**

Ms Estelle Lifran, Food Science Australia  
Mr Edward Jansson, Food Science Australia  
Ms Sonya Huang, Food Science Australia  
Ms Christina Jakobsen, Food Science Australia  
Ms Anne Ollivier, Food Science Australia  
Ms Fay Helidoniotis, Food Science Australia  
Ms Leila Alem, Maths & Information Sciences  
Ms Sandrine Balbo, Maths & Information Sciences  
Mr David Lovell, Maths & Information Sciences  
Mr Tim Downie, Maths & Information Sciences  
Mr Alain Mir, Molecular Science  
Ms Joanne Cuomo, Molecular Science  
Mr Yong Tie, Manufacturing Science & Technology

### **Focus Group 2. Consumer Needs Identification**

Dr Gordon Burch, ANZFA  
Dr Brian Johnston, Supermarket Into Asia Ltd  
Ms Barbara Santich, Food Historian  
Mrs Elisabeth Dangar, Danger Research Group  
Mr John Meyers, Meyers Strategy Group Pty Ltd  
Ms Grazyna Hamilton, Australian Bureau of Statistics  
Dr Michael Eyles, Food Science Australia  
Dr Richard Head, CSIRO Human Nutrition  
Dr Katrine Baghurst, CSIRO Human Nutrition  
Mr Roger King, CSIRO Human Nutrition

### **Focus Group 3. Product Design**

Dr Geoffrey Annison, Australian Food Council  
Dr Mareeta Grundy, Heart Foundation  
Mr Jeff Dalson, Woolworths  
Dr Robert Young, Unifoods  
Mr Frank Lee, Goodman Fielder  
Mr Alan Randall, Uncle Toby's  
Dr Bryan Cox, Clever Country Research  
Mr Brad Forrest, Goodman Fielder  
Mr Nigel Barrett, Goodman Fielder  
Mr Graham Gourlay, CSIRO Agribusiness

### **Focus Group 4. Transport, Storage & Distribution**

Mr Andrew Pik, CSIRO Canberra  
Mr David Symington, CSIRO Melbourne  
Mr Ingilby Dickson, Goodman Fielder  
Mr Roy Gaynor, Deepsea Chartering (Aust) P/L  
Mr John Lagerlow, Ponderosa Meat Exports  
Mr Isaac Scheinberg, Centapak Pty Ltd  
Mr Peter Archer, Sara Lee Bakery  
Mr Greg Ryan, Moraitis Fresh  
Ms Ruth Moyses, Qantas Flight Catering

**Focus Group 5. Retail & Marketing Support**

Ms Wendy Morgan, Goodman Fielder  
Dr Ron Bowrey, Meadow Lea  
Mr Bill, Hazard, Goodman Fielder  
Dr Bruce Perkin, Masterfoods  
Mr Michael Depalo, Arnotts Biscuits  
Mr Michael Liddell, Cerebos

**Focus Group 6. Production Optimisation**

Mr Martin Houben, National Foods  
Mr Peter Gallagher, Don Smallgoods  
Mr Ian Longson, Agricultural Western Australia  
Mr Michael Phillip, Murray Goulburn  
Mr Simon Siow, Kraft Foods Ltd  
Ms Jane Evans, CRC for Industrial Plant  
Mr Robin White, Weston Bioproducts  
Mr Barry Neubecker, Neubecker & Associates  
Mr Maiyuran Konanayakam, HJ Heinz  
Mr Ian Bryce, Ardmona Foods Ltd

**Expert Interviews: US Food Industry Strategic Planning & Corp Structure**

Dr Todd Abraham, Pillsbury – Strategic Tech Devt  
Mr William Burke, Battelle – Consumer Products  
Dr Stephen Millett, Battelle – Breakthrough Leader  
Mr Eric Majewski, Battelle – Business Intelligence Analyst  
Mr Brent Badger, Battelle – Breakthrough Associate  
Ms Sandra Peterson, Nabisco – Exec VP R&D  
Ms Hollis Ashman, Nabisco – Strategic Business Devt  
Mr Michael Harms, Nabisco – Strategic Business Devt  
Mr Frank Freguletti, Nabisco – New Technologies  
Ms Faye Egan, Nabisco – Consumer Behaviour  
Ms Cathy Walchak, Nabisco – Consumer Behaviour  
Dr Enai Razvi, Frost & Sullivan - Biotechnology  
Dr Ganesh Kishore, Monsanto – Nutrition & Consumer

**Helix magazine ‘Shopping trolley 2015’ competition entrants**

Jordan Bagliss-McCulloch, aged 12  
Susannah Lai  
Stephanie Hing, aged 12  
Marion Muller, aged 11  
Ashleigh Bennell, aged 11  
Anthony Straker  
Shan Kornfeld  
Catherine Worsnop  
Andrew Short, aged 5  
Marcel Gordon, aged 15  
Michael Vincent, aged 12  
Martin Towell  
David Bremers, aged 9  
Raymond, aged 10  
Rita Krishna  
Frayne Gomez  
Geraldine Conway  
Freya Ashman, aged 11  
Anthony Read, aged 10

Ben Lancaster  
James Folley, aged 13  
Catherine Ellis  
Kresten Nielsen, aged 13  
Laura Shannon, aged 13  
Samantha Myers, aged 13

## Appendix 3. Cconsumer attitude research results

### Full text of innovation descriptions and tables of research results

#### 3.1 Full text of questions asked

1. You drive through a display where ‘sample’ food products may be viewed and you make a selection, which is boxed for you while you get petrol and have your car washed .....
- (a) How desirable is this? ..... Highly  
undesirable Highly  
1 2 3 4 5 6 7  
desirable
- (Please circle **ONE** number)
- (b) Would you pay extra for this? ..... **YES / NO**
  - (c) Your comments:
2. You can choose to receive menu suggestions and recipes via your PC/TV in the morning or via your car phone as you drive home in the evening .....
  3. When you have approved the menu, you can have the ingredients or completed meal delivered to your home .....
  4. A pantry ‘sensor’ in your home ensures your preferred products are automatically delivered to your home just as you run out .....
  5. You can register a ‘serendipity’ preference in your shopping orders, so some of the foods delivered to you will be new to you or unexpected .....
  6. Your food shopping outlets offer performances of your favourite live music (opera, classical, jazz, popular, etc.) or other artistic performances you enjoy .....
  7. Your food shopping outlets offer programs of educational classes you may select from and join, including food handling, cooking classes, how foods affect your moods, nutritional foods, the culture and history of foods .....
  8. Your food shopping outlets offer safe entertainment facilities and activities for your children.....
  9. Your shopping trolley contains an in-built scanner which keeps a running tally of costs. You can check the subtotal at any time. When you get to the checkout stand, you can choose an ‘express lane’ and swipe your card so the money is transferred from your account without your having to wait in a queue.....
  - 10 Your shopping trolley also has a lightweight, strong, lift-out returnable shopping
  11. You can choose in advance the portion size of all your food products; e.g., single, couple, family, (any number of) guests to dinner. .
  12. Your personalised, portable shopping ‘advisor’ scans information digitally encoded on the packaging label, and recommends food products with nutritional or other properties which suit your personal health profile .....
  13. You may select food products that come packaged in attractive re-usable or re-cyclable dishes you can heat and put directly on the table .....
  14. Nanosensors (tiny organic sensors) integrated into the packaging detect the presence of harmful micro-organisms. If for any reason, the product is not suitable for consumption, the packaging will change to a distinctive colour .....
  15. Prepared meals, chilled and other food products which may spoil are packaged in a special thermal pouch which is re-usable or recyclable .....
  16. The Global Food Regulatory Agency has issued clear guidelines regarding health claims food manufacturers may make to consumers about the health benefits of their products .....
  17. Food outlets organise shopping displays and aisles around dinner menus, so all the ingredients, even fresh produce, that you need for dinner are in the same place in the store.....
  18. A new range of baking mixes has been launched with a scratch ‘n sniff patch, so you can tell exactly how the fresh bread or cake will smell in the oven .....

19. The Global Food Regulatory Agency has just issued packaging standards which make it easy for consumers to compare contents and value for money of similar products .....
20. Manufacturers of recycled packaging must demonstrate that they have met strict new guidelines regarding the safety of their materials and non-migration of contaminants into food products .....
21. You can register you 'own label' of foods products. 'Your label' features a profile of your personal preferences for attributes of food products (e.g., kilojoule content, cholesterol level, even countries or regions of origin which you find incompatible with your ethical beliefs) .....
22. The Global Food Regulatory Agency has developed a rating system which must be printed on all food product labels. It rates major food brands on safety, quality, freshness, taste and value for money in the product category .....
23. A new range of dessert substitutes is available, which tastes exactly like your favourite mud cake, crème caramel, or mousse, but has no calories.....
24. A new range of fruit salads and deli meats and cheeses is available. The range has a special edible coating which has no taste in itself but keeps cut products fresh, with no discolouring, taste or texture change, for thirty days .....
25. You can choose from a range of products with the same taste as original foods but enriched according to your dietary needs with fibre, proteins, vitamins, minerals and other supplements.....
26. You can choose from a range of products with the same taste as original foods but reduced in fat, sugar, salt or alcohol .....
27. You can choose from a range of products with the same taste as original foods but which have fat, sucrose or sodium replaced by organic substitutes .....
28. You can choose from a range of products which have clear warnings to people with food allergies, including warnings about all ingredients in the products .....
29. All the packaging on food products contains information about how they were produced. You can immediately tell whether the product was developed using biotechnology, organic or traditional methods of pest control, produced via intensive farming methods, and by whom and where the product was produced.....
30. A new range of pasta and baking 'mixes' have all the ingredients necessary for home processing in a smart home processor that makes any flavour or shape you desire .....
31. Following a rigorous audit by the Global Food Regulatory Agency, a new manufacturer is able to guarantee that all the products developed under the brand will be produced with environmentally non-damaging and sustainable methods.....
32. A new manufacturer promises that a considerable proportion of the company's profits will be used to invest in and provide access to improved global environmental technologies .....
33. Advances in biotechnology have made it possible to incorporate vaccines to most infectious diseases in plants. You can see to it that your family members receive their vaccines without having injections—in a single palatable food product .....
34. One new manufacturer guarantees that all the products they produce are subjected to a rigorous detection system which identifies the source of all raw ingredients in products, rejecting any supplier who does not meet high standards regarding hygiene, safety and residue levels .....
35. The members of your family select from menus of their favourite meals, which arrive cooked but chilled in the morning. Each person chooses his or her meal for heating and eating whenever he or she wishes .....
36. You are invited to dinner with friends. They offer you a menu, as extensive as that of any prestige hotel, of prepared meals from which you can choose .....
37. You heat your meal choice together with your friends on a tabletop microwave, fondu-style.....
38. You are invited to dinner with friends. They put on a banquet of several courses. Everything, from the crisps, pates, and marinated olives before dinner to pasta and bread during, and the cake and ice cream at the end, has been hand-made by your friends .....

39. A new range of 'freeway fare' foods is released which is specially designed for eating convenience while commuting. If you wish, you can warm the food in your glove compartment

### 3.2. Respondents by gender, age and income

Men	Women	Men	Women
404	605	39%	59%

	Men	Women
<b>AGE (years)</b>		
TOTAL	100%	100%
under 40 years	40%	44%
40-54 years	29%	30%
55+ years	30%	25%
<b>Income group (\$)</b>		
TOTAL	100%	100%
0-30,000	29%	35%
31-45,000	22%	18%
46-75,000	27%	25%
76,000+	11%	11%

### 3.3. Percentage of people willing to pay extra: (by gender)

	TOTAL	Men	Women
33. vaccines in foods	45%	48%	45%
8. kids activities at food shop	44%	41%	47%
14. sensors detect micro-org.	44%	47%	43%
7. educat. classes at food shop	36%	32%	41%
26. good tasting food lo fat etc	36%	34%	39%
28. allergy warnings on foods	36%	34%	38%
3. food delivered from recipe	35%	29%	40%
15. food in re-use therml pouch	34%	31%	37%
31. food manuf enviro. sustain	34%	35%	34%
23. calorie free deserts	33%	27%	38%
25. foods enriched with personalised nut	33%	33%	34%
4. pantry sensor orders food	32%	31%	34%
34. controll hygiene level etc,	32%	35%	31%
9. shop trolley tallies up costs	30%	28%	33%
32. part profits benefit envir	30%	33%	30%
13. food in reusable containers	29%	26%	31%
12. "adviser" scans nutr.&health	28%	29%	28%
24. coating keeps food fresh 30d	28%	30%	27%
27. tasty food, sug, salt subst.	28%	25%	30%
29. label production methods	26%	26%	27%
38. dinner banquet handmade	25%	25%	26%
22. food rating system	23%	27%	20%
20. standard for recycle packag'g	22%	26%	20%
35. indiv. menus for fam.members	21%	19%	23%
30. bake mix in smart processor	19%	20%	19%
11. variable n of serves in food	18%	17%	19%
19. standardised content label	18%	24%	15%
16. guideline for health claims	17%	20%	15%
36. guests offered prestige menu	16%	16%	17%
10. removeable basket in trolley	15%	16%	15%
39. freeway fare heated in car	14%	15%	13%
21. "own label" for products	13%	14%	13%
1. shop from sample food	11%	8%	13%
2. menus, recipes from PC, phone	10%	9%	11%
17. shops organised around menus	10%	12%	8%
6. live music at food shop	9%	10%	8%
37. table microwave at dinner	6%	6%	7%
5. serendipity item in shopping	5%	5%	6%
18. scratch'n'sniff packaging	4%	6%	3%

### 3.4. Percentage of people willing to pay extra: (by age group)

	<b>under 40 years</b>	<b>40-54 years</b>	<b>55+ years</b>
8. kids activities at food shop	53%	40%	36%
33. vaccines in foods	51%	42%	42%
3. food delivered from recipe	47%	34%	20%
14. sensors detect micro-org.	45%	45%	43%
7. educat. classes at food shop	43%	32%	32%
26. good tasting food lo fat etc	42%	36%	29%
4. pantry sensor orders food	41%	31%	22%
23. calorie free deserts	41%	29%	27%
25. foods enriched with personalised nut	37%	31%	30%
31. food manuf enviro. sustain	37%	34%	30%
9. shop trolley tallies up costs	36%	34%	19%
15. food in re-use therml pouch	34%	36%	35%
13. food in reusable containers	32%	29%	27%
27. tasty food, sug, salt subst.	31%	31%	20%
28. allergy warnings on foods	31%	43%	38%
32. part profits benefit envir	31%	33%	28%
34. controll hygiene level etc,	31%	35%	32%
12. "adviser" scans nutr.&health	29%	31%	25%
24. coating keeps food fresh 30d	27%	31%	25%
35. indiv. menus for fam.members	27%	19%	12%
38. dinner banquet handmade	26%	27%	22%
30. bake mix in smart processor	24%	16%	15%
20. standard for recycle packag'g	22%	25%	20%
29. label production methods	22%	32%	28%
36. guests offered prestige menu	22%	14%	9%
22. food rating system	21%	23%	25%
11. variable n of serves in food	18%	18%	18%
19. standardised content label	18%	18%	20%
39. freeway fare heated in car	18%	9%	11%
1. shop from sample food	14%	8%	9%
2. menus, recipes from PC, phone	14%	9%	7%
10. removeable basket in trolley	14%	17%	13%
16. guideline for health claims	14%	19%	19%
21. "own label" for products	13%	17%	11%
6. live music at food shop	12%	7%	6%
37. table microwave at dinner	9%	5%	5%
17. shops organised around menus	8%	12%	10%
5. serendipity item in shopping	7%	5%	4%
18. scratch'n'sniff packaging	3%	4%	7%

**3.5. Mean desirability scores (by gender):**

	<b>TOTAL</b>	<b>Men</b>	<b>Women</b>
20. standard for recycle packag'g	6.0	6.0	5.9
28. allergy warnings on foods	5.9	5.8	6.0
9. shop trolley tallies up costs	5.8	5.7	5.9
14. sensors detect micro-org.	5.8	5.7	5.8
34. controll hygiene level etc,	5.7	5.6	5.8
31. food manuf enviro. sustain	5.6	5.6	5.7
19. standardised content label	5.5	5.7	5.4
29. label production methods	5.5	5.5	5.5
32. part profits benefit envir	5.5	5.5	5.6
16. guideline for health claims	5.4	5.5	5.4
22. food rating system	5.3	5.4	5.3
38. dinner banquet handmade	5.2	5.0	5.4
26. good tasing food lo fat etc	5.0	4.8	5.1
8. kids activities at food shop	4.9	4.9	4.9
15. food in re-use therml pouch	4.9	4.7	5.0
12. "adviser" scans nutr.&health	4.7	4.6	4.7
23. calorie free deserts	4.6	4.3	4.9
33. vaccines in foods	4.6	4.7	4.5
10. removeable basket in trolley	4.5	4.5	4.5
11. variable n of serves in food	4.5	4.3	4.7
25. foods enriched with personalised nut	4.5	4.4	4.5
27. tasty food, sug, salt subst.	4.3	4.2	4.4
13. food in reusable containers	4.2	4.3	4.2
17. shops organised around menus	4.2	4.2	4.2
24. coating keeps food fresh 30d	4.2	4.4	4.1
7. educat. classes at food shop	4.1	4.0	4.2
30. bake mix in smart processor	4.0	4.2	3.9
4. pantry sensor orders food	3.7	3.7	3.7
21. "own label" for products	3.7	3.8	3.7
3. food delivered from recipe	3.5	3.4	3.5
36. guests offered prestige menu	3.5	3.7	3.4
6. live music at food shop	3.3	3.5	3.3
1. shop from sample food	3.1	3.0	3.2
2. menus, recipes from PC, phone	3.1	3.0	3.2
35. indiv. menus for fam.members	3.1	3.1	3.0
18. scratch'n'sniff packaging	3.0	3.2	2.9
37. table microwave at dinner	2.9	2.9	2.9
39. freeway fare heated in car	2.8	2.9	2.7
5. serendipity item in shopping	2.4	2.3	2.5

**3.6. Mean desirability scores (by age group):**

	under 40 years	40-54 years	55+ years
9. shop trolley tallies up costs	6.1	5.8	5.3
28. allergy warnings on foods	5.8	6.0	6.1
20. standard for recycle packag'g	5.8	6.0	6.2
14. sensors detect micro-org.	5.8	5.6	5.9
34. controll hygiene level etc,	5.6	5.8	5.9
31. food manuf enviro. sustain	5.6	5.6	5.7
32. part profits benefit envir	5.5	5.5	5.6
19. standardised content label	5.5	5.4	5.7
38. dinner banquet handmade	5.4	5.3	4.9
29. label production methods	5.3	5.5	5.6
16. guideline for health claims	5.3	5.4	5.6
8. kids activities at food shop	5.2	4.8	4.4
22. food rating system	5.2	5.2	5.6
26. good tasing food lo fat etc	5.1	4.9	4.8
15. food in re-use therml pouch	5.0	4.8	4.8
23. calorie free deserts	4.9	4.4	4.4
33. vaccines in foods	4.8	4.4	4.4
12. "adviser" scans nutr.&health	4.7	4.7	4.6
27. tasty food, sug, salt subst.	4.6	4.3	3.9
25. foods enriched with personalised nut	4.6	4.2	4.5
11. variable n of serves in food	4.6	4.5	4.5
13. food in reusable containers	4.5	4.1	4.0
10. removeable basket in trolley	4.4	4.6	4.5
7. educat. classes at food shop	4.3	4.0	3.9
30. bake mix in smart processor	4.3	3.8	3.9
24. coating keeps food fresh 30d	4.2	4.1	4.3
4. pantry sensor orders food	4.1	3.7	3.1
17. shops organised around menus	4.1	4.2	4.4
3. food delivered from recipe	4.0	3.4	2.7
36. guests offered prestige menu	3.8	3.4	3.1
6. live music at food shop	3.6	3.3	3.1
21. "own label" for products	3.6	3.6	4.0
2. menus, recipes from PC, phone	3.5	3.1	2.5
35. indiv. menus for fam.members	3.4	2.9	2.6
1. shop from sample food	3.4	2.9	2.9
39. freeway fare heated in car	3.1	2.5	2.4
37. table microwave at dinner	3.1	2.7	2.7
18. scratch'n'sniff packaging	3.0	2.9	3.1
5. serendipity item in shopping	2.7	2.4	2.0

## Appendix 4. Major challenges to the food industry and strategic business responses

Table 1. R&D opportunities by strategic issues and business strategies. This table presents an overview of industry challenges and approximate food industry business responses as distinguished by the Sector Advisory Committee (8 December 1998):

Major challenges to the food industry →	GLOBALISATION	CONSUMERISM	TECHNOLOGY DOMINATION/ TECHNOLOGY TRANSFER	URBANISATION	CHANGING DEMOGRAPHICS	REGULATION AND GOVERNMENT POLICY
Potential business responses to challenges ↓	<b>Enhanced industry efficiency</b> (as response to multinational ownership of the industry)	<b>Sustainable production</b> (as response to consumer interest in environmental issues)	<b>Clear IP ownership policies</b> (as response to platform technology monopolies)	<b>Improved supply chain management</b> (as response to national trend to urban migrancy)	<b>Food products for vitality, longevity</b> (as response to aging populations)	<b>Contribute to harmonisation of standards</b> (as response to complex regulatory environment)
	<b>Regulation and legislation monitoring</b> (as response to global standards)	<b>Improved consumer research and education</b> (in response to technology backlash)	<b>Improved speed to market</b> (as response to shortened product life cycles)	<b>Better understanding of changing purchasing habits</b> (as response to international trend to urban migrancy)	<b>Product and packaging adaptations for smaller portions</b> (as response to changing household composition)	<b>Substantiation</b> (as response to regulation of health claims)
	<b>Enhanced export orientation</b> (as response to globalisation of markets)	<b>Improved food safety standards, packaging, processes</b> , (in response to food safety concerns)	<b>Improved communication and education</b> (as response to consumer technology backlash, e.g. genetic engineering)	<b>Better understanding of cultural drivers of food choice</b> (as response to international trend to urban migrancy)	<b>Convenience foods, meal solutions</b> (as response to time-poor consumers)	<b>Education and substantiations</b> (as response to regulation of gene technology)
	<b>Enhanced product safety</b> (as response to international safety standards)	<b>Global communication</b> (as response to Internet-based business competition)	<b>Multidisciplinary R&amp;D planning, strategic alliances</b> (as response to advances in technologies in other business areas)	<b>Better understanding of changing nutritional patterns</b> (as response to international trend to urban migrancy)	<b>Food education and information</b> (as response to declining food preparation skills)	<b>Industry self-regulation</b> (as response to gov't environmental initiatives)
	<b>Food product and attribute substantiation processes</b> (as response to health claim regulations)	<b>Increased customisation</b> (as response to increased demand for choice)	<b>Exploit new tools for product development</b> (as response to emerging gene technologies)		<b>Nutraceutical/functional foods</b> (as response to increased interest in health)	
	<b>Strategic alliances</b> (as response to global R&D teams and projects)	<b>Consumer/customer distinction</b> (as response to demand for customisation)			<b>Improved quality control measures</b> (as response to input resource pressures)	

	<b>Realignment of stakeholders</b> (as response to international exploitation of R&D outcomes)	<b>Improved understanding of links between diet and health</b> (as response to interest in health management)				
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