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Shanghai and Beijing milk consumer consumption behaviour and product preferences: A Latent Class Analysis of New Zealand UHT milk

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Research Report 374
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Key Points

- The Agribusiness and Economics Research Unit (AERU) at Lincoln University with the support of research partners under the *Unlocking Export Prosperity from the Agri-food Values of Aotearoa New Zealand* research programme has estimated willingness-to-pay (WTP) values for selected credence attributes of UHT milk products by Beijing and Shanghai (China) consumers, with a focus on identifying preferences for attributes considered *distinctively New Zealand.*
- Preferences for many of the credence attributes considered here are not readily observable from market prices and so the economic non-market valuation method of Discrete Choice Experiments was used. This involved an online survey of Beijing and Shanghai residents in August 2021.
- As well as consumer willingness-to-pay values, this survey reports findings on:
    - Purchase and consumption frequency
    - Country-of-origin purchase frequency and quality ranking
    - Reasons for buying NZ UHT milk
    - Ideal UHT milk characteristics
    - Factors associated with high food safety UHT milk
    - Factors associated with socially responsible UHT milk production
    - Factors associated with high quality UHT milk
    - Factors associated with high nutritional content UHT milk
    - Attitudes towards environment, health, price, and trust
    - Use of digital media and smart technologies for milk shopping
- Beijing consumers exhibit moderately higher overall purchase and consumption frequency of UHT milk than Shanghai consumers. China was the main source of UHT milk being purchased by both Beijing and Shanghai consumers, followed by New Zealand, then the Netherlands. NZ purchase frequency was moderately higher in Shanghai, with 20 per cent of Beijing consumers having never purchased UHT milk from New Zealand.
- New Zealand was ranked second highest of the countries included for quality of UHT milk (behind China) by both Beijing and Shanghai consumers. With 51 per cent of Beijing and 55 per cent of Shanghai consumers ranking New Zealand in the top three out of a set of thirteen countries selling UHT milk in China.
- High food safety, high nutritional value, high quality, and high environmental quality on farm were the main reasons given for purchasing NZ UHT milk by both cities consumers.
- Consumers stated that the most important factor associated with high quality milk was food safety, with 52 per cent of Beijing and 51 per cent of Shanghai consumers stating this was very important. The main factors important for food safety included freshness, government certification, reduced use of agrichemicals, and high on-farm environmental quality.
- Over a third of Shanghai consumers, and almost half of Beijing consumers use QR codes for purchasing and information searching related to UHT milk. Over half of both cities consumers use mobile apps to purchase UHT. 76 per cent of Beijing consumers and 65 per cent of Shanghai consumers bought UHT milk online with an average of 24 per cent of expenditure online by Beijing consumers and 23 per cent by Shanghai consumers. The majority of UHT expenditure is at supermarkets at 35 per cent for each city, and supermarkets are also the most used online retailer.

- The survey included a Discrete Choice Experiment to assess consumers' willingness-to-pay for credence attributes associated with UHT milk production. Our objective was to identify which UHT milk attributes drive product choices, by how much, and by who. We do this using a statistical method called Latent Class Modelling that identifies consumer segments in the data based on which product offerings consumers preferred.
- The Discrete Choice Experiment identified three distinct groupings of UHT milk consumers in each city, and we describe profiles for these groups using the questions above. While differences between segments are found, those having strong preferences for a 100% Pasture Raised production claim have in common that they are more likely to have higher incomes, rank NZ UHT milk quality high, and have higher usual spend on UHT milk.
- Beijing consumers overall have stronger preferences and higher willingness-to-pay compared to Shanghai consumers for the product attributes considered.
- Both cities' consumers have similar patterns of preference overall, they value similar attributes, and their ranking of willingness-to-pay across attributes is generally consistent.
- Pasture raised and Organic production attributes stand out as offering the greatest value to both Beijing and Shanghai consumers overall.
- Socially Responsible production attributes rank relatively lowly overall. A 100% Grass-fed claim attracts only a small premium for Shanghai consumers, and none for those from Beijing.
- Water Quality Protection is valued significantly by both cities' consumers; however, Biodiversity Enhancement and Carbon Neutral production attributes did not attract significant willingness-to-pay in this survey.

	Average willingness-to-pay per 250ml carton of UHT Milk					
UHT Milk Attribute Claim	Beijing			Shanghai		
	Segment 1 47% of Consumers	Segment 2 5% of Consumers	Segment 3 48% of Consumers	Segment 1 57% of Consumers	Segment 2 38% of Consumers	Segment 3 5% of Consumers
Enhanced Animal Welfare	13%		66%	15%	24%	63%
Organic Production	20%		103%	24%	33%	81%
Increased Protein	46%					53%
Increase Calcium	19%		51%	19%	11%	
100% Pasture Raised	24%		119%		84%	
Feedlot Raised	17%		48%		29%	88%
100% Grass Fed						82%
Grain Fed	8%		75%	5%	21%	45%
Care for Workers	21%	15%				49%
Contribute to Local Communities	28%	16%		20%		
Support for Farmers	19%			7%	17%	
Water Quality Protection	8%		46%	12%		85%

Average marginal WTP / 250ml carton of UHT Milk

Chapter 1
Introduction

This study is part of a research programme entitled *Unlocking Export Prosperity from the Agri-food Values of Aotearoa New Zealand*. It is funded by the Ministry of Business, Innovation and Employment (MBIE) Endeavour Fund for science research programmes. Information on this research programme including reports of other surveys are available from the AERU website https://www.aeru.co.nz/projects/uep.

The research aims to provide new knowledge on how local enterprises can achieve higher returns by ensuring global consumers understand the distinctive qualities of the physical, credence and cultural attributes of agri-food products that are "Made in New Zealand".

Agricultural exports are an important contributor to the New Zealand (NZ) economy. While NZ historically relied on key markets such as the United Kingdom for export trade, NZ has more recently significantly expanded its export markets and China has become established as an important dairy product destination. It is critically important for NZ exporters to understand export markets and the different cultures and preferences of those consumers to safeguard market access, and for realising potential premiums.

This report describes the application of a survey of Beijing and Shanghai UHT milk consumers that is designed to examine consumption behaviour and consumer Willingness-to-Pay (WTP) for credence attributes. While *search attributes* such as price or colour can be observed directly, and *experience attributes* such as flavour can be assessed when consumed, *credence attributes* such as environmental sustainability cannot be immediately seen or experienced at the point of sale. For products promoting credence attributes, the role of verification including labelling design is of significant importance.

Our approach is to apply a Discrete Choice Experiment economic valuation method, analysed using a statistical approach called Latent Class Modelling that describes profiles for different consumer segments identified in the data and provides estimates of attribute WTP across these segments.

Chapter 2
UHT Milk Survey Method

To understand how consumers' value NZ credence attributes, this study used a structured self-administered online survey that included a Discrete Choice Experiment, conducted in Beijing and in Shanghai in August 2021. The survey was administered through Qualtrics™, a web-based survey system, and focused on UHT milk consumers with purchase frequency of at least monthly.

The survey was developed by the research team drawing from a literature review on consumer trends for dairy products, results from previous surveys examining consumer preferences in overseas markets including China, and consultation with industry partners and stakeholders including the programmes advisory board.

Sampling involved recruiting participants from an online consumer panel database provided by an international market research company (dynata.com). Panel members are recruited by online marketing across a range of channels, and panels are profiled to ensure adequate representativeness. Panels are frequently refreshed, with the participation history of members reviewed regularly. Respondents for each survey are compensated with a retail voucher for completing a survey.

2.1 Using Discrete Choice Experiments to examine consumer preferences

Discrete Choice Experiments are a survey-based economic valuation approach that have been widely used to value consumer preferences for food product attributes. They are particularly useful for examining the role of new attributes, and attributes that are not easily observable in market prices, such as the attributes explored in the current report. The ability of this method to identify which individual attributes are more important in consumer choices, and to estimate consumers' WTP for these, has seen this approach to valuation become increasingly favoured by researchers.

Designing a Discrete Choice Experiment survey involves deciding which product attributes are of interest, combining these into different product offerings, and asking consumers to pick which offering they prefer from a range of alternatives. In this study, alternative UHT milk products are described by production practices, nutritional content and price (Table 2-1). Attribute selection was primarily informed by previous surveys, including scoping surveys that used a combination of open text and structured questions to identify which attributes Chinese consumers considered distinctive of NZ milk.

Table 2-1 UHT milk attribute descriptions used in the choice experiment

UHT milk attributes	Attribute descriptions
Enhanced Animal Welfare	The milk may be labelled as using a production system that provides animal welfare that is above the minimum regulatory requirements.
Organic Production	The milk may be labelled as being 100% organically produced, which is GE free, with no synthetic fertilisers or pesticides used.
Enhanced Nutrition	The milk may be labelled as containing increased levels of protein or calcium compared to standard milk.
Animal Housing	The milk may be labelled as being from cows raised mainly in pastures, or mainly in feedlots.
Animal Feed	The milk may be labelled as being from cows feed mostly grass, or mostly grain.
Social Responsibility	The milk may be labelled as being produced by dairy farms that are socially responsible who either care for workers, contribute to local communities, or support farmers.
Environmental Sustainability	The milk may be labelled as using a production system that is either Carbon Neutral, Enhances Biodiversity, or Protects Water Quality.
Price	Yuan per one 250ml carton or bag of UHT milk.

Changes in milk attributes are described using the labels in Table 2-2. Price levels were determined by market prices, and from what scoping survey respondents said that they usually paid.

Table 2-2 UHT milk attribute levels used in the choice experiment

UHT milk attributes	Attribute levels			
Enhanced Animal Welfare	No Label	Certified		
Organic Production	No Label	Certified		
Enhanced Nutritional	No change	Increased Protein	Increased Calcium	
Animal Housing	No label	100% Pasture Raised	Feedlot raised	
Animal Feed	No label	100% Grass-fed	Grain-fed	
Social Responsibility	No label	Care for workers	Contribute to local communities	Support for farmers
Environmental Sustainability	No Label	Carbon Neutral	Biodiversity Enhancement	Water Quality Protection
Price ¥ per 250ml UHT milk	¥2.5	¥4.5	¥6.5	

An example of alternative product offerings presented to respondents is shown in Figure 2-1. Each set of offerings comprises three options, of which respondents chose their preferred one. Two options present alternative UHT milk products, while the third is a 'none of these' option. Each respondent answered ten choice sets. Product choices are statistically analysed using Latent Class Models to identify consumer preferences for each product attribute and to estimate consumers' WTP for each attribute. A more detailed description of the theoretical foundation and statistical procedure of Discrete Choice Experiments can be found in Appendix A.

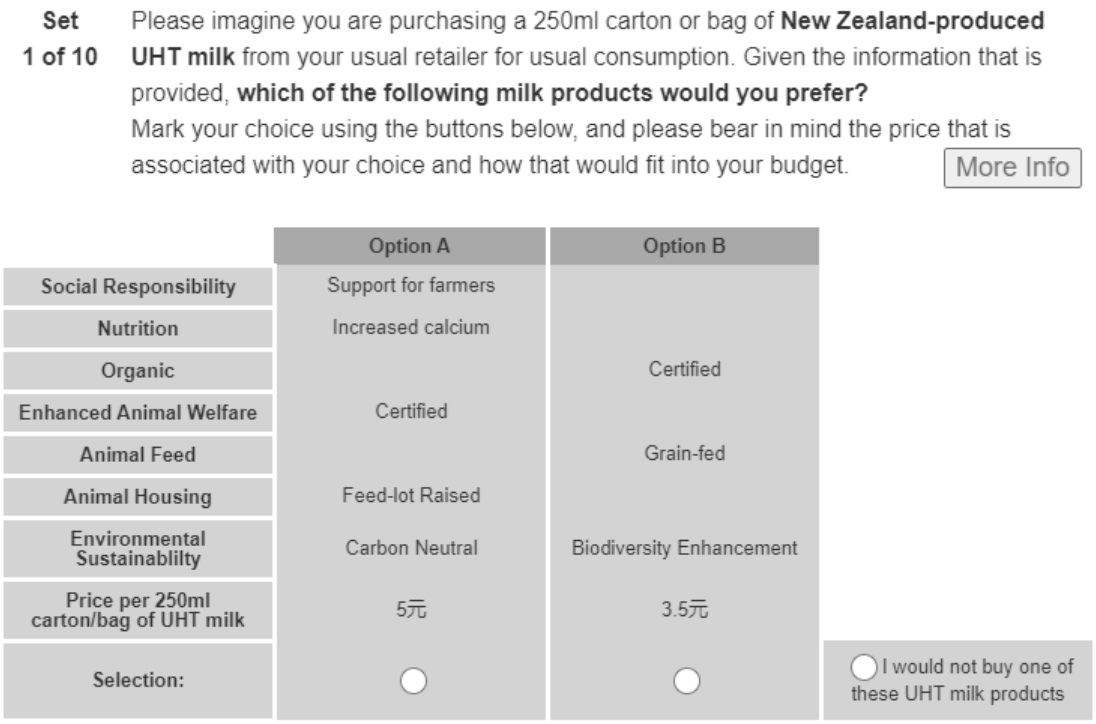
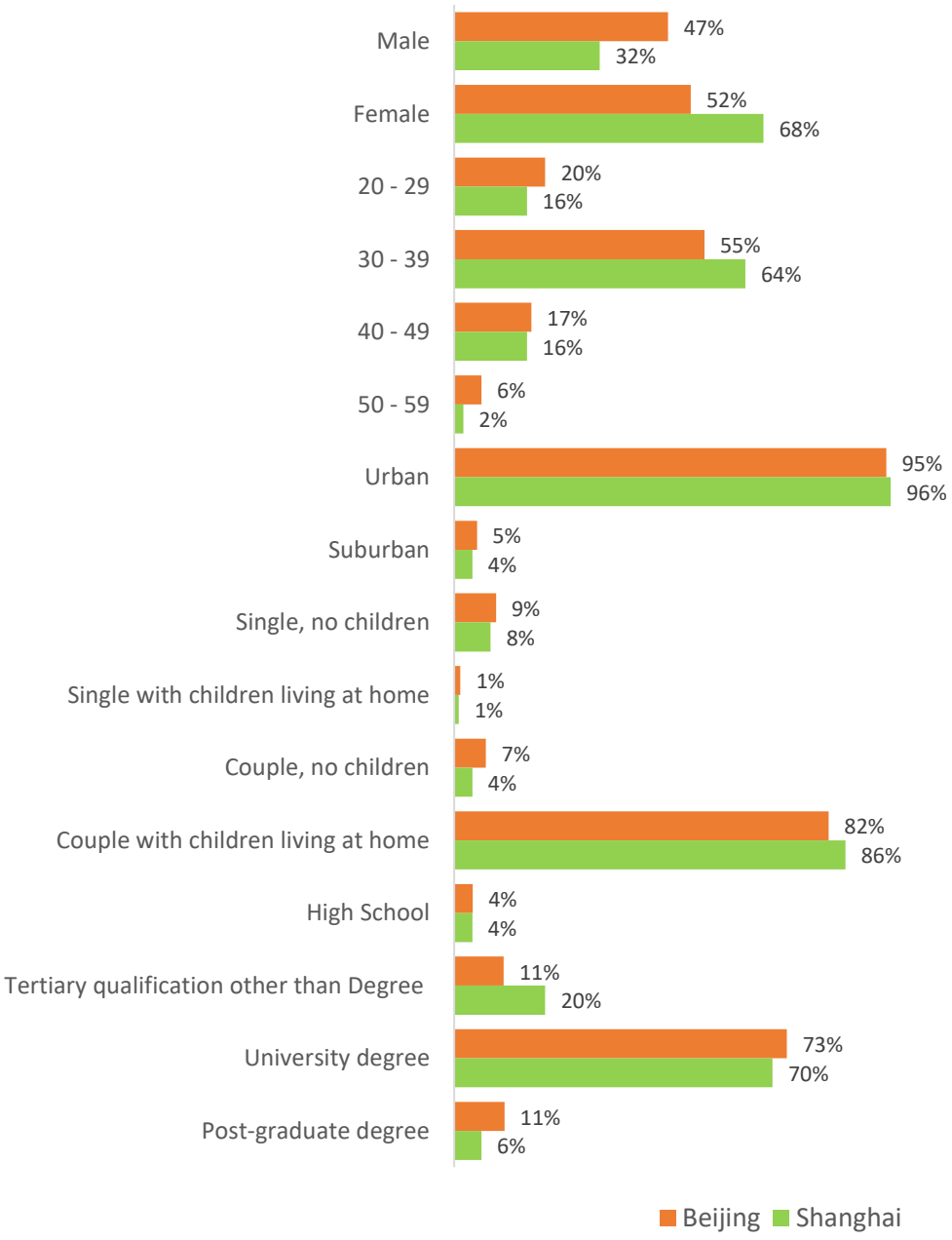


Figure 2-1 Example of a choice experiment question shown to respondents

Chapter 3
Survey Results

3.1 Sample demographic description

- The sample comprised a wide range of demographics which is important to ensure that the sampling process has broadly canvased the relevant population (Figure 3.1).
- It is important to note that we are not attempting to represent the overall Beijing or Shanghai population, but rather those consumers that purchase UHT milk at least monthly.



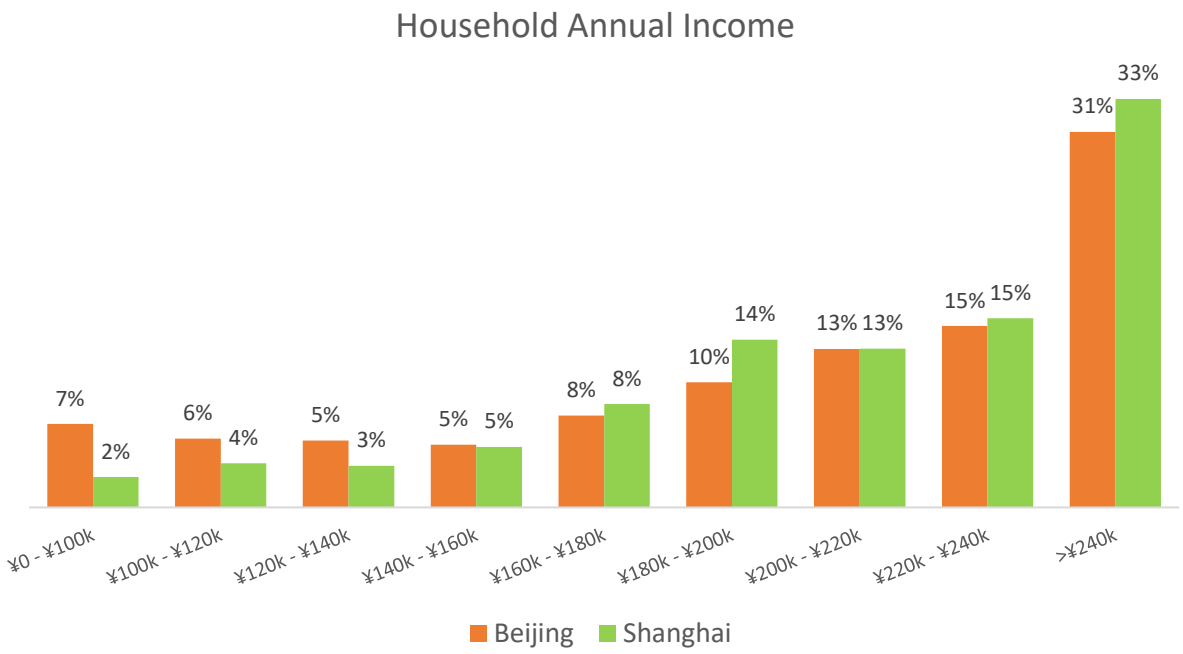


Figure 3-1 Sample demographics

3.2 Purchase and consumption behaviour

3.2.1 Purchase frequency of alternative dairy products

- Looking first at **purchase frequency of alternative dairy products,** the results show that everyone invited to respond to the survey purchased UHT milk at least monthly (Figure 3-2).
- Beijing has moderately higher daily UHT purchase frequency compared to Beijing consumers.
- The ranking of purchase frequency between products is consistent across both cities, with pasteurised liquid milk being the next most frequently purchased dairy product, and butter the least.

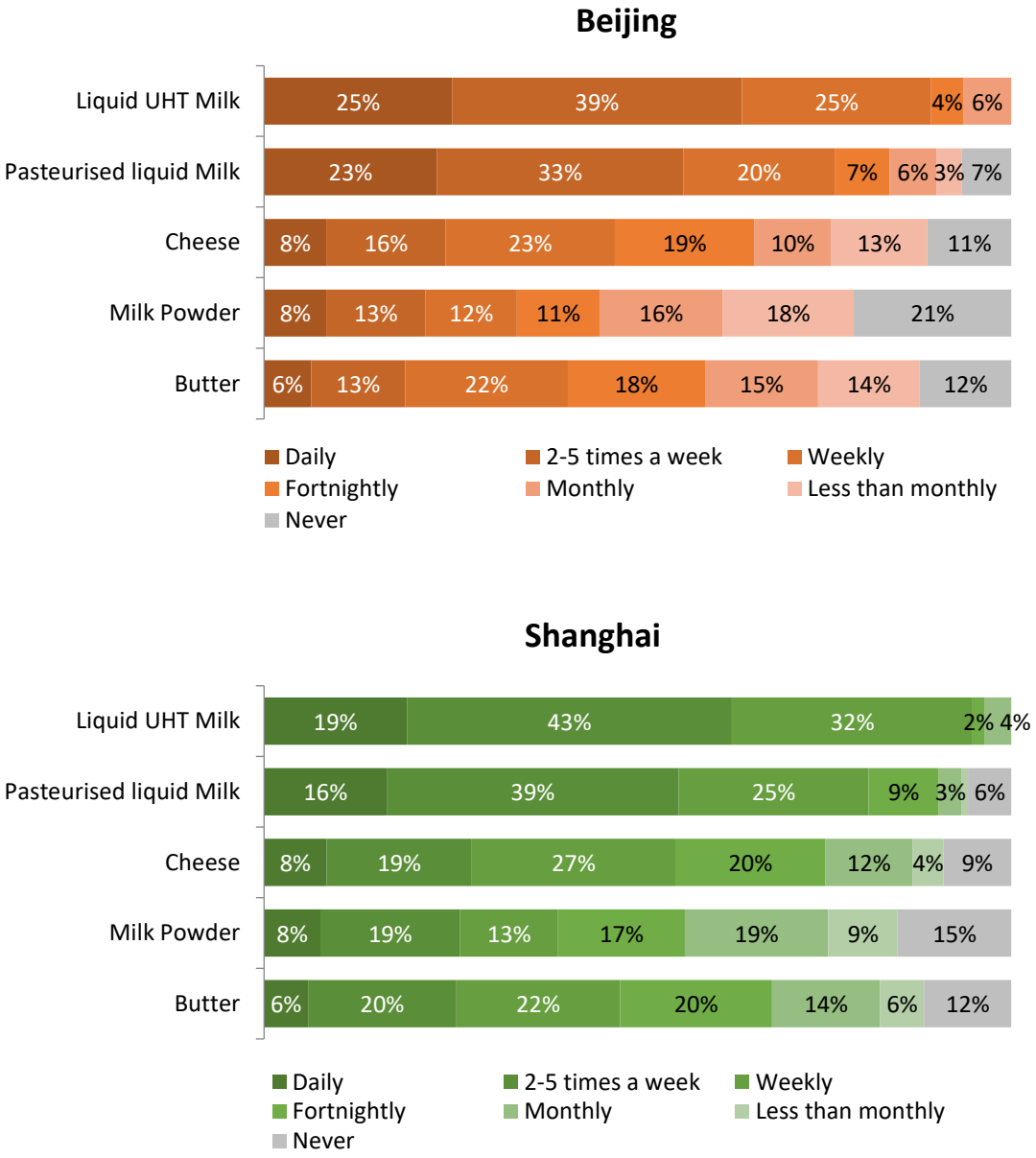


Figure 3-2 Dairy product purchase frequency

- Respondents were asked to indicate **which packaging formats** they typically purchased UHT milk (Figure 3-3).
- The majority of respondents purchase UHT in small individual bags or cartons, with multipacks being the least purchased UHT form across both Beijing and Shanghai consumers.

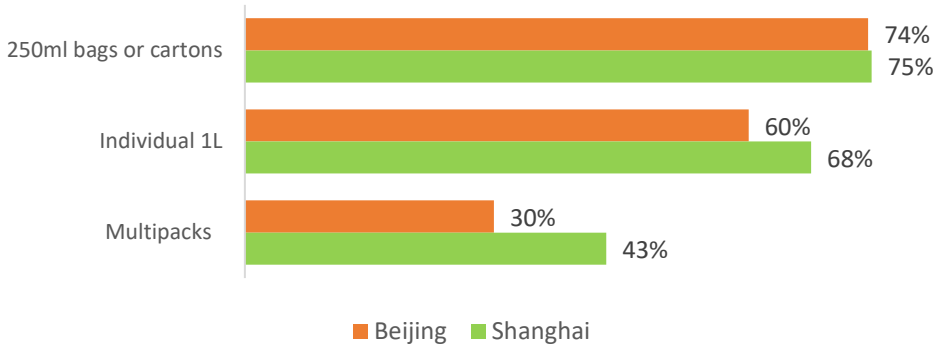


Figure 3-3 UHT product formats purchased

3.2.2 Consumption frequency of alternative dairy products

- Looking at **consumption frequency** reveals a similar pattern between alternative dairy products as for purchasing (Figure 3-4).
- Similarly, Beijing consumers have moderately higher consumption frequency compared to Shanghai consumers.

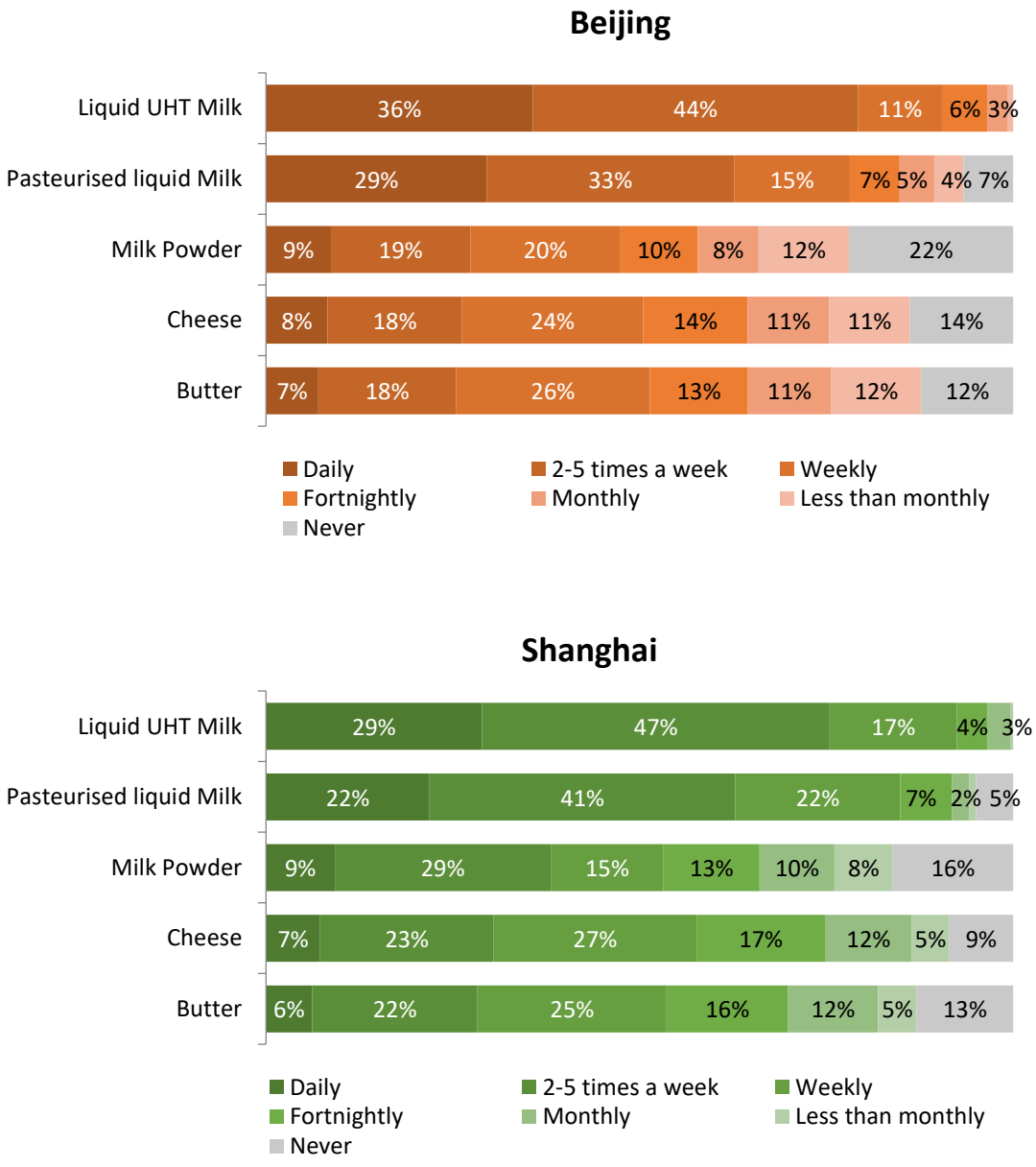


Figure 3-4 Dairy product consumption frequency

3.2.3 Country-of-origin purchase frequency

- Consumers were asked to indicate which **country-of-origin** was the UHT milk from that they purchase (Figure 3-5).
- Looking at the country-of-origin for UHT milk purchases shows that New Zealand has the second highest purchase frequency among both cities consumers, with moderately higher NZ purchase frequency among Shanghai consumers.
- However, 20 per cent of Beijing consumers never purchase UHT from New Zealand, and 12 per cent of Shanghai consumers.

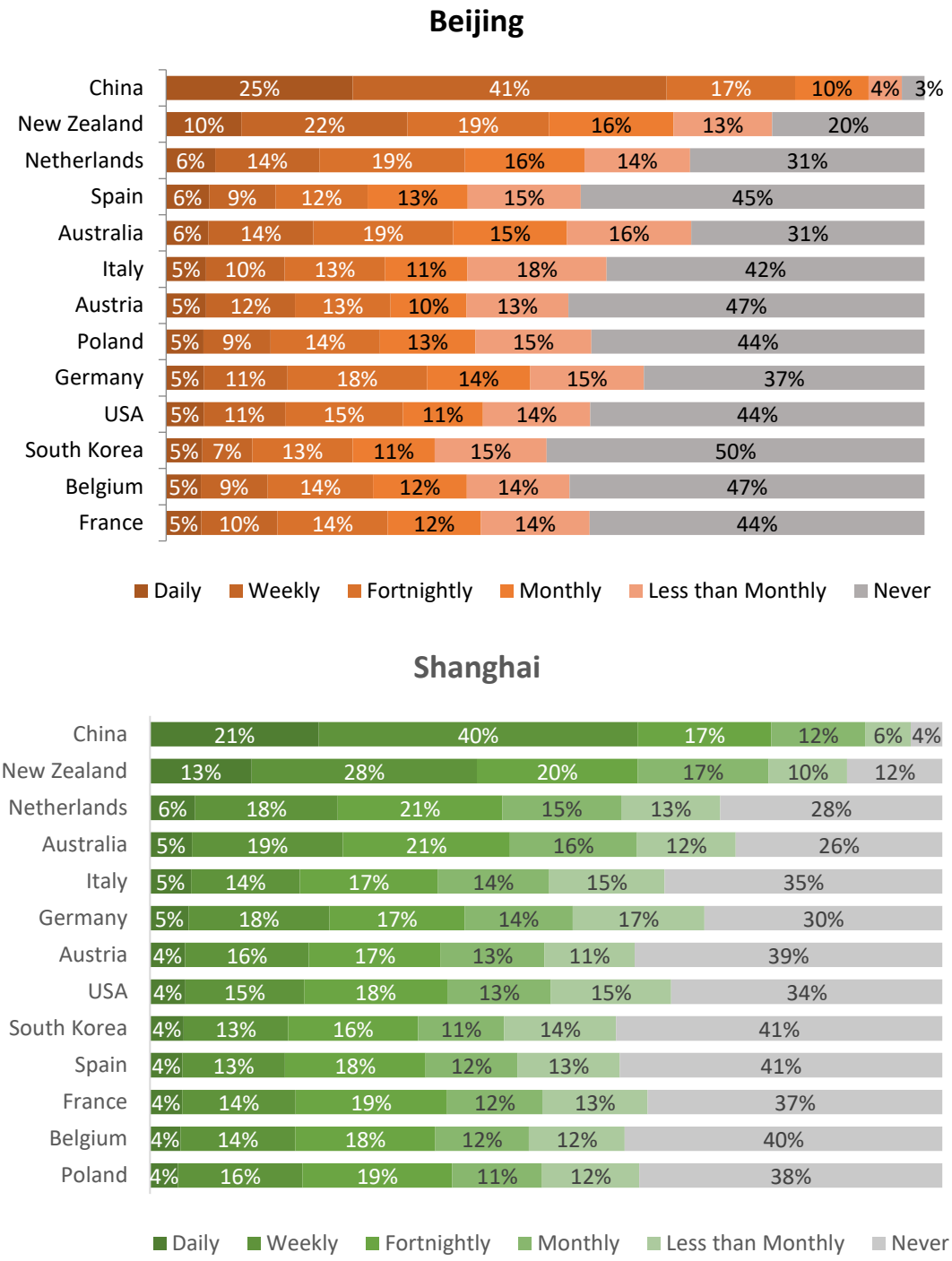


Figure 3-5 Country-of-origin purchase frequency

3.3 Perceptions, preferences and attitudes

3.3.1 Country-of-origin quality ranking

- Respondents were asked to **rank countries according to the quality** of UHT milk produced in that country-of-origin (Figure 3-6).
- The graph below shows the percent of time that a country was ranked in the top three by a consumer. We see that NZ is ranked in the top three by 51 per cent of Beijing and 55 per cent of Shanghai respondents.
- The rank of each country is the same between Beijing and Shanghai consumers.

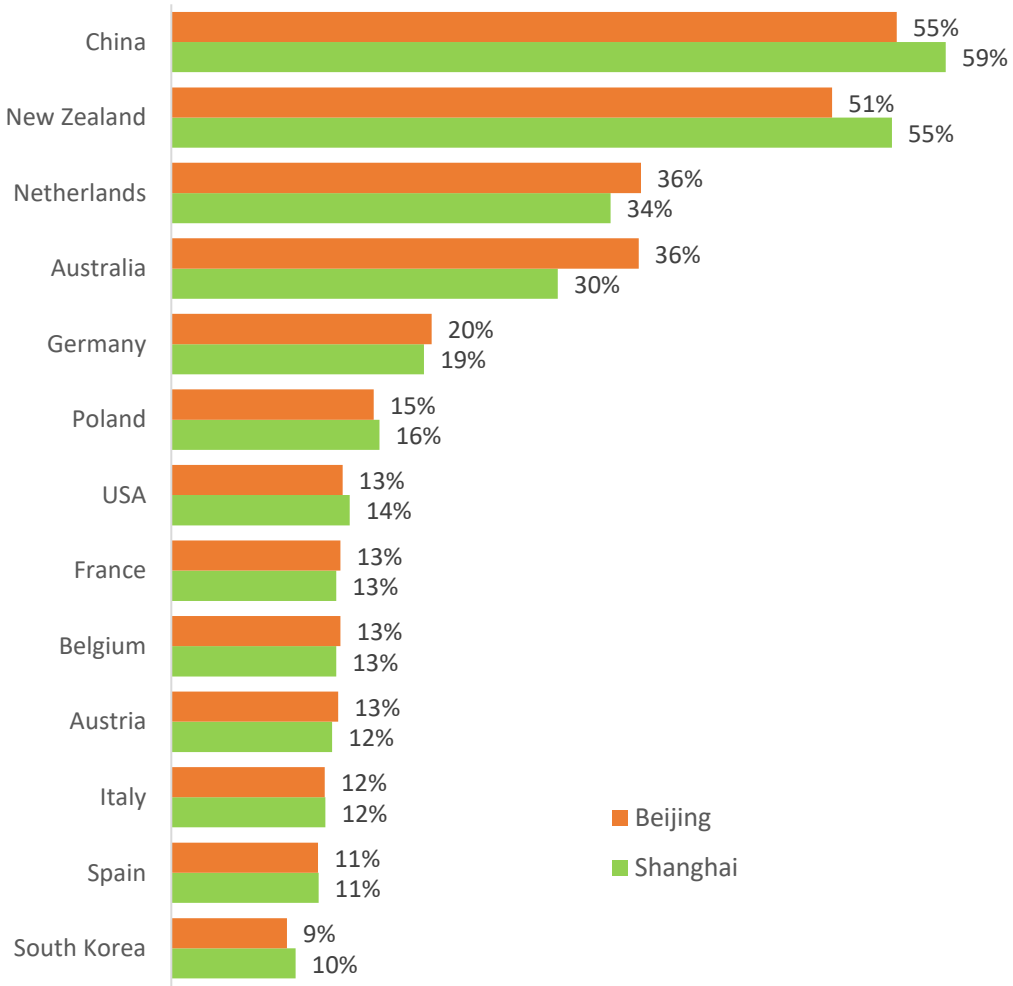


Figure 3-6 Country-of-origin quality ranking

3.3.2 NZ purchase reasons

- Consumers who purchase NZ UHT milk at least monthly were asked to indicate which reasons were important considerations in choosing milk from NZ (67 per cent Beijing, 61 per cent Shanghai).
- High food safety, high nutritional value, high product quality, and environmental quality are important reasons for purchasing NZ UHT milk (Figure 3-7).
- The ranking of reasons is the same for Beijing and Shanghai consumers.

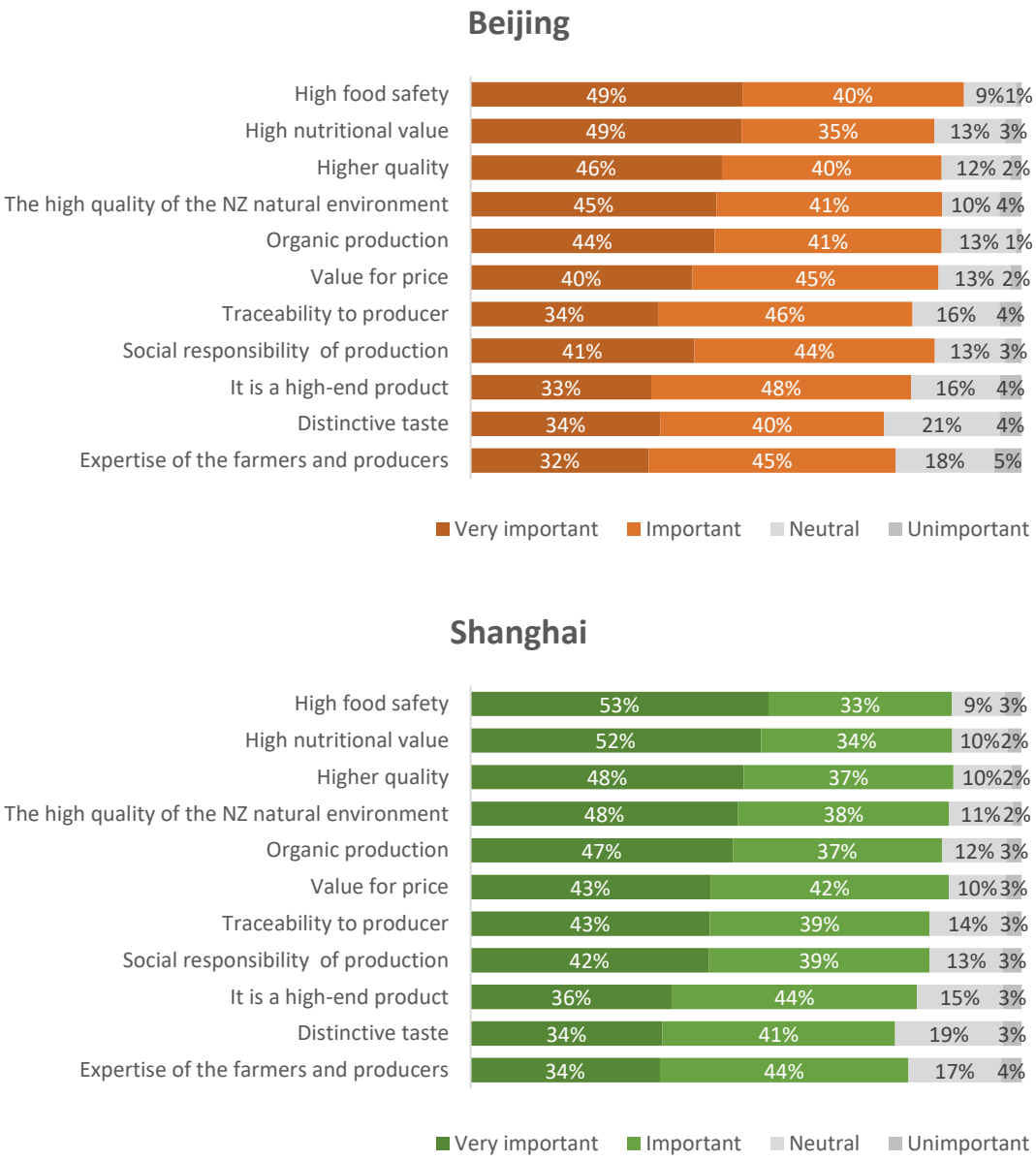


Figure 3-7 Reasons for purchasing New Zealand produced UHT milk

3.3.3 Ideal UHT milk characteristics

- Respondents were then asked to **describe their ideal UHT milk product** by indicating which characteristics were important (Figure 3-8).
- Consistent across both cities' consumers is the high importance of UHT milk that does not contain additives, artificial colors or preservatives.
- Similarly, the top five ideal characteristics for both cities included being free from genetically modified organisms, made from environmentally sustainable farms, and high in calcium content.

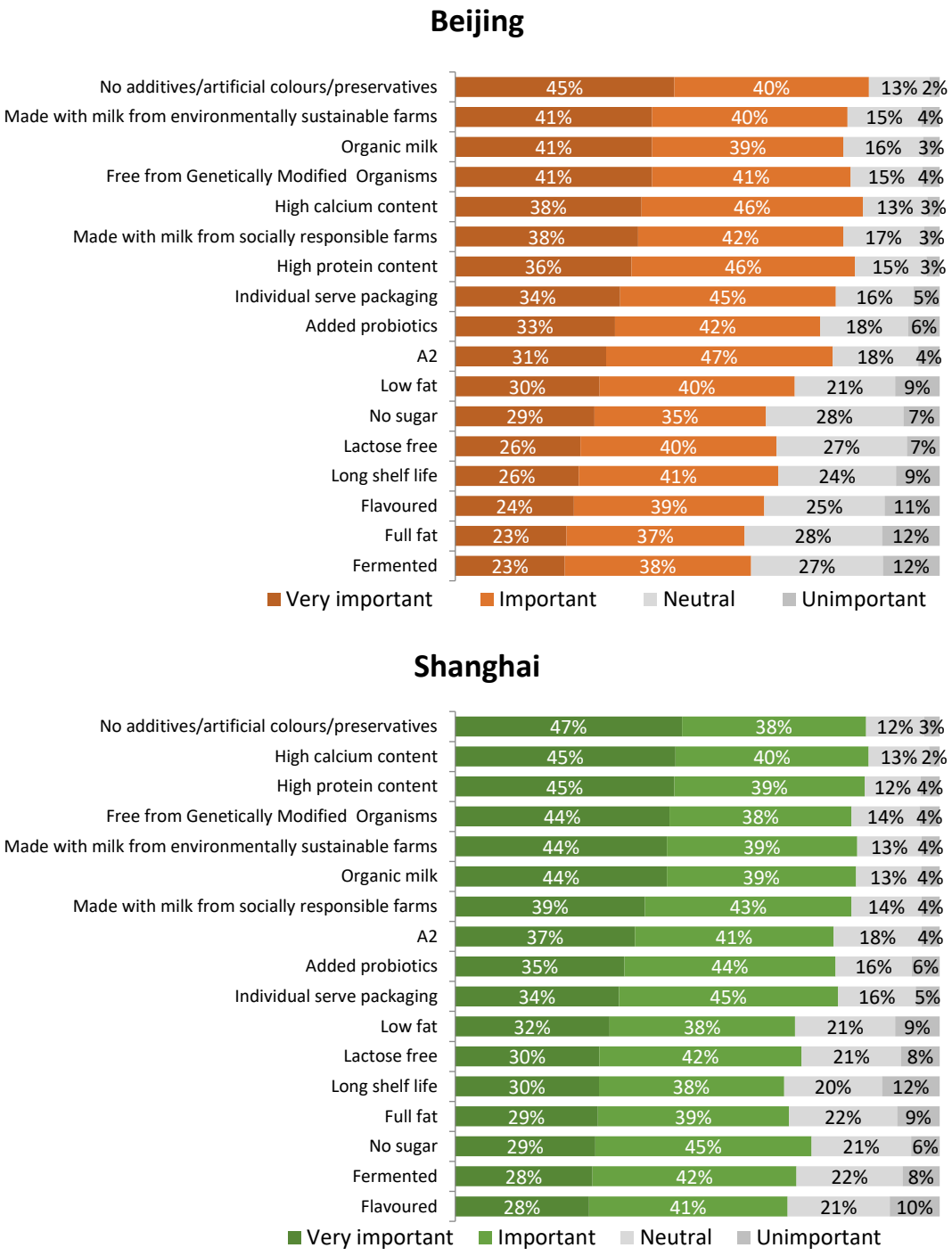


Figure 3-8 Characteristics of the ideal UHT milk product

The next set of questions explored consumers perceptions about what they thought were important factors associated with high food safety of milk, socially responsible milk, high quality milk, and high nutritional value of milk.

3.3.4 Factors associated with high food safety

- Considering **factors associated with high food safety**. Freshness, certification, reduced use of agrichemicals and on-farm environmental quality represent some of the most important factors for high food safety across both cities' consumers (Figure 3-9).

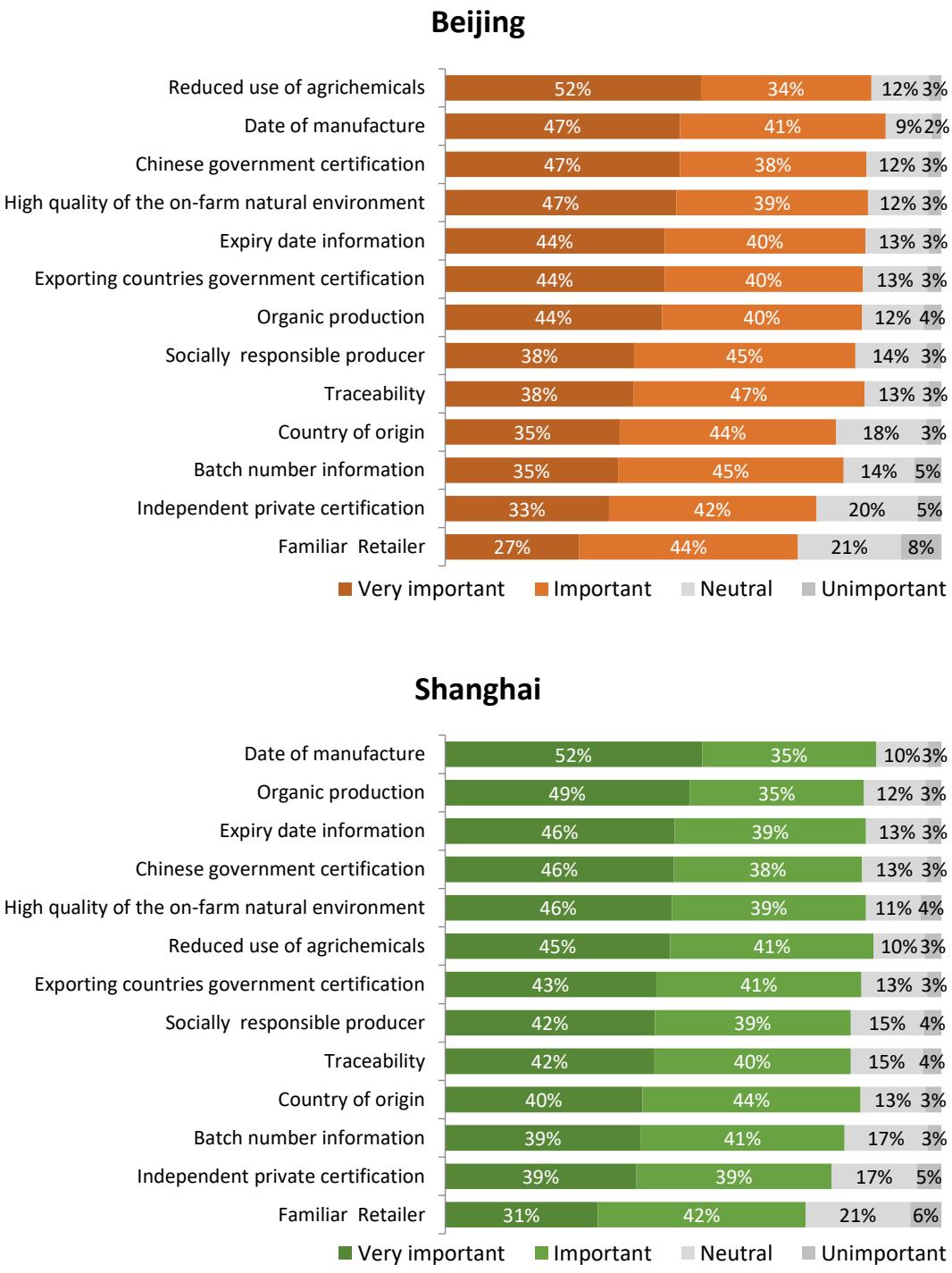


Figure 3-9 Important factors for high food safety of UHT milk

3.3.5 Factors associated with socially responsible production

- Considering **factors associated with socially responsible** UHT milk production. Food safety and quality, and environmental protection were the two most important factors for consumers in both cities (Figure 3-10).

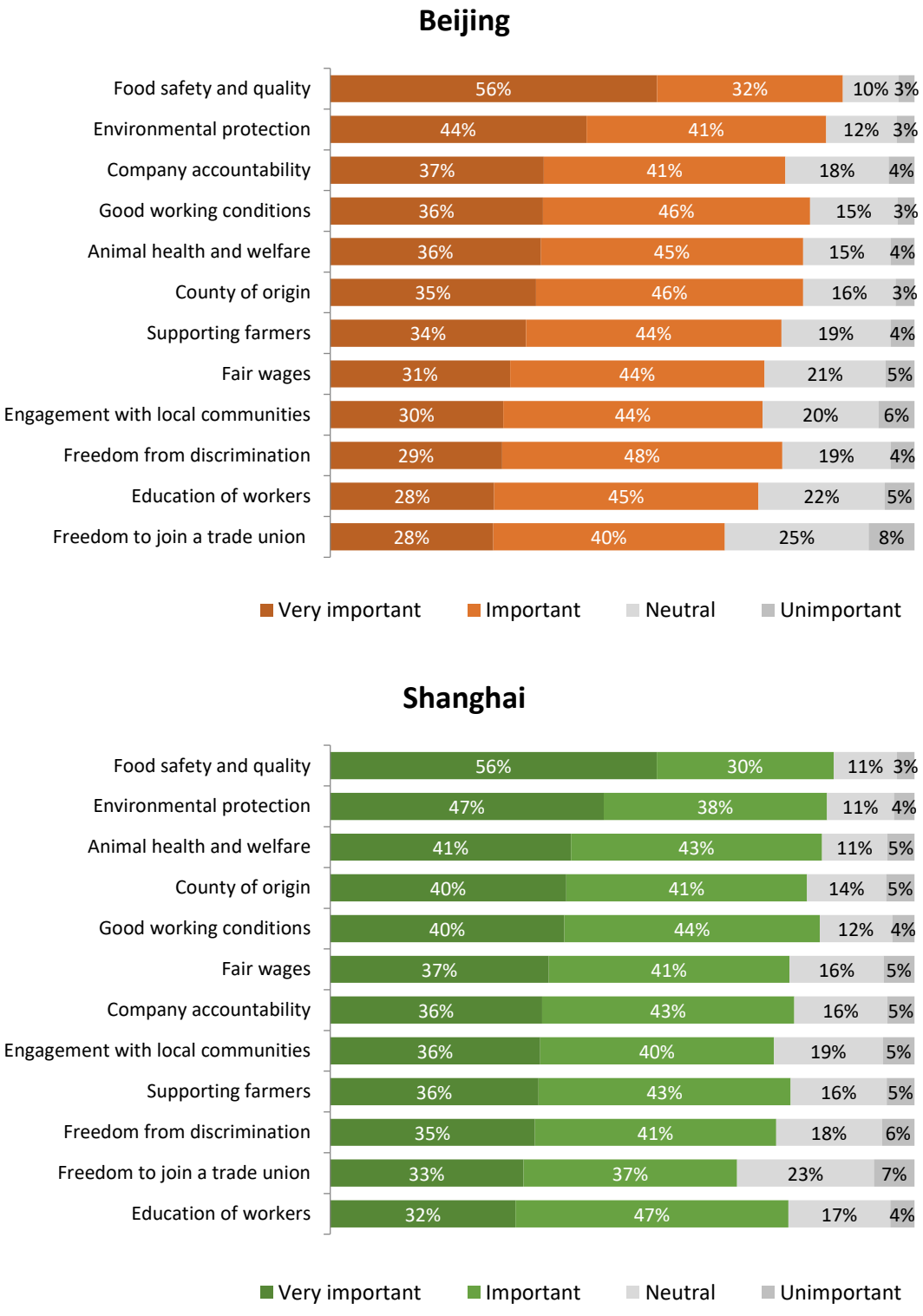


Figure 3-10 Important factors for socially responsible production of UHT milk

3.3.6 Factors associated with high quality UHT milk

- Considering **factors associated with high quality** UHT milk production. Food safety is the most important factor for consumers in both cities (Figure 3-11).

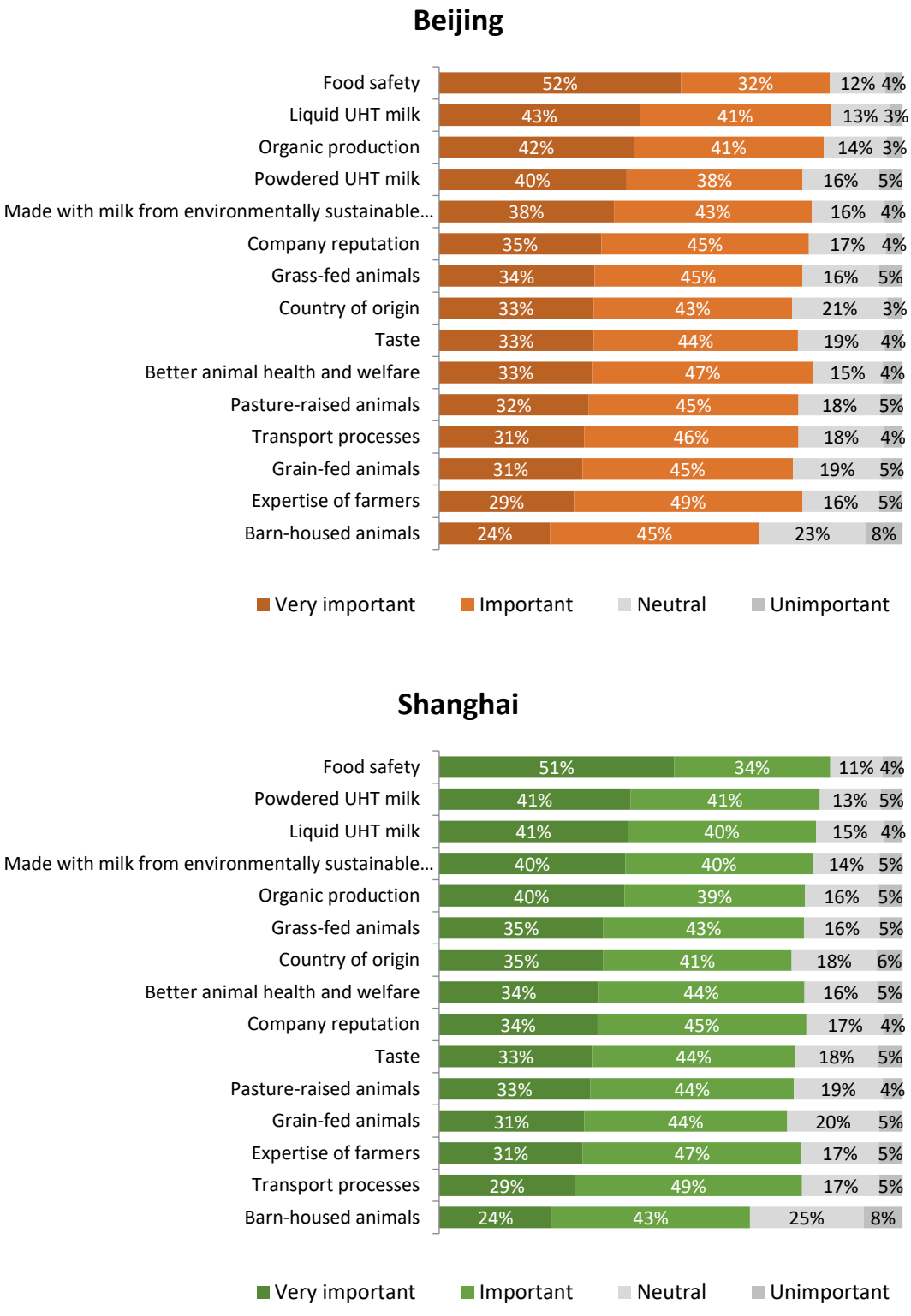


Figure 3-11 Important factors for higher quality of UHT milk

3.3.7 Factors associated with high nutritional value UHT milk

- Considering factors associated with high nutritional value of UHT milk (Figure 3-12). Food safety and quality are the most important factors for both cities consumers.
- Common to both Beijing and Shanghai consumers is the importance of no additives, no artificial colours, and being preservative free.

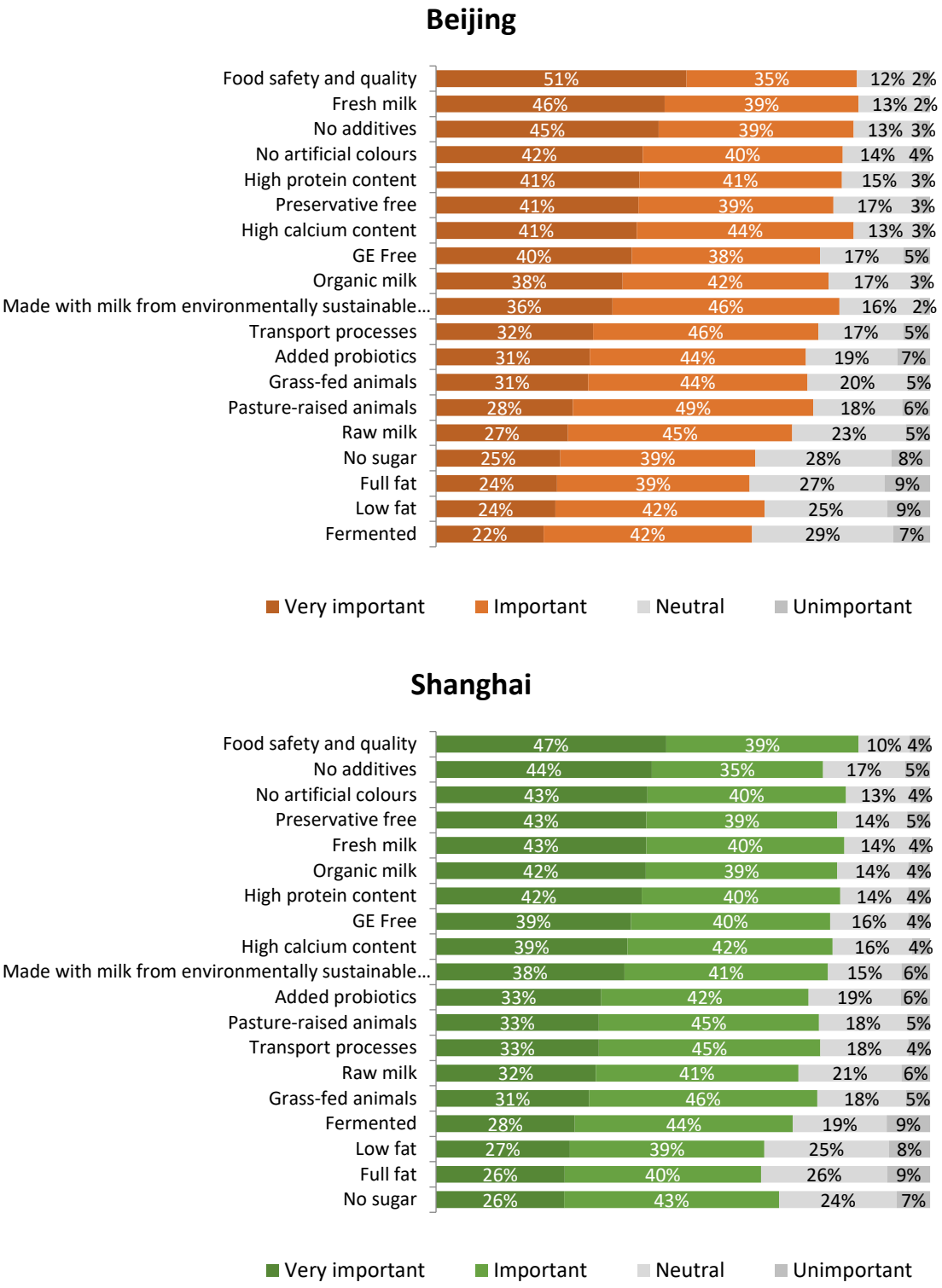


Figure 3-12 Important factors for higher nutritional value of UHT milk

3.3.8 Personal beliefs

- Respondents express some **concerns regarding the effects of agrichemicals and additives** on the environment and health, and an interest in **more labels providing information addressing these issues** (Figure 3.13).
- Common to both cities consumers', there is a greater level of trust in Chinese brands claims compared with those made by foreign brands.

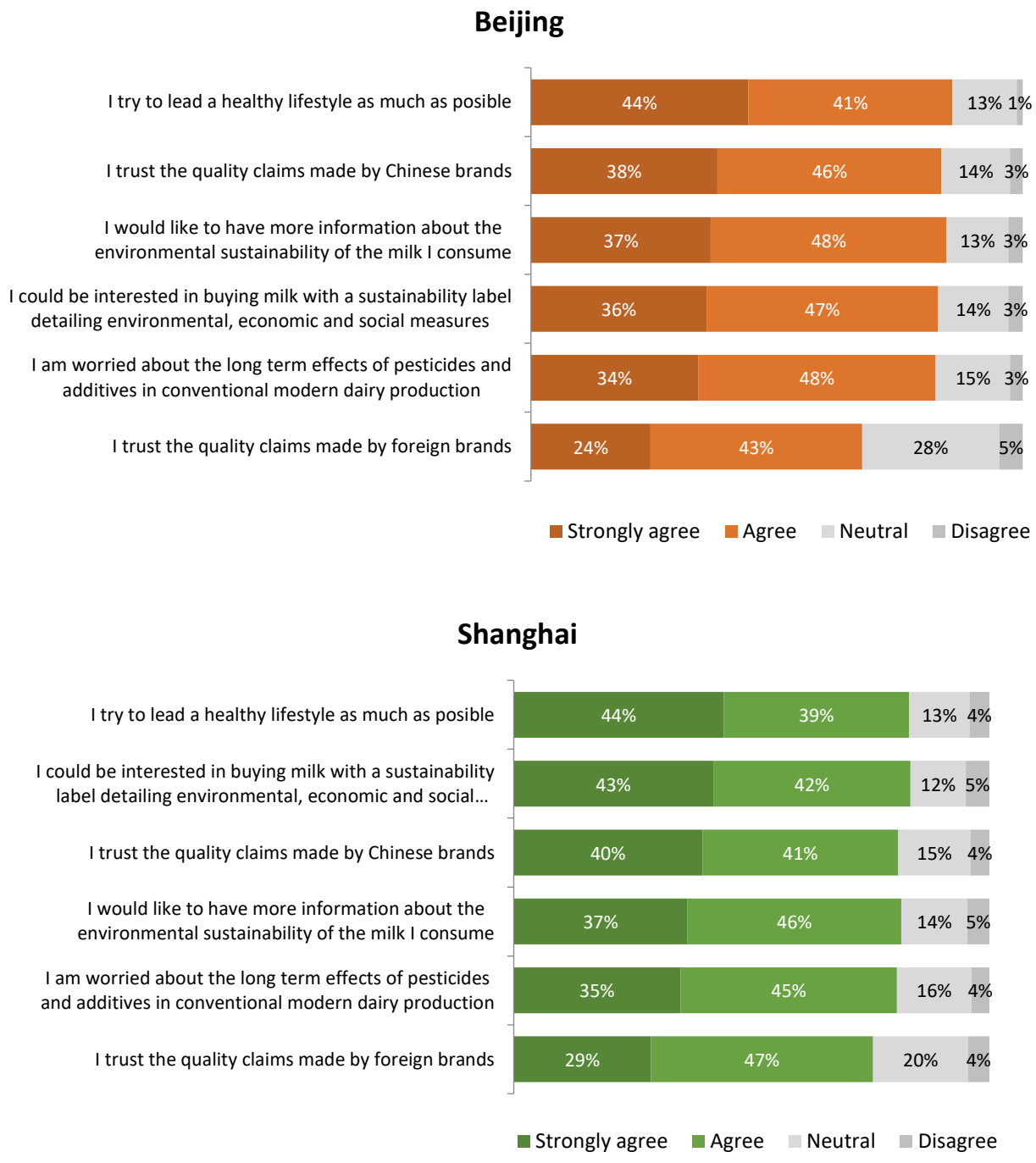


Figure 3-13 Consumer attitudes towards environment, health, labelling, and trust

3.4 Use of digital media and smart technology for milk shopping

3.4.1 Internet access by device and use

- Almost 80 per cent of respondents **access the internet** daily across both cities, with most using a mobile device (Figure 3-14).

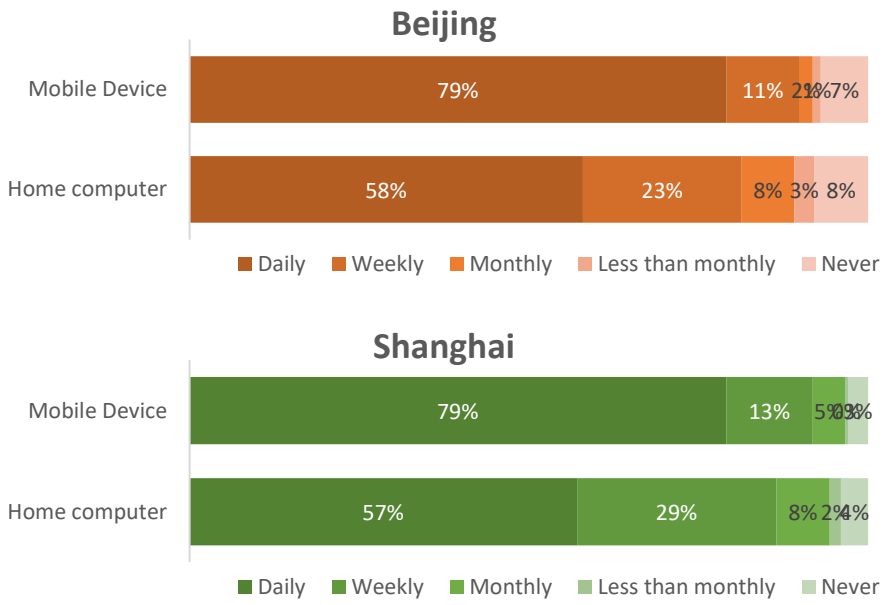


Figure 3-14 Frequency of internet access across device types

- With a consistent level of use across both cities, **digital media is used** more often to search for **milk product information** than to purchase milk (Figure 3-15).

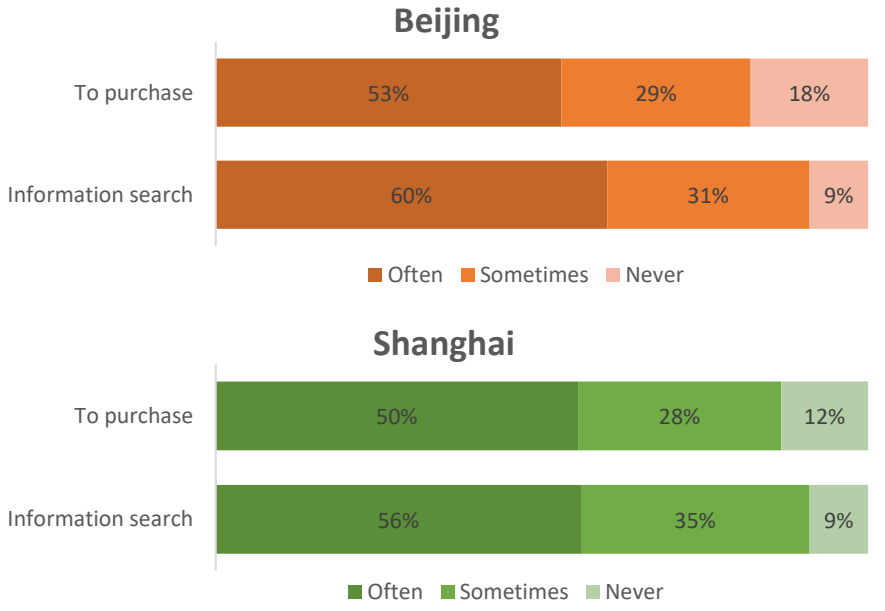


Figure 3-15 Use of digital media for information searching and purchase

3.4.2 Use of mobile device smart technologies in relation to UHT milk

- Looking at the **use of mobile device smart technologies,** the use of QR codes for purchasing and information searching is relatively high is both cities,and is significantly higher in Beijing. (Figure 3-16).

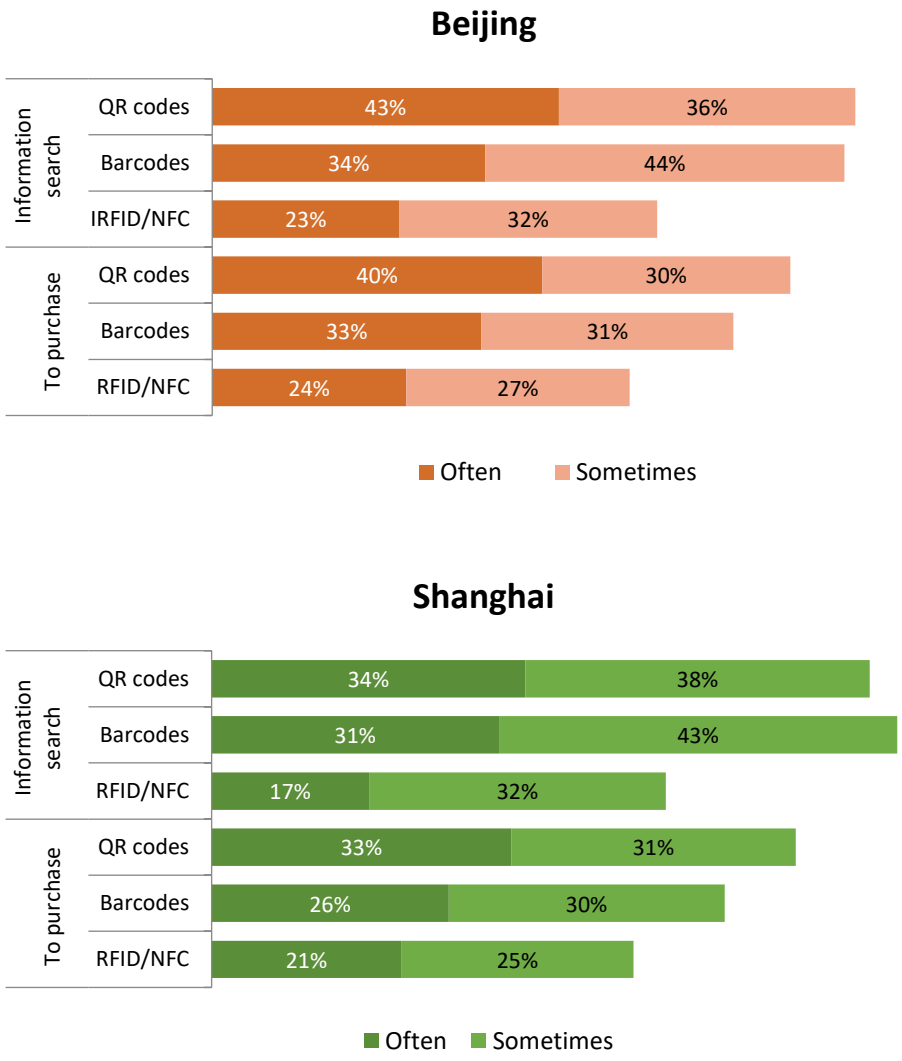


Figure 3-16 Use of mobile smart technologies for information searching and purchase

3.4.3 Sources of online information related to UHT milk

- Looking at the **sources of online information** used for finding out how a UHT milk product is produced, or for which UHT milk to buy (Figure 3-17) shows that the sources of information are generally different across the two cities. The websites where consumers make purchases are not the same as those they gather product information from.
- Sources are generally consistent across the two cities, with Baidu the main source of production information, and Jingdong the main source for purchases in both cities.

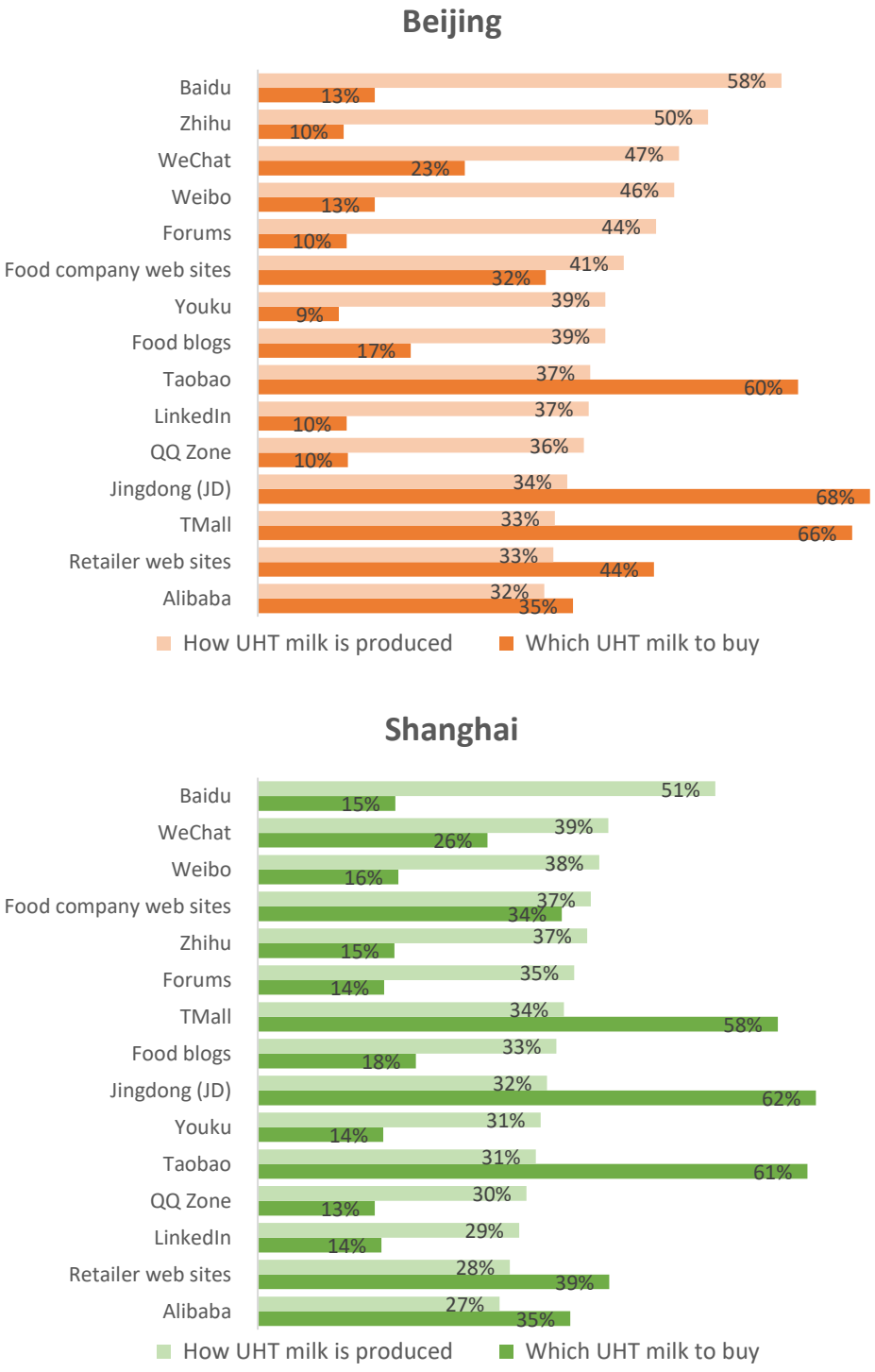


Figure 3-17 Types of digital media used for information searching

3.4.4 Mobile app use related to milk

- Consumers were asked if they **currently use, or were interested in using mobile apps** for a variety of milk related reasons. Over half of respondents use specific applications to make milk purchases, and while one third use apps for traceability - another 50 per cent are interested in this use (Figure 3-18).

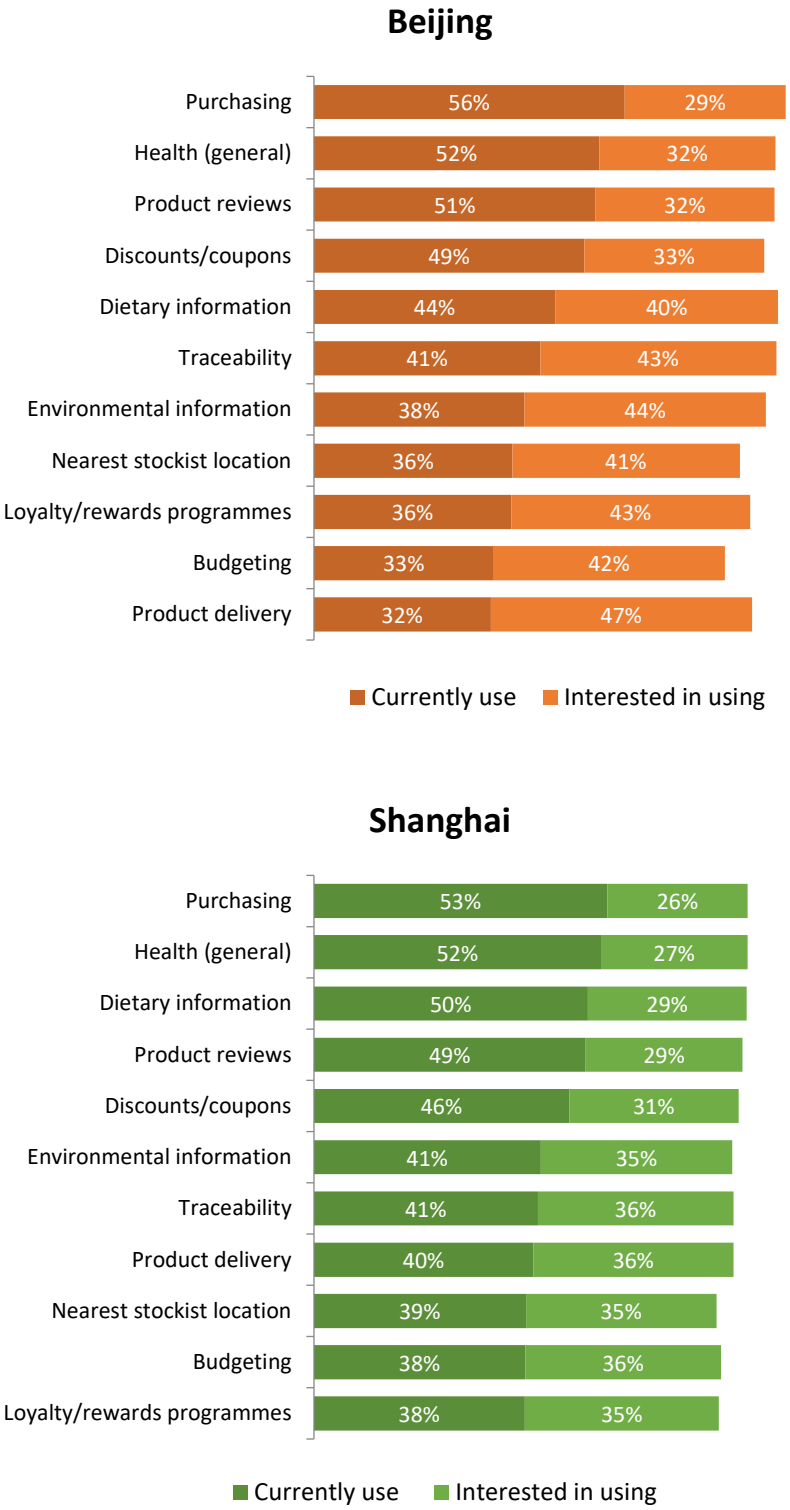


Figure 3-18 Current and potential uses of mobile applications

3.4.5 UHT milk expenditure by purchase channel

- Respondents were asked to allocate their **UHT milk expenditure according to their usual purchase channels** (Figure 3-19). The graph below shows the average expenditure by channel.
- For both cities consumers, an average of 35 per cent of their UHT milk expenditure occurs at supermarkets, while about a quarter of expenditure is done online.
- 76 per cent of Beijing consumers, and 65 per cent of Shanghai consumers bought UHT milk online.

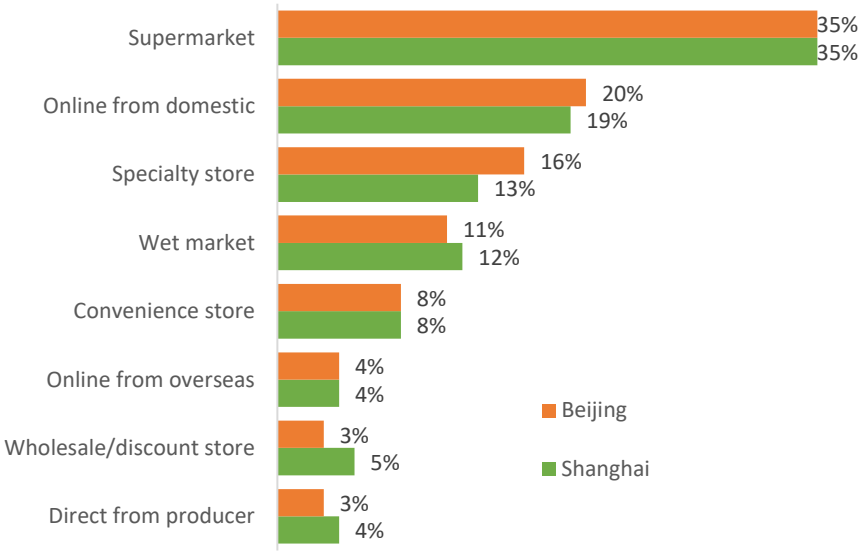


Figure 3-19 Percentage of milk expenditure by retail channel

- The two main benefits of online shopping were greater variety and home delivery for both Beijing and Shanghai consumers (Figure 3-20).

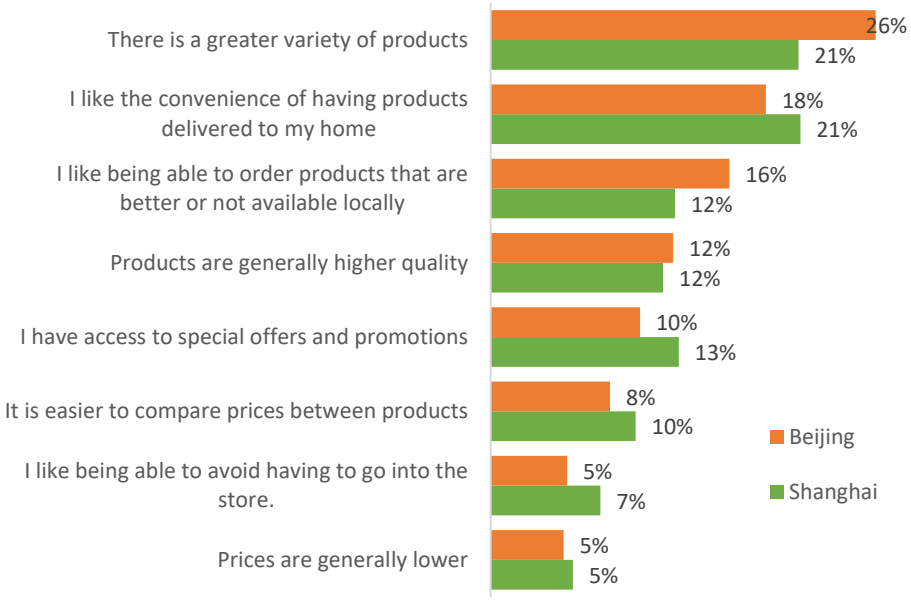


Figure 3-20 Main benefit of shopping online for UHT milk

3.4.6 Use of online retailers

- For those consumers purchasing UHT milk online, supermarkets are the main **online retailer** used by both cities consumers (Figure 3-21).
- The relative use of each online retail channel is consistent across Beijing and Shanghai consumers.

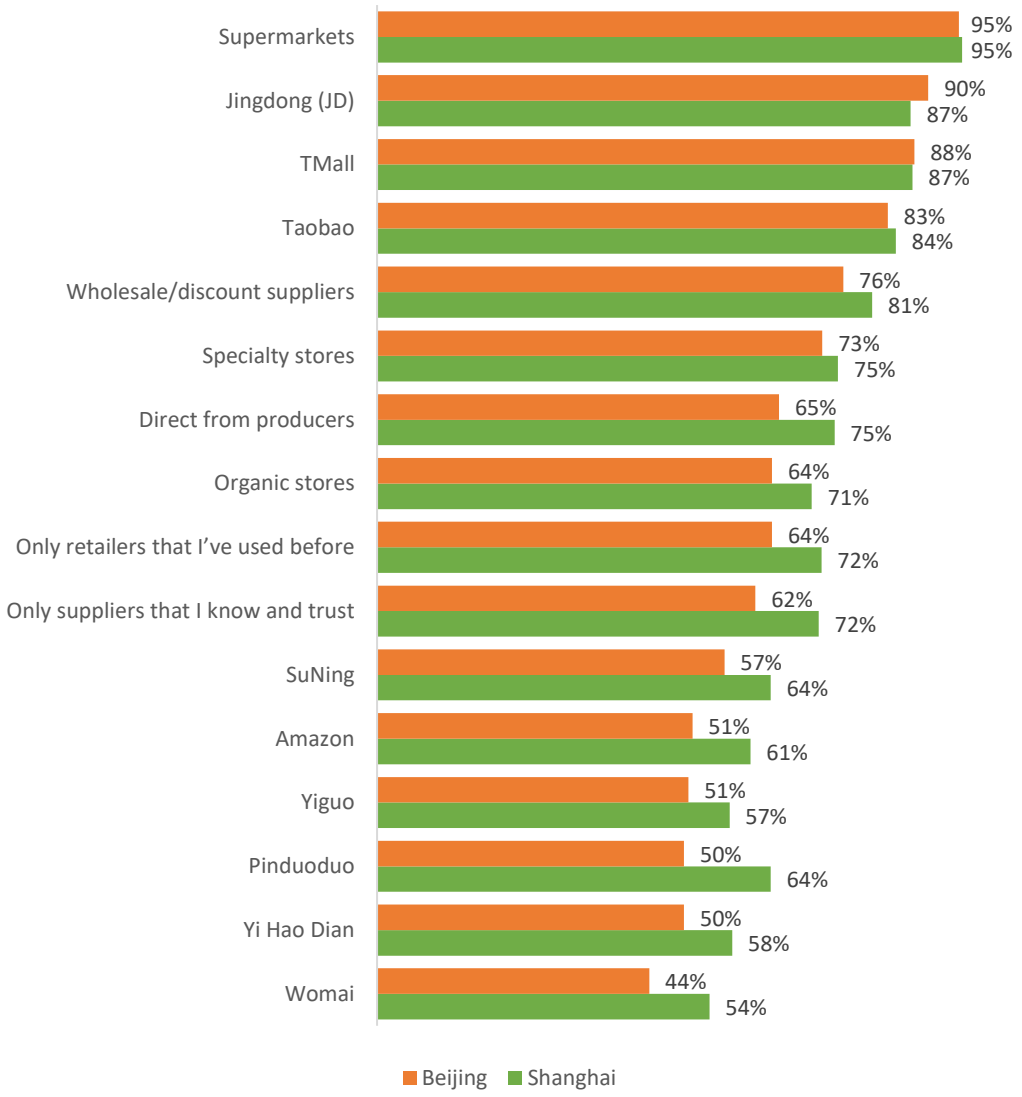


Figure 3-21 Use of online retail channels

3.5 Discrete Choice Experiment analysis of UHT milk choices

In this section we present findings of the Discrete Choice Experiment. Our objective is to identify which UHT milk attributes drive product choices, by how much, and by who. We do this using a statistical method called Latent Class Modelling that identifies consumer segments in the data based on which product offerings consumers preferred. The model parameter estimates can be found in Appendix B. Discrete Choice Experiments can be somewhat more difficult to answer compared with the usual question formats that people have typically seen before, so it is important to check whether respondents have been able to complete the exercise reliably. Overall, the choice task and product attribute understanding was high, respondents felt that they were able to express what was important to them concerning milk attributes, and most respondents felt certain that their responses reflected real-world choices if these UHT milk products were available (Figure 3-22).

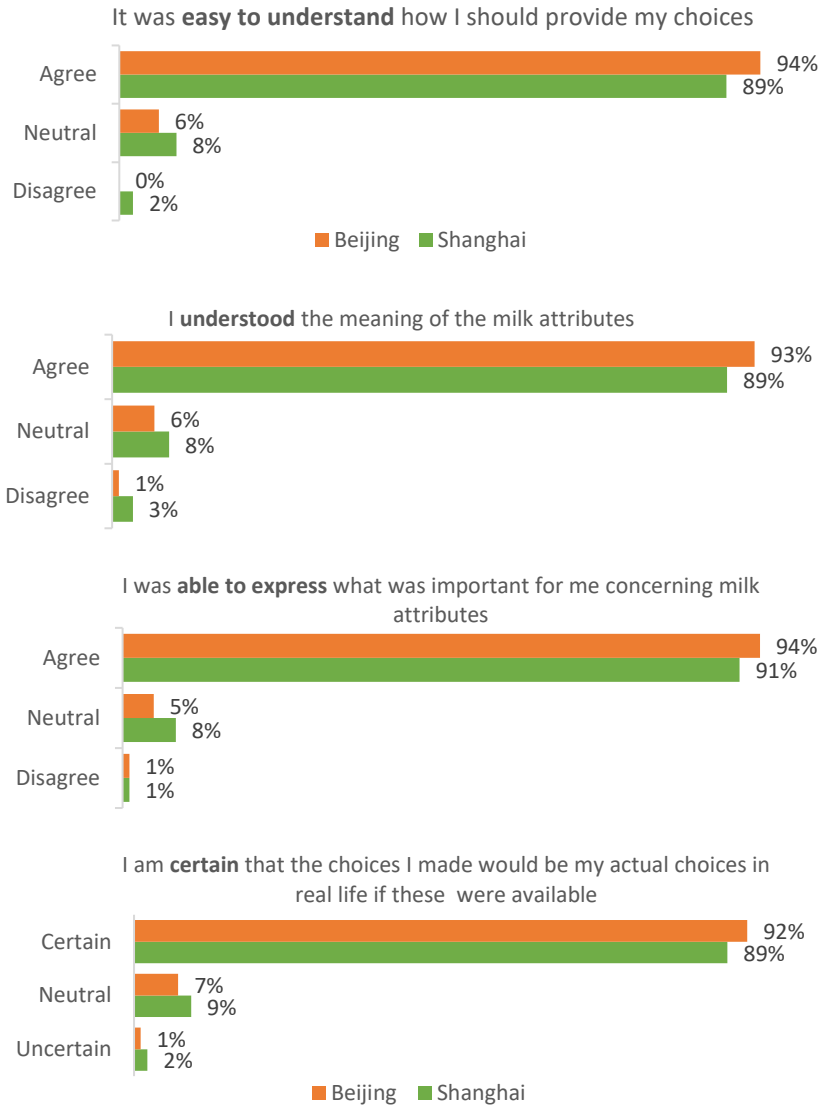


Figure 3-22 Choice experiment debriefing questions: task understanding, attribute understanding, ability to express preferences, certainty of choices made

3.5.1 Consumer willingness-to-pay values

Estimates of WTP tell us how much more the average consumer is willing to pay for a 250ml UHT milk product with a particular attribute, over one that does not have this attribute (Table 3-1,Figure 3-23, Figure 3-24). For example, members of Beijing Segment One are willing to pay, on average, ¥0.47 more for milk that is produced with Enhanced Animal Welfare standards over one that is not. There is some uncertainty in WTP estimates, and the Confidence Intervals reported indicate that we can be 95 per cent sure that the true WTP falls within this interval, in this case between ¥0.28 and ¥0.67.

We can see that the Latent Class Modelling has identified three distinct consumer groups for each city. Reported under each segments column heading is the size of each segment, Beijing Segment One has an estimated size of 47 per cent, the second segments size is 5 per cent and the third is 48 per cent. These segment sizes tell us the probability that a randomly selected Beijing UHT milk purchaser belongs to that consumer group.

Table 3-1 UHT milk attribute willingness-to-pay by consumer segment

	Beijing			Shanghai		
	Segment 1 47%	Segment 2 5%	Segment 3 48%	Segment 1 57%	Segment 2 38%	Segment 3 5%
Enhanced Animal Welfare	¥0.47*** (0.28:0.67)		¥2.31** (0.13:4.49)	¥0.53*** (0.40:0.67)	¥0.83*** (0.40:1.25)	¥2.27** (0.45:4.09)
Organic Production	¥0.70*** (0.48:0.92)		¥3.60** (0.37:6.83)	¥0.84*** (0.67:1.01)	¥1.16*** (-5.54:3.86)	¥2.83*** (0.86:4.79)
Increased Protein	¥1.67** (0.40:3.13)					¥1.84* (-0.18:3.86)
Increase Calcium	¥0.65*** (0.38:0.92)		¥1.80** (0.13:3.47)	¥0.65*** (0.46:0.84)	¥0.48** (0.07:0.90)	
100% Pasture Raised	¥0.84** (0.13:1.56)		¥4.15** (2.24:6.40)		¥2.94*** (1.17:4.69)	
Feedlot Raised	¥0.58*** (0.23:0.93)		¥1.69*** (0.41:2.96)		¥1.00*** (0.53:1.46)	¥3.07*** (1.35:4.79)
100% Grass Fed						¥2.88** (0.52:5.23)
Grain Fed	¥0.28* (-0.01:0.57)		¥2.63*** (0.71:4.55)	¥0.17* (-0.03:0.37)	¥0.72*** (0.33:1.10)	¥1.59*** (0.44:2.73)
Care for Workers	¥0.75* (-0.03:1.52)	¥0.53* (-0.05:1.12)				¥1.71* (-0.33:3.75)
Contribute to Local Communities	¥0.99*** (0.26:1.72)	¥0.57** (0.09:1.04)		¥0.70** (0.01:1.38)		
Support for Farmers	¥0.67*** (0.30:1.03)			¥0.25*** (0.04:0.47)	¥0.60** (0.09:1.11)	
Carbon Neutral						
Biodiversity Enhancement						
Water Quality Protection	¥0.28* (-0.02:0.57)		¥1.62*** (0.19:3.04)	¥0.43*** (0.20:0.65)		¥2.98*** (0.82:5.14)

Average marginal WTP/250ml carton/bag of UHT Milk ¥2021. 95% Confidence Interval in brackets.
***, **,* denote statistical significance at the 1%, 5% and 10% levels indicating that a willingness-to-pay estimate is significantly different from zero.

Beijing Consumer Willingness-to-pay Segments

1. Broad Considerations — 47% of consumers

These consumers consider the broadest set of milk attributes in their choices out of the three consumer segments. They have the highest willingness-to-pay for Increased Protein, and Water Quality Protection of the three segments.

Consumers in this segment are more likely to:

- Be middle aged
- Have higher education level
- Buy milk daily
- Be trying to lead a healthy lifestyle

2. Socially Responsible — 5% of consumers

These consumers are primarily price focused, and have modest willingness-to-pay only for socially responsibility attributes focused on workers and communities.

Consumers in this segment are more likely to:

- Be female
- Be younger
- Have lower income level

3. Pasture Preferred — 48% of consumers

These consumers have highest WTP of the three segments for all the attributes that they consider in their milk choices. These consumers have strong preference for pasture raised, and organic production.

Consumers in this segment are more likely to:

- Be male, older
- Have higher income level
- Buy NZ milk more often
- Rank NZ milk quality high
- Have higher usual spend

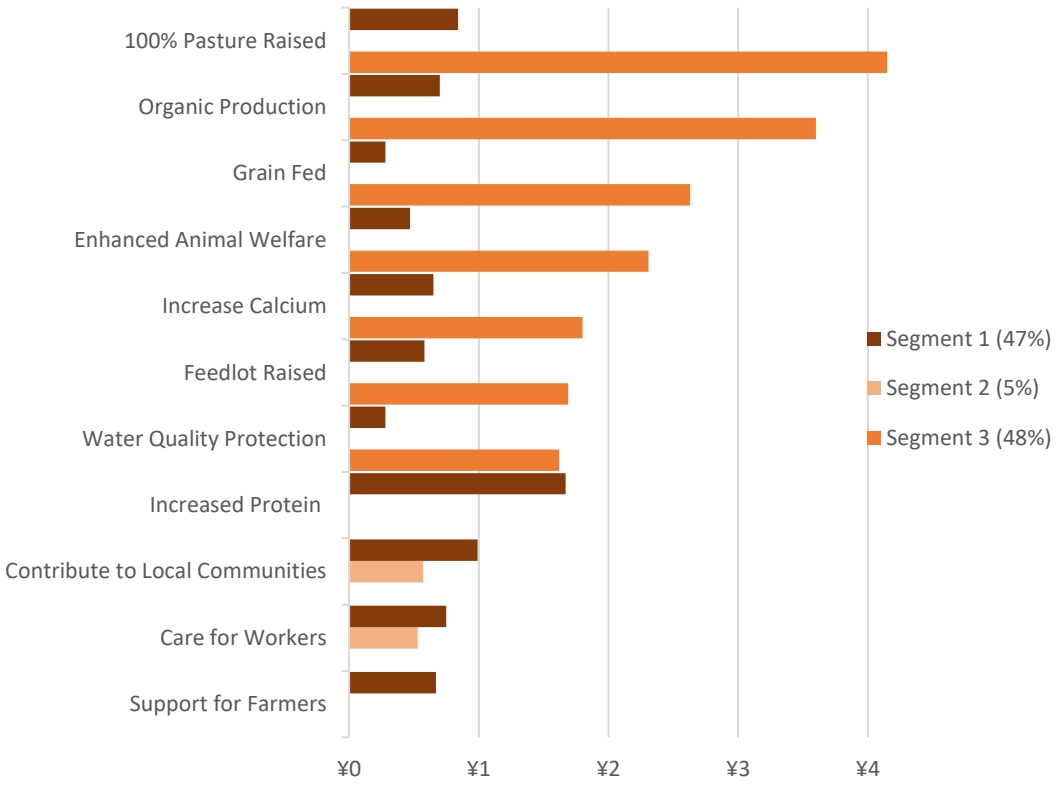


Figure 3-23 Beijing consumers' willingness-to-pay for UHT milk attributes

Shanghai Consumer Willingness-to-pay Segments

1. Broad Considerations — 57% of consumers

This segment is the largest of the three consumer groups. These consumers preferences span a range of health, environmental, and socially responsible attributes. They have the highest willingness-to-pay for Increased Calcium of the three segments.

Consumers in this segment are more likely to:

- Be male, be younger
- Have higher education level
- Purchase milk daily
- Be worried about pesticides and additives in milk production

2. Pasture Preferred — 38% of consumers

These consumers are primarily focused on pasture raised production. They have the highest willingness-to-pay for this attribute of the three segments. And have significant preferences for organic production, and enhanced animal welfare attributes.

Consumers in this segment are more likely to:

- Have higher income levels
- Purchase milk weekly
- Rank NZ milk quality high
- Be trying to lead a healthy lifestyle

3. Strong Preferences — 5% of consumers

These consumers have the highest WTP of the three segments for all the attributes that they consider in their milk choices. However this segment comprises only about 5% of consumers.

Consumers in this segment are more likely to:

- Be female
- Be older
- Have lower purchase frequency

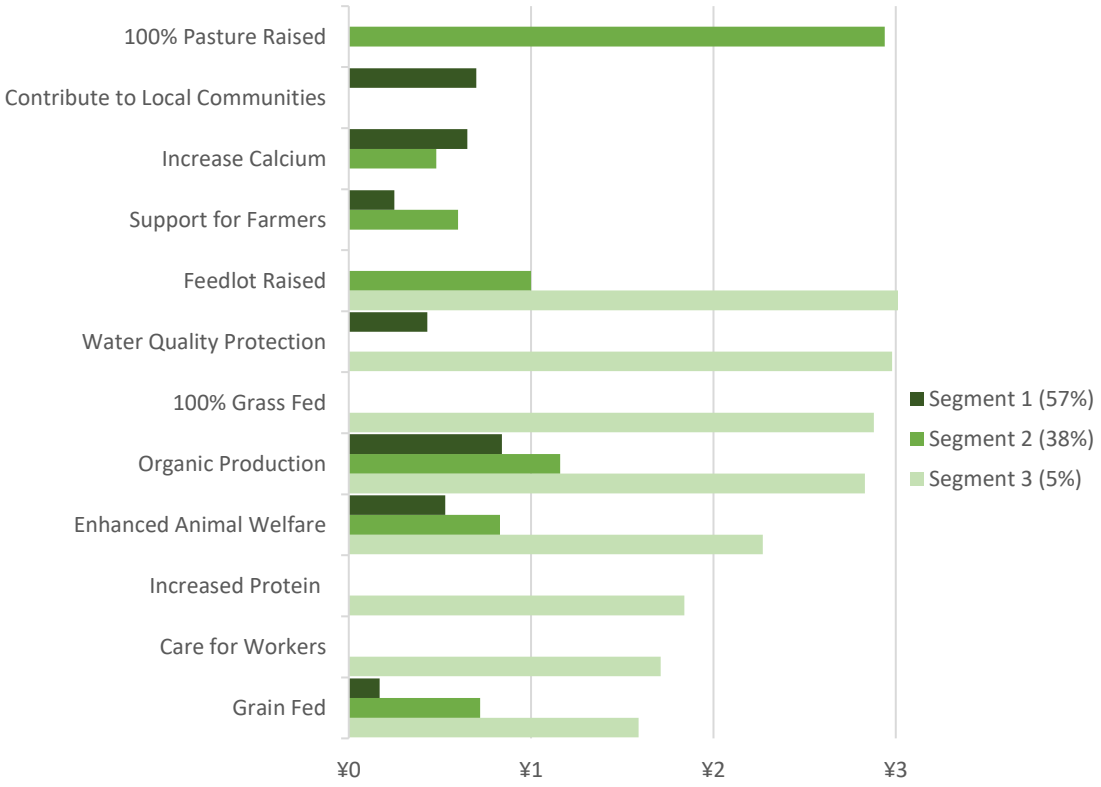


Figure 3-24 Shanghai consumers' willingness-to-pay for UHT milk attributes

To provide an indication of the overall differences in preferences and willingness-to-pay values between Beijing and Shanghai consumers, the Latent Class Modelling presented above is combined at the city level (Figure 3-25). These estimates are formed by weighting each willingness-to-pay value for each class by their class size, and summing across each city's segments.

Overall:

- Beijing consumers overall have much stronger preferences and higher willingness-to-pay compared to Shanghai consumers for the product attributes considered.
- Both cities' consumers have similar patterns of preference, they value similar attributes, and their ranking of willingness-to-pay across attributes is generally consistent.
- Pasture raised and Organic production attributes stand out as offering the greatest value to consumers overall.
- Socially Responsible production attributes rank relatively lowly overall.
- Grass-fed production attribute attracts only a small premium for Shanghai consumers, and none for those consumers from Beijing.
- While Water Quality Protection is valued significantly by both cities' consumers, Biodiversity Enhancement and Carbon Neutral production attributes do not attract significant willingness-to-pay in this survey.

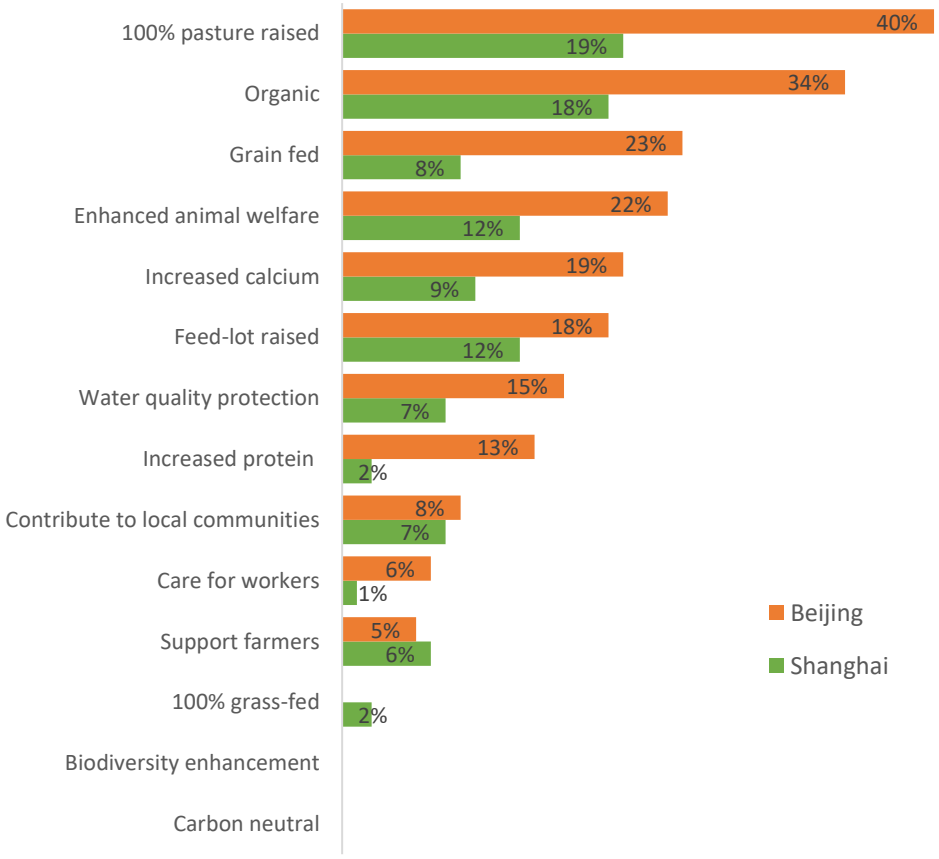


Figure 3-25 Weighted willingness-to-pay as percent of usual price paid

Chapter 4
Conclusions

This report presents the findings of a structured online survey of Beijing and Shanghai UHT milk consumers. The surveys objective was to provide insights into consumers' purchase and consumption behaviours. The information gathered included examining perceptions of important drivers of product characteristics, the role of digital media and smart technologies, and consumer preferences for distinctively New Zealand credence attributes.

Overall, results indicate clearly that New Zealand UHT milk is held in high regard as a high-quality offering that is safe, nutritious and has other beneficial characteristics that consumers prefer and value. The statistical analysis of consumers' milk choices using the Discrete Choice Experiment and Latent Class Modelling provides a robust analytical framework to identify consumer segments with differing characteristics and product preferences. Profiling high value consumers can inform a tailored marketing strategy that aims to engage those consumers with highest willingness-to-pay for the types of product attributes that New Zealand can deliver. The relatively strong result found for Pasture Raised claims is an example of this opportunity, and requires the coordination of marketing tools such as through smart technologies and information communicated using digital media to reach these consumers.

The 100% Pasture-raised claim found relatively strong support from around half of Beijing consumers and about two out of five Shanghai consumers. The average willingness-to-pay in the Pasture Preferring segment of Beijing consumers was about 30 per cent higher than that of Shanghai counterparts. Common across both cities, these Pasture Preferring consumers are generally in higher income brackets and rank New Zealand milk quality high. While both cities consumers share many similarities, Beijing consumers tend to have higher purchase and consumption frequency, and importantly they exhibit stronger preferences for the attributes considered with estimates of willingness-to-pay values generally significantly higher for Beijing consumers. A potentially countervailing consumer preference was the lack of effect on UHT milk choice from inclusion of a 100% Grass-fed claim in product offerings. Only a small segment of Shanghai consumers had positive willingness-to-pay for this claim, while the majority of both cities consumers exhibited relatively moderate levels of willingness-to-pay for a Grain-fed claim. This highlights the need to further develop understanding of the qualities that consumers associate with animal fed regimes, and how they interact with pasture systems.

Findings also reinforce the pivotal role that food safety has in Chinese consumers' food choices. Food Safety was the most important factor associated with high quality UHT milk, high nutritional value, and socially responsible production. Here, New Zealand is positioned well as it a regarded supplier of safe milk. Both cities consumers' consider reduced use of agrichemicals and the quality of the on-farm natural environment as important factors associated with high food safety. Consumers expressed that environmental factors were important drivers of social responsibility, and high quality. While moderate levels of willingness-to-pay were found for a Water Quality Protection claim across the majority of both cities consumers', Biodiversity Enhancement and Carbon Neutral claims had no influence on the milk choices of most consumers surveyed. This suggests that the type of environmental benefit generated may play an important role in perceived associations, and requires further study.

The significant role that digital media and smart technologies have in Beijing and Shanghai consumers interaction with UHT milk information and purchasing offers potential avenues to effectively communicate New Zealand claims, that can maintain and enhance market opportunities.

Appendix A
Statistical Method

This appendix provides technical details of statistical analysis of choice data. The appendix includes a brief description of the theoretical foundations of choice analysis followed by statistical probability estimation approaches, focusing on contemporary models applied in this report. Lastly, the method used in generating monetary estimates is described.

A-1 Conceptual Framework

In Choice Experiments (CEs), researchers are interested of what influences, on average, the survey respondents' decisions to choose one alternative over others. These influences are driven by people's preferences towards the attributes but also the individual circumstances such as their demographics or perceptions of the choice task (e.g., the level of difficulty or understanding) (Hensher et al. 2015).

Each alternative in a choice set is described by attributes that differ in their levels, both across the alternatives and across the choice sets. The levels can be measured either qualitatively (e.g., poor and good) or quantitatively (e.g., kilometres). This concept is based on the characteristics theory of value (Lancaster 1966) stating that these attributes, when combined, provide people a level of utility[1] *U* hence providing a starting point for measuring preferences in CE (Hanley et al. 2013; Hensher et al. 2015). The alternative chosen, by assumption, is the one that maximises people's utility[2] providing the behavioural rule underlying choice analysis:

$$U_j > U_i \tag{0.1}$$

where the individual *n* chooses the alternative *j* if this provides higher utility than alternative *i*. A cornerstone of this framework is Random Utility Theory, dated back to early research on choice making (e.g., Thurstone 1927) and related probability estimation. This theory postulates that utility can be decomposed into systematic (explainable or observed) utility *V* and a stochastic (unobserved) utility ε (Hensher et al. 2015; Lancsar and Savage 2004).

$$U_{nj} = V_{nj} + \varepsilon_{nj} \tag{0.2}$$

where *j* belongs to a set of J alternatives. The importance of this decomposition is the concept of utility only partly being observable to the researcher, and remaining unobserved sources of utility can be treated as random (Hensher et al. 2015). The observed component includes information of the attributes as a linear function of them and their preference weights (coefficient estimates).

$$V_{nsj} = \sum_{k=1}^{K} \beta_k x_{nsjk} \tag{0.3}$$

with *k* attributes in vector x for a choice set s. Essentially, the estimated parameter β shows "the effect on utility of a change in the level of each attribute" (Hanley et al. 2013, p. 65). This change can be specified as linear across the attribute levels, or as non-linear using either dummy coding or effect coding

[1]Related terminology used in psychology discipline is *the level of satisfaction* (Hensher et al. 2015).
[2]In choice analysis, utility is considered as *ordinal utility* where the relative values of utility are measured (Hensher et al. 2015).

approaches. The latter coding approach has a benefit of not confounding with an alternative specific constant (ASC) when included in the model (Hensher et al. 2015).

A-2 Statistical Modelling of Choice Probabilities

The statistical analysis aims to explain as much as possible of the observed utility using the data obtained from the CE and other relevant survey data. In order to do so, the behavioural rule (eq. 1.1) and the utility function (eq. 1.2) are combined (Hensher et al. 2015; Lancsar and Savage 2004) to estimate the probability of selecting an alternative *j*:

$$\Pr_{nsj} = \Pr\left(U_{nsj} > U_{nsi}\right) = \Pr\left(V_{nsj} + \varepsilon_{nsj} > V_{nsi} + \varepsilon_{nsi}\right) = \Pr\left(\varepsilon_{nsi} - \varepsilon_{nsj} < V_{nsj} - V_{nsi}\right) \forall j \neq i \quad (0.4)$$

where the probability of selecting alternative *j* states that differences in the random part of utility are smaller than differences in the observed part. A standard approach to estimate this probability is a conditional logit, or multinomial logit (MNL) model (McFadden 1974). This model can be derived from the above equations (1.2 and 1.3) by assuming that the unobserved component is independently and identically distributed (IID) following the Extreme Value type 1 distribution (see e.g. Hensher et al. 2015; Train, 2003). Although the MNL model provides a "workhorse" approach in CE, it includes a range of major limitations (see e.g. Fiebig et al. 2010; Greene and Hensher 2007; Hensher et al. 2015):

- Restrictive assumption of the IID error components
- Systematic, or homogenous, preferences allowing no heterogeneity across the sample
- Restrictive substitution patterns, namely the existence of independence of irrelevant alternatives property where introduction (or reduction) of a new alternative would not impact on the relativity of the other alternatives
- The fixed scale parameter obscures potential source of variation

Some or all of these assumptions are often not realised in collected data. These restrictive limitations can be relaxed in contemporary choice models. In particular, the random parameter logit (RPL) model (aka, the mixed logit model) has emerged in empirical application allowing preference estimates to vary across respondents (Fiebig, et al. 2010; Hensher et al. 2015; Revelt and Train, 1998). This is done by specifying a known distribution of variation to be parameter means. The RPL model probability of choosing alternative *j* can be written as:

$$\Pr_{nsj} = \frac{\exp(\beta_n' x_{nsj})}{\sum_J \exp(\beta_n' x_{nsj})} \quad (0.5)$$

where, in the basic specification, $\beta_n = \beta + \eta_n$ with η being a specific variation around the mean for *k* attributes in vector *x* (Fiebig, et al. 2010; Hensher et al. 2015). Typical distributional assumptions for the random parameters include normal, triangular and lognormal distributions, amongst others. The normal distribution captures both positive and negative preferences (i.e., *utility* and *disutility*) (Revelt and Train, 1998). The lognormal function can be used in cases where the researcher wants to ensure the parameter has a certain sign (positive or negative), a disadvantage is the resultant long tail of estimate distributions (Hensher et al. 2015). The triangular distribution provides an alternative functional form, where the spread can be constrained (i.e., the mean parameter is free whereas spread is fixed equal to mean) to ensure behaviourally plausible signs in estimation (Hensher et al. 2015). Further specifications used in

modelling include parameters associated with individual specific characteristics (e.g, income) that can influence the heterogeneity around the mean, or allowing correlation across the random parameters. The heterogeneity in mean, for example, captures whether individual specific characteristics influence the location of an observation on the random distribution (Hensher et al. 2015). In this study, the frequency of visits to rivers, streams and lakes was used to explain such variance.

Another way to write this probability function (in eq. 1.4) (Hensher et al. 2015) involves an integral of the estimated likelihood over the population:

$$L_{njs} = \int_{\beta} \Pr_{nsj}(\beta) f(\beta|\theta) d\beta \tag{0.6}$$

In this specification, the parameter θ is now the probability density function conditional to the distributional assumption of β. As this integral has no closed form solution, the approximation of the probabilities requires a simulation process (Hensher et al. 2015; Train, 2003). In this process for data *X*, *R* number of draws are taken from the random distributions (i.e. the assumption made by the researcher) followed by averaging probabilities from these draws; furthermore these simulated draws are used to compute the expected likelihood functions:

$$L_{nsj} = E(\Pr_{nsj}) \approx \frac{1}{R} \sum_{R} f(\beta^{(r)}|X) \tag{0.7}$$

where the $E(\Pr_{nsj})$ is maximised through Maximum Likelihood Estimation. This specification (in eq. 1.6) can be found in Hensher et al. (2015). In practice, a popular simulation method is the Halton sequence which is considered a systematic method to draw parameters from distributions compared to for example, pseudo-random type approaches (Hensher et al. 2015).

A-3 Econometric Extensions

Common variations of the RPL model include specification of an additional error component (EC) in the unobserved part of the model. This EC extension captures the unobserved variance that is alternative-specific (Greene and Hensher 2007) hence relating to substitution patterns between the alternatives (Hensher et al. 2015). Empirically, one way to explain significant EC in a model is SQ-bias depicted in the stochastic part of utility if the EC is defined to capture correlation between the non-SQ alternatives (Scarpa et al., 2005).

Another extension which has gained increasing attention in recent CE literature, is the Generalized Mixed Logit (GMXL) model (Czajkowski et al. 2014; Hensher et al. 2015; Juutinen et al. 2012; Kragt 2013; Phillips 2014). This model aims to capture remaining unobserved components in utility as a source of choice variability by allowing estimation of the scale heterogeneity alongside the preference heterogeneity (Fiebig et al. 2010; Hensher et al. 2015). This scale parameter is (inversely) related to the error variance, and in convenient applications such as MNL or RPL, this is normalised to one to allow identification (Fiebig et al. 2010; Louviere and Eagle 2006). However, it is possible that the level of error variance differs between or within individuals, due to reasons such as behavioural outcomes, individual characteristics or contextual factors (Louviere and Eagle 2006).

Recent GMXL application builds on model specifications presented in Fiebig et al. (2010), stating that β_n (in eq. 1.4) becomes:

$$\beta_n = \sigma_n \beta + \gamma \eta_n + (1-\gamma)\sigma_n \eta_n \quad (0.8)$$

where σ is the scale factor (typically = 1) and $\gamma \in \{0,1\}$ is a weighting parameter indicating variance in the residual component. In the case the scale factor equals 1, this reduces to the RPL model. The importance of the weighting parameter is the impact on the scaling effect on the overall utility function (population means) versus the individual preference weights (individual means): when *γ* parameter approaches zero the scale heterogeneity affects both means, whereas when this approaches one the scale heterogeneity affects only the population means (Hensher et al. 2015; Juutinen et al. 2015). Interpretation of these parameters includes

- If *γ* is close to zero, and statistically significant, this supports the model specification with the variance of residual taste heterogeneity increases with scale (Juutinen et al. 2012); and
- If *γ* is not statistically significant from one, this suggests that the unobserved residual taste heterogeneity is independent of the scale effect, that is the individual-level parameter estimates differ in means but not variances around the mean (Kragt, 2013)

The scale factor specification (eq. 1.7) can also be extended to respondent specific characteristics associated with the unobserved scale heterogeneity (Hensher et al. 2015; Juutinen et al. 2015):

$$\sigma_n = \exp\{\overline{\sigma} + \tau \omega_n\} \quad (0.9)$$

where $\overline{\sigma}$ *is* the mean parameter in the error variance; and ω is unobserved scale heterogeneity (normally distributed) captured with coefficient *τ* (Hensher et al. 2015; Juutinen et al. 2015; Kragt, 2013). Juutinen et al. (2012), for example, in context of natural park management found that respondents' education level and the time spent in the park explained the scale heterogeneity ($\tau > 0$, p-value < 0.01). In this study, the respondents indicated levels of choice task understanding and difficulty were used to explain scale heterogeneity.

A-4 Estimation of Monetary Values

Typically the final step of interest in the CE application is the estimation of monetary values of respondent preferences for the attributes considered in utility functions. These are commonly referred to as marginal willingness-to-pay (WTP). WTP estimation is based on the marginal rate of substitution expressed in dollar terms providing a trade-off between some attribute k and the cost involved (Hensher et al. 2015) and is calculated using the ratio of an attribute parameter and the cost parameter. WTP can take into account interaction effects, if statistically significant, such as with the respondent demographics. WTP of attribute *j* by respondent *i* is calculated as the ratio of the estimated model parameters accommodating the influence of the random component (Cicia et al. 2013) as:

$$WTP_i^j = -\left(\frac{\beta_j + \varepsilon_{ij}}{\beta_{price} + \varepsilon_{ip}}\right) \quad (0.10)$$

The estimated mode parameters can also be used to estimate compensating surplus (CS) as a result of policy or quality change in a combination of attributes, using (Hanemann, 1984):

$$\mathbf{CS} = \frac{-1}{\beta cost}\left[\ln\sum_{j=1}^{J}\exp\left\{V_j^0\right\} - \ln\sum_{j=1}^{J}\exp\left\{V_j^1\right\}\right] \quad (0.11)$$

which calculates the difference in utilities before the policy or quality change (V_0) and after the policy or quality change (V_1) (Hanley et al. 2013; Lancsar and Savage 2004). Similar to WTP, the monetary estimation of this change is possible by using the estimate for the monetary attribute $\beta_{cost.}$. Lastly, there are some challenges associated with the empirical estimation of the WTP in the RPL based models. One approach is to use a fixed cost, which simplifies the WTP estimation (Daly et al. 2012) but which may not be as behaviourally a plausible consideration as allowing heterogeneous preferences towards the cost attribute (Bliemer and Rose, 2013; Daziano and Achtnicht, 2014). Conceptually, the estimated cost parameter is a proxy for the marginal utility of income for respondents and economic theory suggests individuals will respondent differently to varying income levels. The use of a random cost parameter however, presents complications in deriving population distribution moments from the ratio of two random parameters.

Appendix B
Latent Class Models of UHT milk choices

Table B-1 Beijing UHT milk choice Latent Class model

UHT Milk Attributes	Class 1		Class 2		Class 3	
Enhanced Animal Welfare	0.44***	(0.09)	0.12	(0.24)	0.29***	(0.05)
Organic Production	0.65***	(0.09)	0.20	(0.23)	0.46***	(0.06)
Increased Protein	1.65**	(0.66)	0.05	(0.39)	-0.27	(0.68)
Increase Calcium	0.61****	(0.12)	0.35	(0.31)	0.23***	(0.07)
100% Pasture Raised	0.79**	(0.32)	0.11	(0.49)	1.17***	(0.23)
Feedlot Raised	0.54***	(0.14)	0.03	(0.41)	0.21**	(0.09)
100% Grass Fed	- 0.15	(0.56)	0.57	(0.46)	0.15	(0.78)
Grain Fed	0.27**	(0.13)	-0.09	(0.35)	0.33***	(0.08)
Care for Workers	0.70*	(0.36)	0.83*	(0.46)	-0.33	(0.24)
Contribute to Local Communities	0.92***	(0.33)	0.88**	(0.38)	- 0.06	(0.21)
Support for Farmers	0.62***	(0.15)	0.19	(0.52)	0.10	(0.10)
Carbon Neutral	-0.53	(0.45)	-0.22	(0.53)	0.11	(0.23)
Biodiversity Enhancement	-0.29	(0.43)	0.21	(0.46)	0.24	(0.21)
Water Quality Protection	0.26**	(0.13)	0.56	(0.38)	0.21***	(0.08)
Price ¥/250ml carton/bag	-0.93***	(0.11)	-1.56***	(0.18)	-0.13**	(0.06)
Opt-out Choice	-2.46***	(0.59)	-4.64***	(0.57)	-4.26***	(0.48)
Average Class Probability	0.47		0.05		0.48	
Log Likelihood	-3,647					
McFadden Pseudo-R^2	0.435					
AIC/N	1.258					
Number of Observations	5,880					

***, **,* denote statistical significance at the 1%, 5% and 10% levels respectively for the null hypothesis that a parameter estimate is not significantly different from zero.
Standard errors in brackets.
[1] Parameter mean estimates indicates the estimated average value in the model, for each different parameter

Table B-2 Shanghai UHT milk choice Latent Class model

UHT Milk Attributes	Class 1		Class 2		Class 3	
Enhanced Animal Welfare	0.43***	(0.05)	0.23***	(0.04)	1.15***	(0.26)
Organic Production	0.68***	(0.06)	0.32***	(0.05)	1.43***	(0.30)
Increased Protein	-1.11	(2.09)	0.21	(0.66)	0.93**	(0.44)
Increase Calcium	0.53****	(0.07)	0.13**	(0.06)	0.54*	(0.33)
100% Pasture Raised	0.35	(0.27)	0.80***	(0.20)	0.62	(0.53)
Feedlot Raised	0.29***	(0.08)	0.27***	(0.09)	1.56***	(0.41)
100% Grass Fed	2.76	(3.56)	-0.23	(0.66)	1.46***	(0.49)
Grain Fed	0.14*	(0.08)	0.20***	(0.07)	0.81***	(0.31)
Care for Workers	0.21	(0.31)	-0.43**	(0.21)	0.87*	(0.46)
Contribute to Local Communities	0.56**	(0.27)	-0.24	(0.19)	0.41	(0.43)
Support for Farmers	0.21**	(0.08)	0.16*	(0.09)	1.13***	(0.40)
Carbon Neutral	-0.99***	(0.29)	0.06	(0.21)	0.69	(0.46)
Biodiversity Enhancement	-0.77***	(0.28)	0.22	(0.19)	0.80	(0.50)
Water Quality Protection	0.35***	(0.08)	-0.01	(0.07)	1.52***	(0.38)
Price ¥/250ml carton/bag	-0.82***	(0.07)	-0.27***	(0.05)	-0.51**	(0.18)
Opt-out Choice	-2.73***	(1.88)	-5.71***	(0.45)	-2.39***	(0.81)
Average Class Probability	0.57		0.38		0.05	
Log Likelihood	-5,860					
McFadden Pseudo-R^2	0.449					
AIC/N	1.221					
Number of Observations	9,680					

***, **,* denote statistical significance at the 1%, 5% and 10% levels respectively for the null hypothesis that a parameter estimate is not significantly different from zero.
Standard errors in brackets.
[1] Parameter mean estimates indicates the estimated average value in the model, for each different parameter

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