

Counterfeiting and Design-Driven Deterrents:

*Trust perceptions
of anti-counterfeiting strategies for
food and product packaging*

by

CAROLINE MAREE FRANCIS
BBE, GDID, MAS (Industrial Design)
ORCID-ID 0000-0002-0903-8828

A THESIS SUMMITTED IN TOTAL FULFILMENT OF THE DEGREE OF
DOCTOR OF PHILOSOPHY

February 2020

FACULTY OF VETERINARY AND AGRICULTURAL SCIENCES
UNIVERSITY OF MELBOURNE

Keywords

Anti-counterfeiting, Authenticity, Brand Protection, Consumer Perceptions, Design Education, Design-Driven, Design Education, Deterrents, Design Thinking, Disruptive Innovation, Export, Food Fraud, Food Product Packaging, Security, SME, Initial Trust, Australian and Chinese, Trust.

Abstract

Purpose - Premium international goods are sought after by quality-concerned Chinese consumers who are increasingly turning towards cross-border e-Commerce and social media platforms with the expectation to avoid local food safety scares. Online retail of foreign brands however, does not guarantee protection against fraud. Counterfeit products are now commonly placed and are marketed equally besides the genuine items exposing consumers to vulnerabilities and heightening their perceived risk prior to purchase. Products are forensically scrutinised on multiple levels of security and further judged on authenticity.

Australian Small-to-Medium Enterprises (SMEs), which make up 97% of all Australia's workforce, are not well represented in the encouraged export trade opportunities as they fear export pathways that are increasingly complicated and changing. Compounding the problem is SMEs limited investment funds to upscale with expensive anti-counterfeiting solutions that may not clearly deliver on counterfeiting deterrent effectiveness and appropriateness to build consumer's 'initial trust'.

This paper seeks to shed light on three key principles of the food counterfeiting phenomenon. Firstly, to map literature on food fraud, packaging counterfeiting with a focus on deceptive counterfeiting operations and tactics. Secondly, to investigate the unique trust relationship formation between risk adverse consumers and emerging, unfamiliar SME brands. Finally, the research will appraise anti-counterfeiting responses, from two perspectives: technological and design-driven, with a primary focus on cost-effective deterrent strategies catering to SMEs.

Design/methodology/approach – A Mixed Methods approach was adopted to integrate the Participatory Action Research (PAR) methodology and co-creation strategies to later inform the larger online survey, triangulating the overall findings through qualitative and quantitative studies. Comparisons were made between Consumer and Industry insights as well as a cross-cultural study between Australia (low risk) and China (high risk) representing diverse levels of Risk Societies. The three studies investigated trust influences and drivers of Security Elements applied to food packaging founded on Technology and/or Design applications. The studies consisted of: (1) a Qualitative Multivariate Analysis, identifying the 5 Design-Driven Influencing Factors (DDIFs), (2) an Anti-Counterfeiting Workshop Model testing 30 security elements through the Case Study methodology, and finally (3) a Quantitative Online Study comparing two populations trust propensities and expectations of security elements on food packaging.

Overall, the research identified that consumers acceptance of anti-counterfeiting elements can be strongly influenced by DDIFs that are appropriate for the food category (Fitted), multiple authenticity checks (Layered), connected to the country of origin (Identity Links), presents a reward attraction (User-Purposed), and technologies use a holistic design (Embedded). Design-Driven elements were identified as strong applicable to SME needs and were perceived as strong deterrent hurdles against counterfeiting threats. Future research is needed in developing education for designers to become the trust design guardians for the expansion and protection of the Australian food exporting industry.

Declaration

This is to certify that:

- (i) I have read and understood the Faculty of Veterinary and Agricultural Sciences “Policy on Plagiarism”;
- (ii) the thesis comprises only of the authors original work towards the Doctor of Philosophy award except where indicated in the preface;
- (iii) due acknowledgement has been made in the text to all other material used; and
- (iv) the thesis is fewer than the maximum word limit in length, exclusive of tables, maps, bibliographies and appendices.

Printed Name: CAROLINE MAREE FRANCIS

Date: 17 . 02 . 2020

Preface

Research undertaken for this thesis has been funded through the support of the Australian Commonwealth Government and the scholarships awarded:

- Australian Postgraduate Award STRAPA (funded in 2016),
- The University of Melbourne Studentship Top-up Scheme (funded in 2016-2018)
- Australian Government Research Training Program Scholarship (funded in 2017-2019).

The industry case study research was carried out in collaboration with the Enterprise Director, Ms Hollis Ashman and Ms Colette Day as co-facilitators to the Anti-Counterfeiting Workshop. The unnamed food industry member who participated in the Workshop research is also acknowledged here.

Acknowledgements

Firstly, I would like to thank Professor Frank Dunshea who enables my research journey and provided clear instructions on how to finish the race. I would also like to thank the Enterprise Director, Hollis Ashman, in her persistence and encouragement for me to become the authority in design-embedded anti-counterfeiting.

To the Associate Professor Sigfredo Fuentes and Dr Paul Gurr, thank you for your participation, contribution and technical and scientific guidance. I would also like to acknowledge Ms Colette Day, a valuable contributor and strategic provocateur.

To the University of Melbourne statistical team for delivering an engaging and equipping statistics course, especially to Ms Sue Finch on her supporting statistical guidance, thank you.

Last, but of most importance, I want to recognise my family; to my children Emmerson and Isaiah Francis, of whom they cheered me on from the sidelines and made coming home my joy. To my dearly beloved husband Matthew, this thesis was completed because of your underlying support and encouragement, you are my equally yoked saint under God.

Table of Contents

Abstract.....	iii
List of Figures.....	ix
List of Tables.....	xiv
List of Abbreviations.....	xvii
Chapter 1: INTRODUCTION	1
1.1 Background.....	2
1.2 Context.....	4
1.3 Purposes	5
1.4 Significance, Scope and Definitions	11
1.5 Thesis Outline.....	14
Chapter 2: LITERATURE REVIEW	17
2.1 Fraudsters and Counterfeiting.....	20
2.1.1 Introduction.....	20
2.1.2 Food Fraud Defined	22
2.1.3 Fraud Theories	25
2.1.4 Fraudster Types and Their Intentions	31
2.1.5 The Crime Formula and Anti-Fraud Response.....	35
2.1.6 Counterfeiting - Deceptive and Non-Deceptive	39
2.1.7 Reasons for Counterfeiting Growth and Risk Exposure	42
2.1.8 Profiling Counterfeiters	44
2.1.9 Counterfeiters Capabilities.....	45
2.1.10 The Impact of Counterfeiting	50
2.1.11 Section Summary	52
2.2 Consumer Trust and Risk Perceptions.....	54
2.2.1 Introduction.....	54
2.2.2 Definitions and Initial Trust.....	56
2.2.3 Perceived Risk	62
2.2.4 Risk Society Theory and Trends	65
2.2.5 Different Worlds Theory.....	68
2.2.6 e-Trust	70
2.2.7 Profiling e-Commerce Consumers	74
2.2.8 Trustworthy Cues for Online.....	76
2.2.9 Perceived Risk Reduced by Positive Experience Design	80
2.2.10 Section Summary	83
2.3 Anti-Counterfeiting and Deterrent Design.....	85
2.3.1 Introduction.....	85
2.3.2 Theories of Approach.....	88
2.3.3 The Dilemma of the Anti-Counterfeiting Constructs.....	91
2.3.4 The Commercialisation Construct	92
2.3.5 The Academic Construct	100
2.3.6 The SME User Construct.....	123
2.3.7 High-Risk Target Case Study.....	126

2.3.8	<i>The Design-Driven Model – An Alternative</i>	136
2.3.9	<i>Section Summary</i>	142
2.4	<i>Summary and Implications</i>	144
2.4.1	<i>Key Theories Summarised</i>	144
2.4.2	<i>Identified Knowledge Gaps</i>	148
2.4.3	<i>Research Hypothesis and Questions</i>	150
2.4.4	<i>Theoretical Framework</i>	152
Chapter 3: RESEARCH DESIGN		155
3.1	<i>Methodology and Research Design</i>	156
3.2	<i>Participants</i>	177
3.3	<i>Instruments</i>	183
3.4	<i>Procedures and Timelines</i>	191
3.5	<i>Analysis</i>	197
3.6	<i>Ethics and Limitations</i>	205
Chapter 4: RESULTS & ANALYSIS		207
4.1	<i>Results (Study 1) - Qualitative Consumer Appraisals</i>	209
4.2	<i>Analysis (Study 1) - Qualitative Consumer Appraisals</i>	223
4.3	<i>Results (Study 2) - Qualitative Industry Appraisals</i>	237
4.4	<i>Analysis (Study 2) - Qualitative Industry Appraisals</i>	242
4.5	<i>Results (Study 3) - Quantitative Consumer Survey</i>	249
4.6	<i>Analysis (Study 3) - Quantitative Consumer Survey</i>	282
Chapter 5: CONCLUSION		303
5.1	<i>Conclusions</i>	304
5.2	<i>Discussion of Limitations</i>	312
5.3	<i>Recommendations</i>	314
Bibliography		317
Appendices		xix
Appendix A	<i>Study 2 Workshop Proposal</i>	xxi
Appendix B	<i>Study 3 Online Survey Questionnaire</i>	xxix
Appendix C	<i>Ethics Summary Approval Form</i>	xli
Appendix D	<i>Plain Language Statement</i>	xlvi
Appendix E	<i>Participant Consent Form</i>	xlxi
Appendix F	<i>Study 1 QMA Plotted Elements</i>	li
Appendix G	<i>Study 3 Online Survey Statistical Analyses</i>	liii

List of Figures

Figure 1. Literature Review Framework showing the Impact Chain and the Crucial Diamond Research Questions on Fitness and Acceptance (adapted from Wolfe and Hermanson (2004) <i>Fraud Diamond</i>).	19
Figure 2. Cressey's Fraud Triangle (Cressey, 1953, Dorminey et al., 2012).	26
Figure 3. Fraud Diamond Framework (Wolfe and Hermanson, 2004).	27
Figure 4. Attributes of the Predator Fraudster Model (Dorminey et al., 2012).	31
Figure 5. Food Protection Plan Progression (Spink and Moyer, 2011b).	33
Figure 6. Comparison of Reactive Strategy (top graph) to Proactive Strategy (bottom graph) (Sincerbox, 1993).	34
Figure 7. Albrecht et al. (2006) Triangle of Fraud Action: The Crime, referenced by Dorminey et al. (2012).	35
Figure 8. The Anti-Fraud Profession's Response (Dorminey et al., 2012).	36
Figure 9. The Crime Triangle ((Spink, 2010, Spink, 2007); adapted from Felson (1998)).	37
Figure 10. Access to Technology in Australia ((Brown et al., 2017), Secondary Data from the (2016)).	43
Figure 11. Real (Left) next to Fake (Right), 1962 La Tâche Premium Wines Counterfeited (Mercer, 2014).	46
Figure 12. Authentic Reid Fruit Cherries (left) and the Counterfeit Packaging (right) (ABCNews, 2015).	47
Figure 13. Counterfeiters Capabilities as defined by Packaging Replication (Francis, 2017).	48
Figure 14. The e-Commerce Trust Development Life Cycle (Fung and Lee, 1999).	59
Figure 15. Perceived Risk Conceptual Model (Ha, 2002).	63
Figure 16. Total Retail Report on China and Global eCommerce Comparisons (PWC, 2017).	70
Figure 17. Online and Offline Comparisons across China and Global Summaries (PWC, 2017).	71
Figure 18. Playfulness and Other Experimental Elements Influencing Perceived Personality Traits of a Website ((Shobeiri et al., 2013) adapted from (Mathwick et al., 2001, p.42)).	80
Figure 19. Anti-Counterfeiting Response Stance from a Preventative or Detective Perspective of the Crime Act.	85
Figure 20. The Process of Building Theory (Christensen, 2006).	90
Figure 21. The AIPIA's Categories of Smart Packaging Reviews (2019).	96
Figure 22. Relationship of Technology and Business Models (Khan and Turowski, 2016, Schaefer and Cheung, 2018)	99
Figure 23. Ten Courses of Action Tested Against WTO Commitment (Schultz et al., 1996)	103
Figure 24. Food Fraud Mitigation Framework: proposed by PWC (2016b).	104

Figure 25. (left) Security Printing Combining Hologram Overlay (PuraGroup, 2019).	109
Figure 26. (right) Nano Engraving of Chocolate Mould Surface (Crutchley, 2014).	109
Figure 27. Spray Adhesive Graphene Quantum Dots (GQD) (DataDot, 2019).	110
Figure 28. Smirnoff Vodka showing Peelable Fruit-Skin Branding on Shrink Wrap Destructive Packaging (Pfrang, 2011).	113
Figure 29. Newton Shoes with Unique, Custom Form-Fit Packaging (Nastu, 2009).	114
Figure 30. Example of Intaglio Printing and Merging Overlapping Lines.	115
Figure 31. Moire Patterns using Two Layers of Intersecting Lines at Adjacent Angles (Li, 2015).	115
Figure 32. (left) “Image of Cathedral Under Daylight” (Ziljak et al., 2010).	117
Figure 33. (right) “Image of the Cathedral Scanned with an IR Camera under 665 nm Barrier Filter – Transformation of Impression in IR Graphics” (Ziljak et al., 2010).	117
Figure 34. Voronoi Tessellation, Convex Polygon Regions – Resized (Sourced Creative Commons)	118
Figure 35. (left) 3D Logo with Aperiodic Tessellation Patterns (Do3D, 2019)	119
Figure 36. (right) 3D Modelled Abstract Geometrical Composition showing Varied Textures, Forms and Colours (DepositPhotos, 2019).	119
Figure 37. (left) Almond Milk Promotional Scene with Brand Top Right (Deposit Photos, 2019).	120
Figure 38. (right) Francis (2019) “Modified” Brand Promotional Scene using Online Sourced Almond (adapted DepositPhotos, 2019).	120
Figure 39. Unique Label Profile and Custom Bottle Shape with Layered Textures and Complex Elements all Combined Deterrents (Cubbon, 2019).	121
Figure 40. Unique Artwork with Layered Paint, Colour and Textures (Guseff, 2019)	122
Figure 41. Paid Workers Thread Security Strips by Hand into Individual Bills as revealed in The Guardian (Franklin, 2016).	126
Figure 42. Reserve Bank of Australia Counterfeit Detection of \$5 Banknotes with Added Negative Trendline showing a 1-Year Plateau Period from the Issue of the New Polymer Banknote Released on 1 September 2016 (adapted from RBA data, 2019).	128
Figure 43. Australian Banknotes Detected in 2015-2016 based on Banknote Denomination (RBA, 2018).	128
Figure 44. Counterfeiting Rate as at 2015 showing Yearly Rate and 5 Year Average Peak Rate (Brown et al., 2017)	129
Figure 45. Counterfeits Detected by Substrate reported in 2016 (Brown et al., 2017)	129
Figure 46. Cloneable Anti-Counterfeiting Tags used in Euro Banknotes (Arppe and Sorensen, 2017) adaption of the Euro Banknote.	131
Figure 47. Specimen of the Australian \$5 Polymer Banknote (Reserve Bank of Australia, 2016)	131

Figure 48. <i>Welcome to Sunny Fitzroy, Melbourne by EverFresh Studios</i> (Photograph: Graham Denholm, Timeout, 2019).....	138
Figure 49. <i>Mural in Targeted Hot-Spot Re-Vandalised (Craw et al, 2006)</i>	139
Figure 50. <i>The Anti-Fraud Professionals Response adapted to show Trust</i> <i>Impact (Francis, 2019b) adapted from (Dorminey et al., 2012).</i>	144
Figure 51. <i>Francis (2019b) adapted Trust Development Cycle framework (Fung</i> <i>and Lee, 1999) depicting Brands competing with Fraudsters on Initial</i> <i>Trust.</i>	146
Figure 52. <i>Theoretical Framework.</i>	152
Figure 53. <i>The Mixed Methods Research Conceptual Model using Triangulation</i>	158
Figure 54. <i>Participatory Action Research Model (Reason and Bradbury, 2001,</i> <i>Francis, 2019b)</i>	159
Figure 55. <i>The Co-Creation Continuum (Ind et al., 2017)</i>	159
Figure 56. <i>Design Thinking Stages adopted for the Anti-Counterfeiting</i> <i>Workshop.</i>	160
Figure 57. <i>Problem-Oriented Case Study Stages (Irweb, 2019).</i>	162
Figure 58. <i>Research Design using Mixed Methods over 3 Studies.</i>	163
Figure 59. <i>Qualitative Multivariate Analysis, Preference Matrix with</i> <i>Participants.</i>	165
Figure 60. <i>Preference Matrix and the Four Quadrants Identified.</i>	165
Figure 61. <i>QMA Post-Session Plot Record.</i>	166
Figure 62. <i>Online Survey Conceptual Framework.</i>	173
Figure 63. <i>Online Wine Survey Showing the Everyday Pack Format.</i>	175
Figure 64. <i>Online Wine Survey Showing the Premium Pack Format.</i>	175
Figure 65. (left) <i>QMA Stimulus for assessing Design (13 visuals).</i>	183
Figure 66. (right) <i>QMA Stimulus for assessing Technology (9 visuals).</i>	183
Figure 67. <i>QMA Preference Matrix with Descriptor Anchors and Plotted Visuals.</i>	186
Figure 68. <i>Rapid Knowledge Mapping of Current Risk Perceptions.</i>	187
Figure 69. <i>An Example of a Security Element Summary Poster Reference B1.</i>	188
Figure 70. <i>Workshop Security Element Card (Ref D1 Destructive Packaging).</i>	188
Figure 71. <i>Workshop Success Criteria Sheet to Disarm Counterfeiter's</i> <i>Capabilities.</i>	189
Figure 72. <i>Worksheet Summary Sheets for Stakeholder Appraisals.</i>	194
Figure 73. <i>Brand Enhancing x Insurance Value Graph showing Five Plotted</i> <i>Prototypes of Co-Created Security Elements.</i>	195
Figure 74. <i>QMA comparison of the two groups assessing the technology visuals.</i>	197
Figure 75. <i>QMA Technology plots using a 4-point coordinates grid format.</i>	198
Figure 76. <i>QMA Preference Co-Ordinates Summarised for Analysis.</i>	198
Figure 77. <i>QMA Transcriptions Summarised for Analysis with Clustered</i> <i>Insights.</i>	199
Figure 78. <i>QMA Analysis comparing Technology Premium and Trust Rankings.</i>	199
Figure 79. <i>Workshop Prototype (K1+H1+Y1) against the Success Criteria.</i>	201

Figure 80. Scatterplot of Design Elements Total X_M , Y_M Coordinates with Reference Numbers.	212
Figure 81. Radar Plot of Design QMA Combined X_M , Y_M Coordinates.	213
Figure 82. Scatterplot of Technology Elements Total X_M , Y_M Coordinates.	215
Figure 83. Radar Plot of Technology QMA Combined X_M , Y_M Coordinates.	216
Figure 84. QMA Technology Element 7 (top) and Element 9 (bottom) compared on Fitted and User-Purposed DDIFs with Transcriptions.	225
Figure 85. QMA Design Element 2 (left) and Element 4 (right) compared on Identity Linked and Layered DDIFs.	226
Figure 86. QMA Technology Element 1 (top) and Element 4 (bottom) compared on Embedded and Layered DDIFs with Transcriptions.	227
Figure 87. The Five Bundled Prototypes Using Anti-Counterfeiting Elements.	238
Figure 88. Prototype 1 tested against the Success Criteria (rating 3 out of 6).	239
Figure 89. Prototype 2 tested against the Success Criteria (rating 4 out of 6).	239
Figure 90. Prototype 3 tested against the Success Criteria (rating 5 out of 6).	239
Figure 91. Prototype 4 tested against the Success Criteria (rating 6 out of 6).	240
Figure 92. Prototype 5 tested against the Success Criteria (rating 6 out of 6).	240
Figure 93. Workshop Evaluation Feedback Survey Results.	241
Figure 94. Workshop 30 Anti-Counterfeiting Elements showing Omitted Elements.	243
Figure 95. Study 2 Co-Created Prototype using 3 Design-Driven Elements that Deter all Six Counterfeiter's Capabilities.	248
Figure 96. Life Stage Distribution of Study Participants.	252
Figure 97. Gender Distribution of Study Participants.	253
Figure 98. Income Quintiles of Participants per Country.	254
Figure 99. Distribution of Participants Place of Residence within Australia (measured in frequencies).	255
Figure 100. Distribution of Participants Place of Residence within China (shown in frequencies).	256
Figure 101. Multiple Correspondence Analysis (MCA) Column Plots for Australia Trusted Security Elements (Graph left: Components 1 and 2, Graph right: Components 3 and 4).	261
Figure 102. Multiple Correspondence Analysis (MCA) Column Plots for China Trusted Security Elements (Graph left: Components 1 and 2, Graph right: Components 3 and 4).	262
Figure 103. Residual Plots showing data fit for ANOVA test.	264
Figure 104. The Tukey's Difference in Means Test between China's and Australia's Total Trusted Security shown with a 95% confidence interval.	266
Figure 105. Residual Plots for Australian Trusted Total Trusted Security.	269
Figure 106. Residual Plots for Chinese Trusted Total Trusted Security.	269
Figure 107. Australian Main Effects Plot of Total Trusted Security across Variables.	270
Figure 108. Chinese Main Effects Plot of Total Trusted Security across Variables.	270

Figure 109. Interval Plots of Australian Food Categories ordered from smallest to largest expected Total Trusted Security.	273
Figure 110. Interval Plots of Chinese Food Categories ordered from smallest to largest expected Total Trusted Security.	274
Figure 111. Interval Plots showing Trust Propensity of the Food Industry and Food Categories per Country.....	285
Figure 112. Interval Plot of Total Trusted Security across Trust Propensity per Country.....	286
Figure 113. Revisited Australian Main Effects Plot of Total Trusted Security across Variables.....	290
Figure 114. Revisited Chinese Main Effects Plot of Total Trusted Security across Variables.	290
Figure 115. Interval Plot of Total Trusted Security across Food Categories per Country.....	291
Figure 116. Interval Plot of Total Trusted Security across Life Stage per Country.	292
Figure 117. Interval Plot of Total Trusted Security across Living Arrangement per Country.	294
Figure 118. Interval Plot of Total Trusted Security across Income Quintiles per Country.....	295
Figure 119. Interval Plot of Total Trusted Security across Residence per Australia.....	295
Figure 120. Interval Plot of Total Trusted Security across Residence per China.	296
Figure 121. Australian Made Logo and Awards Element (left) Interaction Plot, (right) Main Effects Plot over Food Categories per Country.	297
Figure 122. Currency Security Graphics Element (left) Interaction Plot, (right) Main Effects Plot over Food Categories per Country.	298
Figure 123. Pack Use Once Element (left) Interaction Plot, (right) Main Effects Plot over Food Categories per Country.	299
Figure 124. Scan QR Element (left) Interaction Plot, (right) Main Effects Plot over Food Categories per Country.	300
Figure 125. Design and Materials Element (left) Interaction Plot, (right) Main Effects Plot over Food Categories per Country.	300
Figure 126. Proposed Theoretical Framework.	311

List of Tables

Table 1. Food Risk Matrix defining Food Fraud from other food related research fields (adapted from Spink and Moyer (2011b)).	22
Table 2. The Fraud Diamond's Components of Capability (Wolfe and Hermanson, 2004).	28
Table 3. Criminal Types and Attributes that apply to product-counterfeiting incidences ¹ ((Spink et al., 2014, Spink et al., 2010) adapted from (Hagan, 2010)).	32
Table 4. Food Fraud incident types (Spink, 2007, Spink and Moyer, 2011b)).	44
Table 5. Trust Parameters: Summarised from Literature (Francis, 2019).	57
Table 6. Risk Factors in the Counterfeiting Context ((Francis, 2019) adapted (Cox, 1967; Ha, 2002))	62
Table 7. Types of Anti-Counterfeiting Technology (Li, 2013)	95
Table 8. Frequently Used IPR Actions to Combat Counterfeiting (Chaudhry et al., 2009) adapted (Review of Literature References).	105
Table 9. Managerial Ranked Most Effective Anti-Counterfeiting Actions (Chaudhry et al., 2009)	106
Table 10. The Advantages and Disadvantages of Overt and Covert Technologies (Ruchir et al., 2010).	123
Table 11. The Five Security Domains with Representative Elements across 'Everyday' and 'Premium' Status showing Repeat or Change Alerts.	171
Table 12. Online Survey Example of 'Everyday' and 'Premium' Comparisons.	174
Table 13. QMA Participant Frequencies and Proportions recorded over 2016-2017.	177
Table 14. Online Survey Recruitment and Analysis Frequencies for Australian and Chinese Participants.	179
Table 15. Online Survey Participant Demographics showing Frequencies and Proportions compared across Countries recorded over 2017-2018.	180
Table 16. Living Arrangements Recorded Groups and Criteria for Inclusion.	181
Table 17. Online Survey Participants Residential Region Frequencies and Proportions compared across Countries recorded over 2017-2018.	181
Table 18. Online Survey Food Categories (Higher-Level) showing Participant Frequencies and Proportions compared across Countries as of 2017-2018.	182
Table 19. QMA Selection Criteria across Trust Attributes: Familiarisation, Transparency, Ability, Engagement and Capability per Visual.	185
Table 20. QMA Sessions and Time Allocations.	191
Table 21. Workshop Analysis Table of Ranked Security Elements against Counterfeiting Capabilities.	200
Table 22. Design QMA Results of Session 1 (n=8) and Session 2 (n=8) Group Coordinates (x, y) and Combined Session Results (n=16) summarised as Total Means (X_M , Y_M) (as of Sept 2016).	211

Table 23. Technology QMA Results of Session 1 (n=8) and Session 2 (n=8) Group Coordinates (x, y) and Combined Session Results (n=16) summarised as Total Means (X_M , Y_M) (as of Sept 2016).	214
Table 24. Clustered Insights for Design Results (continued over page).	218
Table 25. Clustered Insights for Technology Results (continued over page).	221
Table 26. Design-Driven Influence Factors (DDIFs)	224
Table 27. Design QMA Ranked Results showing Individual Premium and Trust Rank Scores and a Total Average Rank Score (as of Sept 2016).	228
Table 28. Technology QMA Ranked Results showing Individual Premium and Trust Rank Scores and a Total Average Rank Score (as of Sept 2016).	232
Table 29. Study 2 Co-Appraised Stakeholder Ranked Votes for 30 Anti-Counterfeiting Elements showing Accepted and Rejected Appraisals across Three Types: (1) Design-Driven, (2) Technology and (3) Design-Driven and Technology.	244
Table 30. Study 2 Elements Grouped by Type showing Accepted and Rejected Totals	246
Table 31. Participant Demographics showing Frequencies and Proportions compared across Countries recorded over 2017-2018.	251
Table 32. Living Arrangements Recoded Groups and Criteria for Inclusion.	253
Table 33. Participant Residential Region Profiles showing Frequencies and Proportions compared across Countries recorded over 2017-2018.	255
Table 34. Food Categories with Allocated Participants showing Frequencies and Proportions per Country.	257
Table 35. Participant Trust Propensities of Food Suppliers and Regulators measured on a 7-point Likert Scale showing Mean and Standard Deviation per Country (2017-2018).	258
Table 36. Multiple Correspondence Analysis (MCA) Factor Definitions by Security Elements.	260
Table 37. ANOVA GLM: Interaction Comparison of Populations expected Total Trusted Security across Food Categories, Demographics and Trust Propensity Variables (Dec 2018).	264
Table 38. Descriptive Statistics and Tukey Pairwise Comparisons for Australian and Chinese Expected Total Trusted Security (Dec 2018).	266
Table 39. ANOVA GLM: Total Trusted Security across Food Categories, Demographics and Trust Propensities of Australian Participants (Dec 2018).	271
Table 40. ANOVA GLM: Total Trusted Security across Food Categories, Demographics and Trust Propensities of Chinese Participants (Dec 2018).	272
Table 41. ANOVA GLM: Total Trusted Security across Individual Food Categories per Country (Dec 2018).	274
Table 42. ANOVA GLM: Total Trusted Security across Life Stage per Country (Dec 2018).	276
Table 43. ANOVA GLM: Total Trusted Security across Living Arrangements per Country (Dec 2018).	277
Table 44. ANOVA GLM: Total Trusted Security across Income Quintiles per Country (Dec 2018).	277

Table 45. ANOVA GLM: Total Trusted Security across Residence Region per Country (Dec 2018).	278
Table 46. ANOVA GLM: Total Trusted Security across Trust Propensity per Country (Dec 2018).	279
Table 47. Country Participants of Nominated Security Elements Expected on Australian Food Packaging Categories shown in Proportions and Odds Ratios with Respective 95% Confidence Intervals and resulting P-values.	281
Table 48. Multiple Correspondence Analysis (MCA) Column Contribution Inertia Results for Multivariate Factors Influencing on Consumer Trust per Country (2018).....	288

List of Abbreviations

<i>ABC</i>	<i>Australian Broadcasting Corporation</i>
<i>ABS</i>	<i>Australian Bureau of Statistics</i>
<i>ACG</i>	<i>The Anti-counterfeiting Group</i>
<i>ACT</i>	<i>Anti-Counterfeiting Technology</i>
<i>AIPIA</i>	<i>Active and Intelligent Packaging Industry Association</i>
<i>ANOVA</i>	<i>Analysis of Variance</i>
<i>CI</i>	<i>Confidence Intervals</i>
<i>DDIF</i>	<i>Design-Driven Influencing Factors</i>
<i>DEFRA</i>	<i>Department for Environment, Food and Rural Affairs</i>
<i>DOM</i>	<i>Difference of Means</i>
<i>ET</i>	<i>Enhanced Traceability</i>
<i>IACC</i>	<i>International Anti-Counterfeiting Coalition</i>
<i>IP</i>	<i>Intellectual Property</i>
<i>FMCG</i>	<i>Fast Moving Consumer Goods</i>
<i>FSAUK</i>	<i>Food Standards Agency United Kingdom</i>
<i>GLM</i>	<i>General Linear Model</i>
<i>GPS</i>	<i>Global Positioning System</i>
<i>GQD</i>	<i>Graphene Quantum Dots</i>
<i>MCA</i>	<i>Multiple Correspondence Analysis</i>
<i>MNC</i>	<i>Multi-National Corporations</i>
<i>NFC</i>	<i>Near Field Communication</i>
<i>NSF</i>	<i>National Sanitation Foundation International</i>
<i>OR</i>	<i>Odds Ratio</i>
<i>OECD</i>	<i>Economic Co-operation and Development</i>
<i>PAR</i>	<i>Participatory Action Research</i>
<i>PDH</i>	<i>Proactive Deterrent Hurdles</i>
<i>PUF</i>	<i>Physical Unclonable Function</i>
<i>PWC</i>	<i>Price Waterhouse Coopers</i>
<i>QMA</i>	<i>Qualitative Multivariate Analysis</i>
<i>QR</i>	<i>Quick Response</i>
<i>RBA</i>	<i>Reserve Bank of Australia</i>
<i>RDR</i>	<i>Reactive Detection Responses</i>
<i>RFID</i>	<i>Radio Frequency Identification</i>
<i>SME</i>	<i>Small-to-Medium Enterprise</i>
<i>SOA</i>	<i>Seals of Approval</i>
<i>WoM</i>	<i>Word-of-Mouth</i>
<i>WTO</i>	<i>World Trade Organisation</i>

Chapter 1:

Introduction

The purpose of Chapter 1.0 is to introduce the dissertations contents and overall objectives to achieve the defined purposes of the study.

This chapter presents on the *Background* (Section 1.1) and *Context* (Section 1.2) of the research, and its *Purposes* (Section 1.3). The *Significance* and *Scope* of this research is described (Section 1.4) and provides *Definitions* of terms used. Finally, a *Thesis Outline* (Section 1.5) is summarised introducing the remaining chapters structure of the thesis.

1.1 *Background*

Australia is internationally known for agricultural best practices and quality produce. It is often coined as the clean, green country (Zonca, 2015) with a growing reputation of premium foods which are well sort after by quality-concerned Chinese consumers. This export opportunity is enhanced by the China-Australia Free Trade Agreement (ChAFTA) which was commenced December 20th, 2015 (Austrade 2016), that through its rollout, is removing many barriers for Australian agri-businesses to access and leverage the growing markets within China. Small-to-Medium Enterprises (SMEs) are freer to expand and diversify through exporting and are looking for economical and practical applications to successfully sell online to Chinese consumers. Cross-Border E-Commerce offers streamlined channels for international companies to reach online shoppers and therefore bypassing the more complex and regulatory supply chains of selling through the “Bricks and Mortar” local retail stores. It is forecasted that China Cross-Border Transactions will reach US\$1 Trillion at the end of 2020 (China Internet Watch, 2016).

With export opportunities, Australian agribusinesses strive to build consumer trust and protect valuable Intellectual Property (IP). As their products are perceived as high quality and premium due to excellent production methods and clean environments, demand is on the rise. However, rapid growth in consumer demand brings with it a heightened risk in food fraud. *Food fraud* is “a collective term used to encompass the deliberate and intentional substitution, addition, tampering, or misrepresentation of food, food ingredients, or food packaging; or false or misleading statements made about a product, for economic gain” (Spink and Moyer, 2011a). The Pew Research Centre reports that numerous high-profile scandals recently regarding unsafe food products have increased the Chinese public’s awareness of Food Fraud and stated that their concerns of food safety are on the rise from 12% surveyed in 2008 to 40% in 2016 (Wike and Stokes, 2016 p.2). Chinese consumers are considered the “weakest link of the five pillars of food safety in China” (being Government, Industry, Academia, Media and Consumer) (Jen and Chen, 2017 p.12), and consumers exposed to food fraud are twice shy. Exposure to food fraud and counterfeit products can be heightened directly through first-hand experiences or through indirect methods such as media reports and social Word-Of-Mouth (WoM), both of which can impact consumers risk perceptions and influence their forensic questioning of food authenticity. Online consumers are becoming risk adverse,

scrutinising products on multi-layered criteria and seeking deeper information prior to purchase. Ha (2006) defines 6 perceptions of risk e-Commerce consumers assess prior to purchase defined as “Security, Privacy, Brand Name, WoM, Information, and (Past) Experience”. These 6 perceptions are founded on trust and

Brand name is leveraged by established businesses with strong local market reputation. This is built on repeated exposure and recognisable ‘familiar’ attributes. Brand, has in the past, acted as a seal of quality and proof of authenticity to online and offline shoppers. The World Economic Forum (Forum, 2004) reported the strongest success measure for businesses was found to be “brand reputation”, which outperformed the expected financial performance indicator. However, emerging SMEs with little brand recognition, lacking home market footholds need to explore alternatives to brand status. SME’s within Victoria State make up 76% of Victoria’s food processing businesses (Powers 2014) which is over three quarters of the industry potentially requiring alternative strategies to brand. Defining ‘Trust’ and the essential building blocks that make up its foundations aids the understanding of planning and designing for trust. Businesses with no familiarity with new markets need to first seek out consumer’s ‘Initial Trust’ (McKnight et al., 1998) which is the competitor ground where counterfeiters prey. Competitors exploit Initial Trust as they ‘copycat’ authentic brands and to avoid detection, operate outside the original brands market jurisdictions.

Initial Trust is fragile and consumer loyalty can be established once authenticity has been judged dependable. Unfamiliar businesses to the market, such as emerging, new to market SMEs require substitution for brand familiarity that also acts as replicant resistant elements. Packaging sophistication plays a key role in building consumer trust. Businesses are encouraged to adopt methods of storytelling (Zonca 2016) to show authenticity and look to robust security technology measures for maintaining quality and protecting IP. However, marketing and technology alone is not the complete key to overcoming counterfeiting threats as they too are well equipped using superior features. While many technologies offer protective attributes, the question remains, can consumer Initial Trust of security elements be strengthened or damaged? Innovative packaging has a greater purpose than what it once was constructed to do. Consumers are requiring more from the businesses to engage them and outsmart counterfeiters to develop lasting trust-based relationships.

1.2 *Context*

Counterfeiting of food packaging is an exponentially growing risk for exporting companies and a threat to IP and brand reputation. Fraudsters are looking for easy economical gain and target all sized businesses especially those who are less equipped to follow up on detected illicit operations such as vulnerable SMEs (DEFRA, 2014). In response, the Anti-counterfeiting industry is pushing for service based high-tech applications that offer authenticity checks and track-n-track data logging. However, these applications not only add costs to each unit, they often require an upscale of human resources to manage content and monitoring of the integrated systems increasing the complexities for emerging sized businesses.

A shift in research focus from detection procedures to pro-active deterrent strategies (Spink et al., 2013) has been identified to minimise counterfeiting attempts prior to the fraudulent crime act. This is to avoid damaged trust of consumers exposed to direct experiences or indirect word of mouth awareness of counterfeiting risks. Deterrent strategies have been used over time and on many applications, from the more obvious forms of identify documents and currency banknotes to products varying in status such as high-value luxury goods through to low-value Fast-Moving Consumer Goods (FMCGs) such as chocolate. Whilst many of these tactics are still relevant to today, they are often overlooked as deterrent resources, especially to the food industry, as they are not commercially promoted. Design-driven deterrents have been created in-house or through design agencies offering flexibility in their applications. Design-driven deterrent elements, with research justification, could prove to build consumer trust and frustrate fraudsters more so in comparison to the complex, smart technologies being rapidly developed and commercially promoted through industry.

1.3 *Purposes*

The overall purpose of the research is to support exporting SMEs awareness and selection of the appropriate anti-counterfeiting technologies and design strategies that can be tailored to their unique business needs and in turn, strengthen Chinese consumers perceived value and trust. Thus, the aim of the research is two-fold:

Firstly, to investigate if design can either act as a form of security and/or positively influence anti-counterfeiting acceptance (Trust) and perceived quality (Premium) by consumers and by unfamiliar SME brands.

Secondly, to review the overall trends adopted by the anti-counterfeiting high-tech industry and reconsider best practice for emerging exporters.

To achieve these aims, the *research objectives* are outlined (Section 1.3.1) which leads to the posed *research questions* that guide the investigation (Section 1.3.2). The *role of the researcher* is explained (Section 1.3.3) and a brief *overview of the selected methodology* is summarised (Section 1.3.4).

1.3.1 Research Objectives

To achieve the aims, four top-level categories of research are investigated from established academic literature and industry reports relating to:

- a. packaging counterfeiting,
- b. consumer trust and risk,
- c. anti-counterfeiting technologies,
- d. designed based security strategies.

The research objectives are:

1. To assess technology and design elements with consumers and industry to identify what are the key influences on security elements communication of trustworthiness and authenticity and what hinders consumer confidence creating counterfeit scepticism (Study 1).
2. To develop and test an anti-counterfeiting workshop for the food industry to support informed group decisions that are valuable to both the business and consumer needs (Study 2).
3. To compare consumer's trust perceptions and security expectations cross-culturally across exported food products and packaging (Study 3).
4. To review the collated findings from the three studies and develop complimentary alternatives to current trends of the high-tech anti-counterfeiting industry using design orientated solutions based on sophistication and intricacy.

Overall, the main objective is to assess security trust expectations from both industry and consumers (cross-culturally) to gain insights that will support the Australian SME exporting community.

1.3.2 Research Questions

Three research questions are posed to guide the three research studies of inquiry, respectively. They are stipulated here and revisited throughout the chapters as required:

Question 1: *Does design impact consumer's acceptance and perceived value of anti-counterfeiting securities applied to food packaging?*

Question 2: *Would an anti-counterfeiting workshop, facilitating multiple stakeholders through co-creative strategies that use design-driven deterrents and anti-counterfeiting technologies, positively impact on exporting SME decision making and planning?*

Question 3: *Do cultures of varying trust propensities comparatively expect different levels of security to trust unbranded products authenticity across food categories, packaging formats, demographics profiles and product status levels?*

1.3.3 Role of the Researcher

The research adopts a Mixed-Methods approach merging qualitative inquiries with quantitative methods with the former insights defining the latter design. The Participatory Action Research (PAR) methodology as defined in Chapter 3.0, Section 3.1.1 Methodology is employed for the first two qualitative studies. PAR states that a researcher participates in the study as a facilitator who learns and evolves research questions as the study progresses; like that of a natural conversation, whilst ensuring the study can be repeatable. Thus, qualitative-based studies 1 and 2 involve the direct participation of the researcher and draws on additional researchers based on their expertise to support model development and execution. Study 3 is the primary study and is structured on a traditional online survey, investigating cross-cultural comparisons. In this study, the researcher is a joint-architect and analyser of the survey design and outputs. However, the data gathering procedure was executed by an outsourced third-party, project managed by the researcher.

1.3.4 Overview of Methodology

As fraud threats and counterfeiting impacts multi-disciplines and industries across every nation, it is not surprising that this topic is well established in academic literature and its presence is freshly reported in modern news and media outlets. Therefore, this thesis takes a cross-discipline approach and draws upon literature established in: business, branding and marketing management; social and behavioural sciences; consumer psychology; design and innovation research; law and policy; criminology; human and computer interaction; and cultural semiotics, aesthetics and perspectives.

The research adopts the Mixed Methods approach (Chapter 3 Research Design) and is founded on more than one theoretical framework driving methodologies from Social Exchange Theory (Homans, 1958) with social behaviour as an “exchange of goods both material and non-material based on reward and cost”; PAR (Freire et al., 2012, Hocesvar, 2018) is simply summarised as “theory informs practice, practice refines theory, in a continuous transformation” (O'Brien, 1998); A Risk Society Theory (Beck, 1992) that with the advancements of technology and modern societies comes the increased risks of ungoverned threats; Theory of Reasoned Action (TRA) (Fishbein and Ajzen, 1975) believes pre-existing attitudes and intentions govern how individuals will behave; Model of Trust and “Initial Trust” (Mayer et al., 1995) model the framework of the beginnings of a trusting relationship; and the Function and Value of Aesthetics (Van Meter, 1941) theorise the evolution of aesthetics and the value that comes with its function. All theories are presented in detail throughout the critical review of literature Part Two of this thesis.

Collectively, these theories construct a framework for the research that follows the cyclic participatory method of: (1) identifying a problem, (2) study and plan, (3) take action, (3) collect and analyse evidence, (4) reflect and share, repeat cycle until problem understanding is satisfied. PAR (Freire et al., 2012) informs us that “Rational social management...proceeds in a spiral of steps, each of which is composed of a circle of planning, action and fact-finding about the result of action.” The research process uses this iterative process through Mixed Methods combining the use of Qualitative and Quantitative methods. Two qualitative methods were initially investigated which developed a further theory of Design as Security which itself and other insights were

tested for significance using a qualitative online survey. The outlined studies, per order of execution are as follows:

Study 1 - Qualitative Multivariate Analysis

Study 2 - Industry Workshop Case Study

Study 3 - Quantitative Conjoint Analysis

All three studies are detailed within Chapter 3.0 Research Design and Chapter 4.0 Results and Analysis which discusses the collective insights and statistical interpretations. Chapter 5.0 concludes the overall thesis and highlights recommendations.

1.4 Significance, Scope and Definitions

1.4.1 Significance

The significance of this research is in its unique design perspective addressing the counterfeiting threat to the food industry. Whilst the anti-counterfeiting industry is rapidly issuing new high-tech interconnected applications for packaging enhancements, it is not accommodating for all. Many emerging SMEs in the food industry hesitate in adopting applications as they are unsure of their added value and trust perceived by consumers. Further compounding the issue is the regular superseding of anti-counterfeiting applications and therefore, design-driven deterrents offers cost-effective alternatives that act as ideal proactive strategies compared to reactive detective tactics that relate to high-tech packaging.

Literature is growing in food fraud and responsive tactics and strategies aim to aid exposed businesses and consumers. This research takes a novel view of the anti-counterfeiting phenomenon and presents evidence supporting a design-driven alternative to build deterrent elements that offer flexibility and tailored responses to all sized businesses that frustrate fraudsters and in turn, strengthens consumer trust.

Design adds value and communicates a brand's trustworthy personality. This research explores the theory that design can also be used to communicate to potential fraudsters a message of deterrence.

1.4.2 Scope

The three areas of primary research focus on the investigation of (1) Food Fraud and its sub-branch counterfeiting, (2) Consumer Trust and Risk Perceptions, and (3) Anti-counterfeiting options, both technologically founded and its alternatives in consideration of SMEs. Deterrent Design is an unpromoted alternative that has proven benefits in the context of currency banknotes and graffiti masterpieces, prevent unwanted targeting. Strong deterrent anti-counterfeiting ‘hurdles’ and security ‘guardians’ are called for to support the food exporting industry especially SMEs who seek cost effective approaches to the ever-dynamic problem.

Food fraud, as defined in Chapter 2, is an umbrella category for many deviants ranging from one off attempt to organised crime and this research narrows its focus on counterfeiting of food packaging such as brand replicas. This research does not cover food theft, food security (such as defence or the supply of food), food tampering or food traceability other than defining these definitions for introduction and awareness. On the contrary, this research offers insights into the threats of copy-cats and understanding that their tactics of operation are limited.

Counterfeiting is an elusive ill-defined problem and as it is close to impossible to interview counterfeiters, one must only use reports of events to deduce capabilities and tools used by the group of fraudsters. The counterfeiter’s capabilities identified in this research is based on criminology theories and industry and literature based counterfeiting reports, prompting thought on how they replicate and with what tools.

1.4.3 Definitions

The hypothetical statement below highlights the literature terms that collectively build the overall theoretical framework to be tested (Section 2.4, Summary and Implications).

If food fraud exposed consumers, relying on forensic information gathering behaviours, are rewarded with trusted security elements, then Initial Trust of product authenticity can be established, and fraudsters deterred.

The terms and concepts highlighted in *red* are briefly defined below with the operational definitions found throughout the dissertation in Chapter 2.0 Literature Review:

Food Fraud involves deceptive fraudsters motivated by financial gain (Spink et al., 2011).

Exposed Consumers are consumers who have a heightened awareness of the counterfeiting crime act either directly through experiences or indirectly through Word-Of-Mouth (WOM) (Gentry et al., 2006).

Forensic is the scientific investigation of a product's identity information to judge authenticity (adapted (Spink, 2007)).

Information Gathering Behaviours is the activity adopted by consumers gathering introductory information on an unfamiliar brand or product (Fung and Lee, 1999, McKnight et al., 2002).

Forensic Information Gathering Behaviours is the intense searching activity adopted by exposed consumers who have heightened perceived risk of fraudster threats, thus, scrutinising all gathered information.

Rewarded or Reward Attraction contributes to the belief that the trust transaction will be more rewarding than the potential costs (Fung and Lee, 1999, Lewicki et al., 1998).

Trust Security Elements pertain to anti-counterfeiting technologies and strategies individually represented as elements that build perceived trust with consumers.

Initial Trust is the commencement of trust when the trustee has no knowledge or recognition of the trustor (McKnight et al., 1998).

Product Authenticity or Food Authenticity is ensuring that food offered for sale or sold is of the nature, substance and quality expected by the purchaser (DEFRA, 2014 p.83).

Fraudsters are the individuals or teams of criminal actors involved in the fraud chain (Spink et al., 2017).

Deterred or Deterrence is the strategies put into place that hinder counterfeiting attempts and dissuade the crime act (Dorminey et al., 2012).

1.5 Thesis Outline

The thesis is divided into six main parts: Chapter 1 Introduction; Chapter 2 Literature Review; Chapter 3 Research Design; Chapter 4 Results; Chapter 5 Analysis; and Chapter 6 Conclusion.

Chapter 2.0 Literature Review presents a critical investigation over 4 sections:

Section 2.1 Fraudsters and Counterfeiting sets out to distinguish food fraud and its fraud theories, the investigated definitions of deceptive counterfeiting in contrast to non-deceptive, and contributors to counterfeiting growth. The section aims to review literature that defines counterfeiters by type and their collective capabilities when replicating packaging design. A cross-section of academic and industry examples of counterfeiting case studies will be reported on.

Section 2.2 Consumer Trust and Risk Perceptions provides definitions of consumer trust, perceived risk and the social move towards a risk society within the Chinese culture. It also covers the acknowledgment of the two cultures studied and the differences between trust meanings. E-Commerce and traditional retail engagements are compared on levels of sensory and emotional play experiences attributed to e-trust. Finally, it presents on three pillars that are identified as perceived risk dampeners.

Section 2.3 Anti-Counterfeiting and Design-Driven Deterrents initially introduces the theories of approach adopted to address the various actors and movements within the anti-counterfeiting academic and industry circles. It then outlines the constructs of each and addresses research on technology reviews, developments and comparative strategies. It identifies problems caused by the commercialisation of high-tech anti-counterfeiting technologies and the unmet needs of emerging SME food businesses. Deterrent design is defined and discussed on its value and impact on direct and indirect examples of counterfeiting cases. Design as a Form of Security is considered and offered as an alternative to hindering replication efforts. Case studies demonstrating deterrent design and functional aesthetics are offered through currency developments and masterpiece graffiti artworks respectively.

Section 2.4: Summary and Implications concludes the literature review, summarises the key theories and identified gaps in literature. A theoretical framework is presented, framing the three research studies and their relation to each other through the Mixed Methods approach.

Chapter 3.0 Research Design defines the adopted Methodologies and Research Design (Section 3.1) used to study the three research questions posed within. The content outlines for each three studies their Participants (Section 3.2), the adopted Instruments (Section 3.3), the detailed Procedures and Timelines (Section 3.4), the individual studies methods of Analysis (Section 3.5), and finally the overarching study considerations for Ethics and Limitations (Section 3.6).

Chapter 4.0 includes both the results and the analysis for the 3 reported studies:

Results reports the outputs taken from the three study designs: the first two studies contribute qualitative insights from: Consumers (Section 4.1 for Study 1) and Industry (Section 4.3 for Study 2). These collective insights were then used to inform the third major quantitative study design of investigation. Statistical results are reported, firstly using descriptive statistics, followed by inferential statistics (Section 4.5 for Study 3).

Analysis presents the overall findings and discusses their significance, both statistically and practically. The analysis and discussions are presented for Study 1 (Section 4.2), Study 2 (Section 4.4), and Study 3 (Section 4.6).

Chapter 5.0 Conclusion summarises the dissertation overall and identifies how the research has contributed insights and findings to the body of academic knowledge. It details final recommendations including areas for further research necessary to progress the area of enquiry into design-driven deterrents and the expertise development in design education.

Chapter 2:

Literature Review

The purpose of this chapter is to critically review the established research and theories that offer debate on the three main impacting bodies of literature core to the investigation:

- 01 *Fraudsters and Counterfeiting (Section 2.1),*
- 02 *Consumer Trust and Risk Perceptions (Section 2.2), and*
- 03 *Anti-Counterfeiting and Design-Driven Deterrents (Section 2.3).*

These three areas are seen to have mutual impact, affecting each other through a linked *Impact Chain* which is conceptualised in the framework (Figure 1). In addition to the framework are the two primary research questions driving the inquiry:

The first question is concerned with the intersecting research of ‘consumer’s trust and their risk perceptions’ influenced by the neighbouring section of research dealing with Design-Driven Deterrents effective for SME Anti-Counterfeiting. Emerging SMEs are considered here as unfamiliar to new markets and cultures. Thus, the question for interrogation is framed:

Question 1: Does design positively impact on consumers trust and acceptance of anti-counterfeiting elements applied to unfamiliar brands across cultures?

The second area of interest focuses on managers of SMEs and their appraisal of commercially available anti-counterfeiting applications including Design-Driven Deterrents on their ‘appropriateness’ or ‘fit’ to their brand protection business needs. Therefore, the research investigation is represented as the following question:

Question 2: Does the design thinking process and co-creation strategies impact positively or negatively on SME managers perceptions of anti-counterfeiting elements and their appropriate fit for brand protection needs?

As it is held, each opposing section in Figure 1 has a mutual influence diamond, created by the combination of reversed arrow heads, indicating a two-way impact. For example, Sections 02 and 03 frames the assumption: if consumers perceive anti-counterfeiting elements as untrustworthy, then it is believed they will not seek out the product, impacting the success of the brand. Another example is Sections 01 and 03 hypothesising that: if anti-counterfeiting elements are well designed and design-embedded into packaging, then consumer's trust is expected to positively strengthen, impacting consumer's loyalty.

This research investigates how the success of anti-counterfeiting elements can be influenced by examining consumer's and industry's 'acceptance' of them. The research also is concerned with anti-counterfeiting's 'fitness' or appropriateness for emerging SME brands and against consumer's expectations. Anti-counterfeiting success is argued to be reliant on these two critical intersections defined in this research as the *crucial diamonds*.

To address the two key questions, the literature review dedicates Section 2.1 to the investigation of Fraudsters and Counterfeiting; Section 2.2 to Consumer Trust and Risk Perceptions; and Section 2.3 to Anti-Counterfeiting and Deterrent Design. Section 2.4 Summary and Implications distils the selected theoretical positions taken from the three literature chapters from criminology, business and management, social sciences and design research disciplines. Key experts and their positions are evaluated to construct the driving research argument of enquiry. Formulated hypotheses are presented for the three-part study design (refer to Chapter 3.0 Research Design). Finally, the main terms and concepts drawn from the literature review will be presented in depth to guardrail the foundational methodologies and overarching research framework.

In each section's summary, clear gaps in the research scope will be concluded either for investigation or posed as recommendations for further research.

2.1 *Fraudsters and Counterfeiting*

2.1.1 *Introduction*

The earliest historically recorded known acts of counterfeiting in China have been published in the Food Safety in China book section “Food Fraud” (Wu et al., 2016) which notes its mention by “Pliny the Elder”, a Roman philosopher and scientist (23 to 70 AD). However, “the earliest Chinese example of published regulation of the food trade was in “the Book of Rites” published in the Zhou Dynasty (1046 to 256 BC)” (Wu et al., 2016). In today’s arena, counterfeiting is found in every industry and affects all types of products and users of those products. It is a growing threat that is destabilising trust and is now an inter-disciplinary field studied under multiple branching that investigate the actors and victims, the impact of the act and forecasted growth, and ultimately counter-response strategies to the ever-evolving risk.

Section 2.1 is the first contribution to the review which aims to draw on the expert literature dealing with the international problem of counterfeiting and its perpetrators. The information is structured to present the phenomenon firstly at a broad level introducing the umbrella topic of food risk over the four research disciplines: the one of interest being ‘Food Fraud’. Criminology literature that developed foundational and expanding fraud theories are presented, leading into the more recent publications arguing on the model on which Food Fraud relates. Triangulation models explaining the types of fraudsters based on their intentions is considered. Following, is an overview of the Crime Formula and the key components that need to be in place for the crime to occur. Expert frameworks are proposed dealing with Anti-Fraud Response that encourages a move from reactive tactics to proactive preventatives.

After establishing the topic of Food Fraud, the research narrows in scope to focus on the specific issue of ‘counterfeiting’. It introduces the two main literature terms defined as *Non-deceptive* counterfeiting and *Deceptive* counterfeiting, with the latter being the research focus. Deceptive counterfeiting is then threaded throughout the remaining investigation. Reports and publications speculating on the continual growth of counterfeiting is discussed alongside the factors listed for potential increased risk exposure. Profiles of counterfeiters are categorised by principle researchers and the focus

on mimicking counterfeiting is distilled. Identified capabilities are discussed and two examples of counterfeit replica products are presented. Finally, literature pertaining to the impact of counterfeiting on brand and consumer levels is compared leading into the *strain-effect* on anti-counterfeiting trust.

2.1.2 Food Fraud Defined

Food Risk and the Four Disciplines

Food Risk, also known as Food Protection, is an overarching field of research that consists of 4 disciplines which Spink and Moyer (2011b) set out in their Food Risk Matrix (Table 1), which are distinct from each other: (1) Food Quality, (2) Food Safety, (3) Food Defence, and (4) Food Fraud. Importance is placed on the profiles of these four research clusters of food risk occurrence as they are separated by two attribute types: the 'Action' and the 'Motivation'. The 'Action' represents whether the result was from unintentional or intentional means and the 'Motivation' describes the actors driving force for action, either by the need to gain (economic) or the purpose to harm (public health, economic, or terror). Spink and Moyer (2011b) further distils each field risk type and provide in their research examples, drivers and impact on public health. In brief, Food Quality is defined by Spink and Moyer (2011b) as an accidental occurrence such as damaged produce (e.g. bruised fruit); Food Safety is the unintentional contamination of food (e.g. a bacteria in the manufacturing plant); Food Defence is a form of terrorism and is indeed intentional to cause harm to the public (such as contamination of ground beef with nicotine); whereas, Food Fraud is dissimilar to Food Defence, as it is justified by deceptive fraudsters motivated by financial gain. From these defined fields of food research, this investigation will focus on the distinct field of *Food Fraud*.

Table 1. Food Risk Matrix defining Food Fraud from other food related research fields (adapted from Spink and Moyer (2011b)).

Food Quality	Food Fraud (Research Focus)	Motivation: Gain: Economic
Food Safety	Food Defence	Harm: Public Health, Economic or Terror
Unintentional	Intentional	
Action:		

Definitions

Whilst the term Food Fraud is growing in attention (Spink and Moyer, 2011b), it is yet to be recognised as its own discipline of research as it still is interchanged with Food Safety and Food Crime which is inclusive of Food Defence. Growing studies are conducted in academia (Lord et al., 2017b, Lord et al., 2017a, Spink et al., 2016, Kendall et al., 2019), industry (Beckett, 2018, Nestlé, 2016, Francis, 2017), and international regulatory bodies connected to governmental sectors (OECD, 2007, FSAUK, 2015, McLeod, 2017, FSA, 2016). Research has been published on the scope of the problem (FSA, 2016, DEFRA, 2014), its actors (Spink et al., 2013) and victims (Gentry et al., 2006) and attempted to scan the overall risk impact (Bamosy and Scammon, 1985).

Definitions of Food Fraud are still evolving and being debated. Spink and Moyer (2011b p.158) offer a widely accepted broad explanation, stating:

“Food fraud is a collective term used to encompass the deliberate and intentional substitution, addition, tampering, or misrepresentation of food, food ingredients, or food packaging, or false or misleading statements made about a product for economic gain.”

This definition is also supported by the UK government’s commissioned Elliott Review report (DEFRA, 2014). Spink et al. (2016) later attributes the drive of fraudsters into the definition by stating Food Fraud is the intentional action and ‘motivated’ by economic gain. Thus, encompassing the sub-category term: “Economically Motivated Adulteration (EMA) of food” (Everstine et al., 2013, Moore et al., 2012, Spink et al., 2013) which mistakenly is interchanged with the larger, more encompassing fields, Food Fraud and Food Crime – Food crime is defined by the motivation to cause harm and its grander scale of organisation (DEFRA, 2014). EMA incidents are considered to be ‘deceptive’, aimed to avoid Quality Assurance detection, intentional actions that are usually not motivated to cause harm, although the latter is not excluded (FSAUK, 2015). A broader definition of Food Fraud, inclusive of EMA, is the “illegal deception for economic gain using food” (DEFRA, 2014, GFSI, 2014, Spink et al., 2019, FSAUK, 2015). Lord et al. (2017a) argues that this definition lacks the acknowledgement of social context that drives decision-making. Lord and his colleges alternatively offer a more behavioural accommodating definition of Food Fraud being:

“...the abuse or misuse of an otherwise legitimate business transaction and an otherwise legitimate social/economic relationship in the food system in which one or more actors undertakes acts or omissions of deception or

dishonesty to avoid legally prescribed procedures (process) with the intent to gain personal or organisational advantage or cause loss/harm (outcome)” (Lord et al., 2017a).

Overall, concerted efforts are being made to provide further scope and definition of the research field of Food Fraud. However, it is far behind the well-established Food Safety discipline which has greater legislative frameworks formed and implementations in action FSAUK (2015). Regulations and policies have included clauses to encompass the acknowledgement of Food Fraudulent activities yet the collative report from FSAUK outlines the disjointed efforts and the need for international government regulatory bodies, concerned with, or give warning about, Food Fraud and its activities; to unite on acting procedures and policies that confine and confront the illusive problem.

2.1.3 *Fraud Theories*

Fraud theories, initially established in the observations of financial organisations, offer insights into the formula that equates the plan and execution approach to fraudulent activity. These frameworks have been extended and some restructured to accommodate new learnings and varied contexts of fraud. To understand the concept of fraudulent behaviour, motivations and propensities, a summary of fraud theories is presented. Theories reviewed that are founded on or expanded from the “*Fraud Triangle Theory*” (Cressey, 1953) are: the “*Fraud Scale*” (Albrecht et al., 2015), “*M.I.C.E.*” (Kranacher et al., 2011), the “*Predator Versus the Accidental Fraudster*” (Dorminey et al. (2012), and the “*Fraud Diamond*” (Wolfe and Hermanson, 2004).

The evolution of fraud theories is important to follow as it defines not only the criminal’s agenda but the aim and objectives of the crime itself. The combination of the Fraud Diamond theory that caters for capability attributes of fraudsters and an expanded version of the Fraud Crime Triangle is used to create the conceptual model for this research.

The Fraud Triangle Theory (FTT)

A predominant model founding the study of fraud perpetrator behaviours and drivers within white-collar financial organisation structures was introduced by Donald Cressey, a criminologist who argued that “there must be a reason behind everything people do” (Cressey, 1953). Dorminey et al. (2012) summarised Cressey’s ideas along with the expanded theories reviewed by identifying the three parts to criminal trust violations as:

“(1) a non-sharable financial problem (Perceived Pressure); (2) knowledge of the workings of a specific enterprise and the opportunity to violate a position of trust (Opportunity); and (3) the ability to adjust one’s self-perception such that violating this trust does not constitute, in his or her mind, criminal behaviour (Rationalisation).”

Dorminey and his colleges visualise the now recognisable Fraud Triangle (Figure 2) in which Cressey believed that all three attributes had to be accounted for to activate the Fraud Act’s viability to occur (Mohn, 2018).

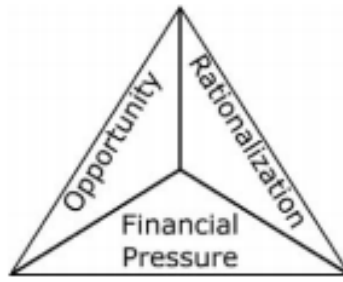


Figure 2. Cressey's Fraud Triangle (Cressey, 1953, Dorminey et al., 2012).

According to Cressey's theory, the "Financial Pressure" is described by the stigma seemingly associated with a financial problem that causes a person to retract and keep the financial problem a secret or 'non-sharable'. Therefore, a motive is developed for the crime act. Some with ego-centric personalities in high ranked placements may avoid seeking help as they do not wish to portray any form of need, in which they may consider illicit alternatives. "Perceived opportunity" is the belief that a control system can be compromised and is vulnerable for exploitation, with the risk of being caught considered unlikely. "Rationalization" is the effort to cognitively justify one's planned action and that the reward is believed to be greater than the risk for the individual (Ramamoorti et al., 2009, Dorminey et al., 2012).

Pustjens et al. (2016) in their book chapter "Food Fraud and Authenticity: Emerging issues and future trends", applies the fraud triangle directly into the food fraud context. They translate the three triangle attributes with (1) 'financial pressure' as the 'economic gain' motivators, (2) the 'rationalisation' is confirmed by the fraudsters 'self-justification to achieve notions of decency and trust' and finally, (3) if fraudsters perception that the advantage of economical gain surpasses the chance of detection then vulnerabilities of fraud threats on the food supply chain will be ongoing (Everstine et al., 2013).

Acknowledged alternative fraud theories that have leveraged Cressey's model are briefly mentioned here. Albrecht et al. (1984) were concerned about the nature of fraud and its complexities when predicting perpetrator actions and their profiles. They proposed 'the Fraud Scale', that made use of two elements of the Fraud Triangle Theory being: pressure and opportunity. However, they replaced the 'rationalisation' component with 'personal integrity' as they believed that fraudulent actions could be rationalised away, and that 'individual's integrity' was the driving parameter behind the actions. Kranacher et al. (2011) discussed the motivations beyond the described fraud perpetrators driven by

financial non-sharable problems. Fraudsters were observed to not always be driven by a hidden financial pressure and some perpetrators were in high status positions with no financial needs yet still ambitious to commit fraud. Kranacher et al. (2011) proposed that “Money, Ideology, Coercion and Ego (entitlement) (M.I.C.E)” could explain actors at high positioned levels within organisations (such as at the financial CEO level) who have no financial needs and yet can still act in a fraudulent case. Financial gain and pride are said to be joint stimuluses of fraud opportunities (Dorminey et al., 2012).

The Fraud Diamond Theory (FDT) – expanding the FTT

Wolfe and Hermanson (2004) saw that Cressey’s model lacked in describing the abilities of a fraudster and this contribution to a fraud activity. They proposed a Fraud Diamond framework that expands on the three facet Fraud Triangle Theory arguing that fraudulent activities could not take place unless the fourth facet of ‘individual capability’ was present, consisting of ‘personal traits’ and ‘abilities’ (Figure 3). This model empowers the anti-fraud professional by expanding investigations into fraudsters capabilities, methods and strategies.

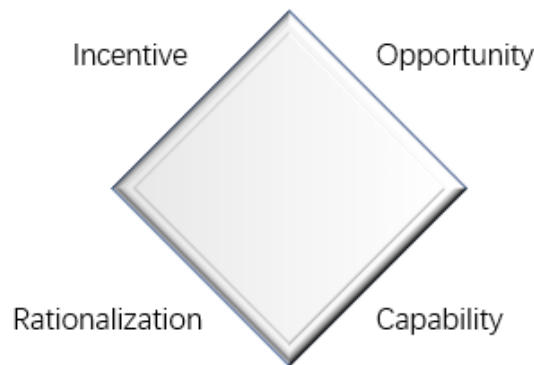


Figure 3. Fraud Diamond Framework (Wolfe and Hermanson, 2004).

To provide an example, they hypothetically outline a four-element thought process exploring a fraudster’s reasoning:

<i>“Incentive:</i>	<i>I want to, or have a need to, commit fraud.</i>
<i>Opportunity:</i>	<i>There is a weakness in the system that the right person could exploit. Fraud is possible.</i>
<i>Rationalization:</i>	<i>I have convinced myself that this fraudulent behaviour is worth the risks.</i>
<i>Capability:</i>	<i>I have the necessary traits and abilities to be the right person to pull it off. I have recognized this particular fraud opportunity and can turn it into reality.”</i>

This proposed view, although fictional and overlapping, deepens the review of the fraudster’s assessment and “moves beyond viewing fraud opportunity largely in terms of environmental or situational factors” (Wolfe and Hermanson, 2004). They present 6 “Components of Fraudulent Capability” (Table 2). (1) Position/Function: for access to tools and influence for decision making, (2) Brains: to know how to take advantage of weaknesses in the system using “position, function, or authorized access” for their greatest means, (3) Confidence/Ego: increased confidence may result in misjudgement of projected cost of fraud due to high expectations of reasoning out of any consequences, (4) Coercion Skills: ability to convince or dictate to others to participate within or ignore fraudulent happenings (5) Effective Lying: to escape detection one must be able to convincingly lie to authorities, regulators and stakeholders, and (6) Immunity to Stress: dealing with the stress that comes from conducting and managing fraudulent activities over time and avoiding constant detection.

Table 2. The Fraud Diamond’s Components of Capability (Wolfe and Hermanson, 2004).

THE COMPONENTS OF CAPABILITY
Position/Function
Brains
Confidence/Ego
Coercion Skills
Effective Lying
Immunity to Stress

Once capability of fraudsters is acknowledged and prioritised of importance, the next step for combating food fraud is to look beyond motivations and consider the capability from the view of tools and methods of action. Research needs to identify what we know about fraud capability in order to act on preventative and detection methods (Wolfe and Hermanson, 2004).

The Situational Prevention Theory – beyond FTT

The Situational Prevention Theory again taken from organisational fraud, moves beyond the ‘causes, motivations and propensities’ of crime activity (such as Cressey’s Fraud Triangle) and changes focus to practical risk reducing methods. Lord et al. (2017b) suggest that specific strategies and methods are to be fitted to the type of fraud and situation as each situation may differ. Lord and his colleagues review the theory in their paper ‘In Pursuit of Food Systems Integrity’ in which they summarise the 5 preventative measures to food fraud:

<i>“1. Increase the effort for offenders</i>	<i>(e.g. making it harder to adulterate food products or to hide frauds behind legitimate business practices by increased transparency),</i>
<i>2. Increase the risks</i>	<i>(e.g. increase routine surveillance of the business environment, that is, the ‘offending locations’ or the likelihood of being detected, such as by buyers and consumers),</i>
<i>3. Reduce the rewards</i>	<i>(e.g. separate products within the business or confiscate profits gained),</i>
<i>4. Reduce provocations</i>	<i>(e.g. reduce temptations to commit fraud by ensuring legitimate business is profitable or neutralising organisational/market pressures), and</i>
<i>5. Remove excuses</i>	<i>(e.g. introducing more prescriptive rules or educating offenders to harms caused) (Lord et al., 2017b).”</i>

Lord et al. (2017b) point out that this approach identifies the needs to be pro-active in fraud deterrence by increasing effort and risks, decreasing rewards and incentives and removing excuses. Although this checklist is helpful, it is not clearly actionable and requires context of the unique business to structure objective task-based solutions under each target.

It is evident that preventative or deterrent methods are essential for increasing counterfeiting ‘effort’ by competing with their capability. Detection procedures are increasing ‘risks’ to the counterfeiter and the probability of being caught. If a business is profitable and has growth potential, the ‘rewards’ and ‘incentives’ for counterfeiting will remain. Therefore, while both prevention and detection responses are essential,

prevention is of primary concern to warn off potential risk and detection is of secondary focus dealing with the occurred risk. Metaphorically speaking, to avoid counterfeiters winning the race, the hurdles need to be heightened beyond their jumping capability. Increasing hurdle complexities are discussed in the Anti-Counterfeiting and Deterrent Design section of this research. However, prior to identification of the right deterrent attributes, one must understand the crime threat, the fraudsters intentions and ways they plan to operate.

2.1.4 Fraudster Types and Their Intentions

Another comparison that can be made on fraudster types is their purpose for action. The ‘Attributes of the Predator Fraudster’ (Figure 4) is visualised on the Fraudster Triangle adapted by Dorminey et al. (2012). On one side, the *Accidental Fraudster* is one that follows the Fraud Triangle model who, unknowingly to others, is pressured financially and needs to internally rationalise their proposition to act; this fraudster most likely has never committed a prior fraudulent act. In contrast, the *Predator* fraudster is one that has experience and replaces the rationalisation drive with a ‘criminal mindset’ and the financial pressure with ‘arrogance’. The sole element remaining in the original fraud triangle is the ‘opportunity’ component which is the defining predictor of the predator’s motivations. An accidental fraudster would argue “It just happened” whereas a predator fraudster would have the audacity to act just because the opportunity has presented itself.

Rare insights of the criminal mindset, justifying arrogance and presented opportunity is provided by Yan (2012) who had the rare chance to interview a Shanghai migrant worker who confessed to producing fake blood pudding. He responded to the enquiry, was he aware that it was harmful to others, by saying “*I knew but I did not care, why should I? I don’t know them at all.*” He continued to state that his actions were acceptable because “*urbanites had medical insurance, if they get sick, they can afford to go see the doctor.*” Yan (2012) further defines the dynamics of the case, discovering that the perpetrator was also acting in revenge against beatings from the “Cheng-guan dui,” an independent governing “patrol force...for food markets” who he sold the fake product to in hope that they would “become seriously ill.”



Figure 4. Attributes of the Predator Fraudster Model (Dorminey et al., 2012).

The motivation of personal gain and justification of immoral behaviour is a result through the growth of individualisation (Yan, 2012), which is a primary concern within China. Research typifying these motivational groups are defined. Moving beyond the fundamental attributes of a predator (Spink et al., 2013, Spink et al., 2010), adopts the model of (Hagan, 2010), and labels fraudulent criminal types and attitudes applying to product-counterfeiting incidences (Table 3) ranging from individuals to networked organisations based on their driving intentions of: (1) Recreational, (2) Occasional, (3) Occupational, and (4) Professional. The threat of counterfeiting can fall into all these identified cases. However, this research focuses on counterfeiting fraudsters who are repeat offenders, looking to gain economically and aim to work undetected. Thus, the driving intentions respective of these conditions are considered at the Occupational to Professional levels.

Table 3. Criminal Types and Attributes that apply to product-counterfeiting incidences¹
((Spink et al., 2014, Spink et al., 2010) adapted from (Hagan, 2010)).

Types of criminals	Definition
Recreational	Action for entertainment or amusement
Occasional	Infrequent, opportunistic
Occupational	Incidents at their place of employment either as an individual act or in collaboration with the company
Professional	Crime fully finances their lifestyle

¹ *Note: Although previously included by the authors in previous research and publications, the 'ideological' type was removed since the motivation is not economic gain. The ideological type included anarchists, terrorists, disgruntled employees, and others who are trying to physically, economically, or emotionally harm a person or entity.*

All types of fraudulent criminals (Spink et al., 2013) threaten legitimate businesses. Counterfeiters however, as defined under Food Fraud, are reported to operate for economical gain, thus aims to mimic on all levels the authentic brand, functioning as an ongoing illegal, yet 'professional' enterprise in order to *deceive* (*deceptive counterfeiting* later to be defined).

Proactive versus Reactive

Detection does not conclude the issue, the fraudulent business, keen to persist, may present as ‘closed down’ and yet later re-establish again under a new guise and through a new channel. Spink and Moyer (2011b) identify that the previous ‘intervention’ and ‘response’ tactics are not effective in the fight against fraudulent activity and that ‘a proactive prevention’ stance is key (Figure 5).

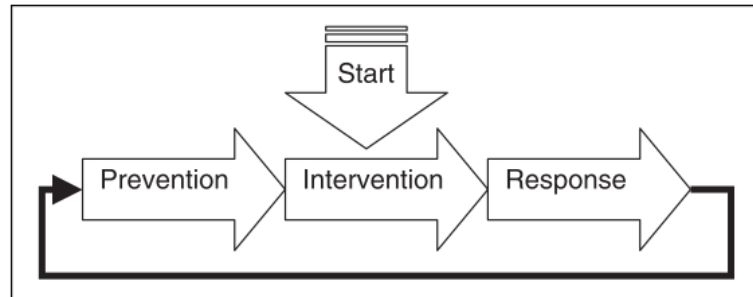


Figure 5. Food Protection Plan Progression (Spink and Moyer, 2011b).

Another way of presenting both proactive and reactive approaches is through their compared strategies. In the context of currency banknote design, Sincerbox (1993) postulates the two general strategies that can lead to appropriate and timely modification advancements which are schematically depicted in comparison strategies (Figure 6) showing theorised *Reactive* (top graph) and *Proactive* (bottom graph) scenarios and outcomes. He proposes the significance in adopting the proactive strategy and the practical advantages which include the containment of manageable counterfeiting problems reducing the threshold of tolerance with planned and executed strategies in anticipation of counterfeiting threats.

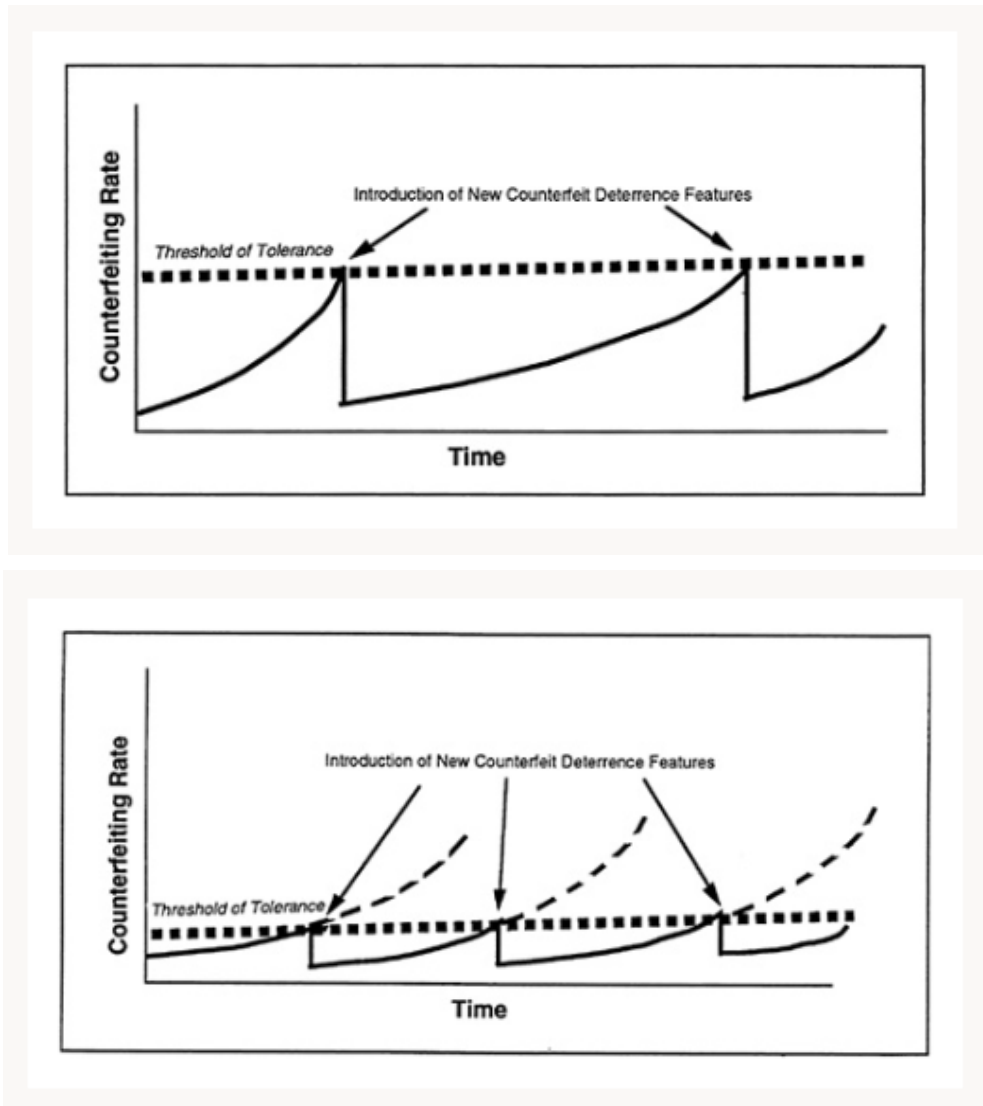


Figure 6. Comparison of Reactive Strategy (top graph) to Proactive Strategy (bottom graph) (Sincerbox, 1993).

2.1.5 *The Crime Formula and Anti-Fraud Response*

Dorminey et al. (2012) summarise and critiques the research by Albrecht et al. (2006) and Kranacher et al. (2011) with the expansion of the Fraud Triangle framework developed by Cressey (1953). Supplementary descriptions of the Crime are offered and represented by the Fraud Action Triangle (Figure 7). This model constructs the elements a perpetrator must action for the fraud crime to eventuate.

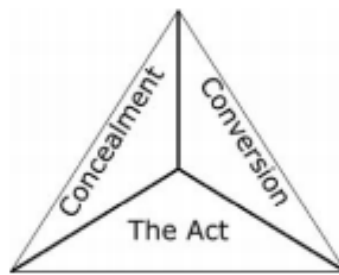


Figure 7. Albrecht et al. (2006) Triangle of Fraud Action: The Crime, referenced by Dorminey et al. (2012).

The Fraud Action Triangle presents three attributes (1) The Act, (2) Concealment, and (3) Conversion. In brief, The Act pertains to the acted upon aims and objectives to execute the plan, the Concealment represents the avoidance of detection from authorities and whistle-blowers, and finally, the Conversion is transposing the fraudulent gains into other beneficial assets to avoid suspicious trails such as using the illicit obtained funds to purchase an artwork. Exposing fraudsters can be achieved by illuminating one or more parts of the crime formula (the Act, the Concealment, or the Conversion) by developing anti-fraud measures, controls or structured audits (Dorminey et al., 2012).

Dorminey et al. (2012) proposes a meta-model for the Anti-fraud professional's response outlining the preventive controls, detection procedures and deterrents outlined in a conceptual framework (Figure 8). This approach illustrates the 'Prevent & Deter Controls' as the first line of defence to reduce the probability of the 'fraud path'. Detection procedures are activated post-crime and although detection is necessary, such procedures are a reactive approach to the damaging problem. Anti-fraud professionals need to have a proactive focus considering Preventative and Deterrent methods and strategies so that businesses can avoid fraudsters and 'the Act'.

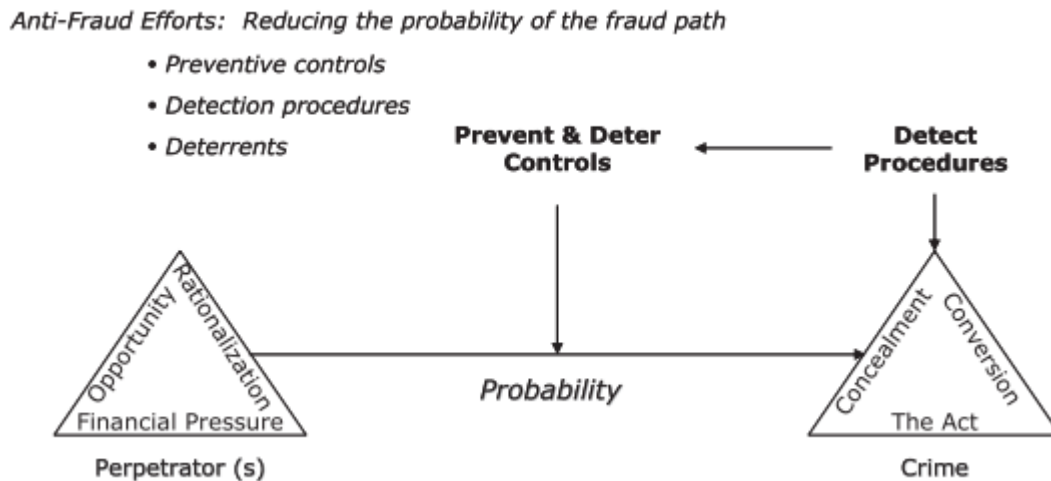


Figure 8. The Anti-Fraud Profession's Response (Dorminey et al., 2012).

“Breaking the Fraud triangle is the key to food fraud deterrence, and implies that if an organization removes one of the elements in the Fraud Triangle, the likelihood of fraudulent activities is highly reduced” (FSAUK, 2015).

Creating preventative and deterrent measures that are in reaction to a fraudster's capabilities, inclusive of the tools they use, is believed to hinder perpetrators efforts and potentially cause them to explore easier targets.

In addition, Spink and Moyer (2011b) adapts the Fraud Triangle from Felson's (1998) model and shifts the consideration of the model from the traditional criminal's 'opportunity' to an adapted framework of 'whom' and 'what' fraudsters need to overcome to take advantage of the opportunity described (Figure 9) as the 'Guardians' and the 'Hurdles'. Disrupting perpetrators requires 'guardians' acting as the team of protecting authorities, and 'hurdles' for the pro-active deterrent actions to be taken. This concept is intriguing as it illustrates businesses obligation to either out-source or build in-house sophistication measures in their processes, people and products, complicating the path and disrupting fraudsters perceived ease in obtaining illegal rewards.

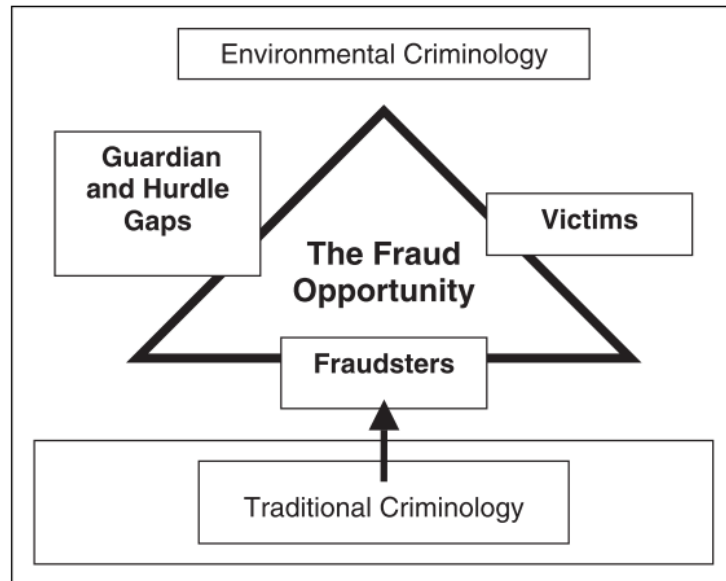


Figure 9. The Crime Triangle ((Spink, 2010, Spink, 2007); adapted from Felson (1998)).

Expanding on the ‘Chemistry of the Crime’ diagram, Spink and Moyer (2011b) consider areas for Brand Protection with underlying disciplines of Management/IT, Marketing Monitoring, Supply Chain Integrity and Product Protection. All areas that require communication and a unified anti-fraud business plan.

Ellis et al. (2015) argues that “Food Fraud is a problem of systems and therefore requires systems level solutions and thinking.” A connected systems approach can enhance all recommended areas of brand management with purposefully strategic planning. In the interest of defining further the types of Product Protection, Spink and Moyer (2011) address areas of product tampering, traceability, authentication, security and safety as key areas of consideration and these are all areas that can make use of systemised strategy. Identifying the areas of potential risk highlights the areas requiring protection. Targeted protection in its effectiveness still needs to meet the business needs that vary across food categories (Olive oil compared to cherries), food type (dried mango strips to fresh mangoes) and business profile and capability to upscale (SMEs versus Multinationals).

In the context of frugal SMEs, simplicity and effectiveness is sought after. This brings us to their specific need to enhance brand protection and packaging sophistication with methods that require little to no upscaling of resources upfront and intense supply monitoring practices. Emerging innovative SMEs do not have the luxury of expendable

time, funds and research capabilities. Solutions for such businesses need to avoid complexities in upscaling human resources in digitally monitoring and management as well as outsourced marketing investments. Systems are required to meet the financial budgets of SMEs, act as unique identifiers and trust elements that distinguishing the faces of SME brands proving to be effective in resisting replicant threats. Within the anti-counterfeiting chapter of this literature review, the learnings from currency notes is presented and considers the simplicity of stand-alone replicant resistant strategies that rely solely on their design, unique labelling and layering that protects and warns against counterfeiting threats.

Structural packaging design, branding and applied technologies together can enhance the appropriate deterrent and preventative elements, such as tamper-proof and destructive packaging, track and trace sensors and codes, consumer digital scan technologies, country of origin call outs and testimonial badges for cross-referencing, just to name a few. However, businesses need to know which packaging attributes are effective for their food category, therefore, the research proposes the question:

Can defining the profiles and capabilities of a packaging counterfeit fraudsters, lead to the informed selection of appropriate packaging enhancements or 'hurdles' to develop a deterrent strategy? The call to purpose is to ensure protection against Food Fraud and its sub-branch, counterfeiting.

2.1.6 Counterfeiting - Deceptive and Non-Deceptive

Counterfeiting is an ill-defined problem, ever dynamic and is a growing concern for brands threatened by the global phenomenon (Green and Smith, 2002, Mackey and Liang, 2011). Professionals are actively debating and distilling its definitions to accommodate newly identified actors, behaviours, drivers, categories, methods and impacts. One agreed upon definition of counterfeiting is the “unauthorised imitative production of products and/or services that are protected by owners’ intellectual property rights (IRP) in the pursuit of profit” (Yang and Fryxell, 2009, Cordell et al., 1996, Schultz et al., 1996). Commercial counterfeiting has been defined in general terms as “the fraudulent practice of affixing a false trademark to a product with the false trademark then appearing superficially indistinguishable from its legitimate counterpart” (Bamossy and Scammon, 1985). Product counterfeiting is the “unauthorised manufacturing of articles which mimic certain characteristics of genuine goods and which may pass themselves off as registered products of licit companies – has developed into a severe threat to licit companies and consumers alike” (Staake et al., 2009, OECD, 2007).

Bodies of literature dealing with counterfeiting acknowledge the two forms identified on consumers awareness and perceptions of the trade which are either *Non-deceptive* (Wilcox et al., 2009, Eisend and Schuchert-Güler, 2006) and *Deceptive* counterfeiting (Grossman and Shapiro, 1988). However, previous studies have disregarded the distinction between the two definitions when investigated, which is a limitation in the literature (Heinonen et al., 2017). The OECD (2007) refers to the concepts by different name, Deceptive counterfeiting referred as Primary markets, and Non-Deceptive counterfeiting as Secondary Markets.

Non-Deceptive counterfeiting contrasts to *Deceptive* counterfeiting in that it is often welcomed by their customer base who knowingly recognise the fakes of legitimate products and still seek to obtain them such as that found in the luxury goods industry (fake handbags and premium timepieces). Green and Smith (2002) summarise the non-deceptive characteristics in four points:

1. *“They pose little or no health or safety risk to the public,*
2. *They have little demonstrable impact on brands being counterfeited,*
3. *They are known by consumers to be counterfeit—indeed, consumers can be viewed as accomplices in the activities, and*
4. *They provide some demonstrable benefit (e.g., employment) to the nation.”*

Non-deceptive counterfeiting is consumers unintendedly linked to the fraud chain.

Deceptive counterfeiting, on the other hand, is where the consumer is the victim. Authentic brands are negatively impacted as the illicit offerings are often lower quality and as they take shortcuts and avoid regulations, they can cause public harm. Food Fraud and food counterfeiting is a deceptive trade, thus not welcomed by consumers who avoid such offerings if detected. It is said to withdraw consumer confidence, with Lord et al. (2017b) stating that “trust is damaged as there is the perceived loss of the ‘right’ to be provided with unadulterated and authentic products.” They go on to point out that within cases of Food Fraud, victims are identified out of the immediate jurisdictions of brand targeted consumers and business distributions and ramifications impact unknown users or traders who have been cheated through below market value enticements.

Counterfeiters can range from an individual through to an organised network of crime (Spink, 2007) and their capabilities define whether their threat is classified as primitive or sophisticated. Lord et al. (2017b) states that fraudulent criminal enterprises range in size but all attempts weaken belief in domestic and international food systems. “One of the biggest issues with monitoring the volume and type of adulterated products is the fact that the landscape of Food Fraud is ever changing” (Fontanazza, 2016). Attempts to categorise and simplify counterfeiters’ schemes and tools into a known database at one point in time would soon be found to be out of date due to the ever-changing methods adopted to commit unlawful sales of brand replicas. Although it is a dynamic and complex problem, documenting known counterfeited case studies will allow review of common practices adopted by counterfeiters and anti-fraud professionals are enabled to highlight potential risks to emerging and established exporting businesses.

Moore (2016) warns that “the perpetrators are always two steps ahead, so innovation is needed to keep up”. Although this statement is alerting and a call to action, it is argued that this notion is misleading. In the context of counterfeiting, fraudsters seek out profitable brands to reference their IP in the form of duplicating their processes, designs or systems and therefore, are always two steps behind.

This simple yet profound fact acts in the favour of legitimate business plans and can result in strengthening strategies that play on this aspect. This is significant; Deceptive Counterfeiting of food packaging that operates outside a legitimate supply chain uses *delayed mimicry* which means there is a suspension time before counterfeiters catch up with authentic businesses new releases. This advantage can be leveraged by management that instils dynamic, phased updates and anti-counterfeiting response planning in the aim to frustrate fraudsters and potentially deter their deceptive practices.

2.1.7 Reasons for Counterfeiting Growth and Risk Exposure

It is evident that counterfeiting is thriving. The Organisation for Economic Co-operation and Development OECD (2007) states that “counterfeiting and piracy are longstanding problems which are growing in scope and magnitude”. Chaudhry and Zimmerman (2013) reason that counterfeiters are becoming more sophisticated in committing fraud because of:

1. *“Low cost technology,*
2. *Globalization,*
3. *Consumer complicity*
4. *Expansion of channels and markets,*
5. *Powerful worldwide brands,*
6. *Weak national and international enforcement and*
7. *High tariffs and taxes.”*

Information is readily available online and intellectual property is easily accessed and copied. These concerns are in line with the reasons of growth identified in the NSF Literature Study by FSAUK (2015) who summarise the phenomenon in 10 factors believed to contribute to Food Fraud:

1. *“Knowingly buying below market price*
2. *Presence of added value claims (organic, Healthy, free range)*
3. *High profit margins*
4. *Less likely to be detected*
5. *Less detectable due to low concentration*
6. *Evadable testing*
7. *Demand exceeding supply*
8. *Passed through many hands*
9. *Cost of adulterant*
10. *Physical form (powdered) eased adulteration process.”*

Others posit the main reasons are due to shifts in cost and availability of:

1. *“Technological resources, and*
2. *Connected networking resources.” (Brown et al., 2017, Heinonen et al., 2012)*

Brown et al. (2017) in their report of banknote counterfeiting trends shows evidence of the price decrease of audio, visual and computing equipment and the rapid increase of

internet access (Figure 10, open source data from the Australian Bureau of Statistics) connecting these trends with the drivers that cause ease of counterfeiters to expand. If counterfeiters have easy access to duplication or re-engineering tools and are equipped to access presented resources online from product presentations, then deterrent strategies need to be considerate of these capabilities used for counterfeiting.

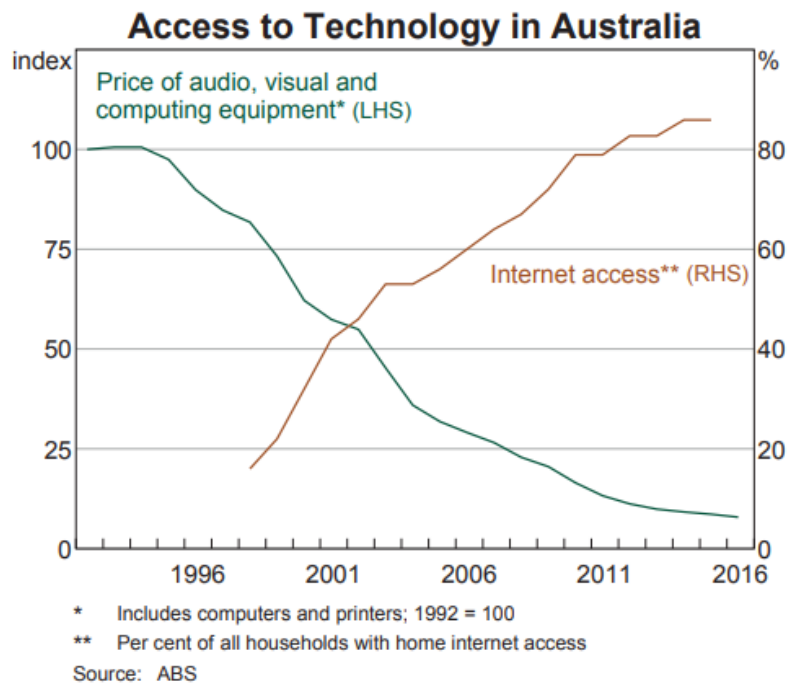


Figure 10. Access to Technology in Australia ((Brown et al., 2017), Secondary Data from the (2016)).

According to the *Elliott Review into the Integrity and Assurance of Food Supply Networks – interim report* commissioned by the Department for Environment, Food and Rural Affairs (DEFRA) (2014), risk exposure to food sectors can be identified by examining a number of factors:

- (1) Increased commodity prices that push consumers demand for lower prices.
- (2) Premium country of origin and seasonal substitution of international brands
- (3) Crop failures and shortages triggering higher prices of raw materials
- (4) Under-supply verses demand e.g. Manuka New Zealand honey

These factors are based on premium prices and under supply which are key drivers for counterfeiting to occur. Therefore, it is questioned if consumers of both every-day and premium products, are equally concerned for the application of anti-counterfeiting elements?

2.1.8 Profiling Counterfeiters

Literature has proposed Counterfeiter profiles as a *distinct group* to other imitation branded good groups such as piracy, imitation brands and products entering via grey markets (Lai and Zaichkowsky, 1999). In contrast, the term ‘counterfeiting’ has more recently been presented as an overarching *category*, type casting all fraudsters (Spink et al., 2013). Spink and his colleagues research compile types of Food Fraud incidents by counterfeiters’ activities as shown in Table 4 with 7 clearly presentable crime acts that, are not mutually exclusive, and can overlap depending on complexities and the level of organised crime. The Types of Food Fraud incidents consist of: “(1) Adulterate, (2) Tamper, (3) Over-run, (4) Theft, (5) Diversion, (6) Simulation and (7) Counterfeit with definitions, examples and impact of each provided below. The identified groups stand to clarify counterfeiting operation tactics. This knowledge enables informed, deterrence strategies to be planned.

Table 4. Food Fraud incident types (Spink, 2007, Spink and Moyer, 2011b)).

Term	Definition	Example	Potential public health threat that may lead to illness or death
Adulterate	A component of the finished product is fraudulent	Melamine added to milk	Fraudulent component
Tamper	Legitimate product and packaging are used in a fraudulent way	Changed expiry information, product up-labeling, so on	Fraudulent packaging information
Over-run	Legitimate product is made in excess of production agreements	Under-reporting of production	Fraudulent product is distributed outside of regulated or controlled supply chain
Theft	Legitimate product is stolen and passed off as legitimately procured	Stolen products are co-mingled with legitimate products.	Fraudulent product is distributed outside of regulated or controlled supply chain
Diversion	The sale or distribution of legitimate products outside of intended markets	Relief food redirected to markets where aid is not required	Shortages or delays of relief food to needy populations
Simulation	Illegitimate product is designed to look like but not exactly copy the legitimate product	“Knock-offs” of popular foods not produced with same food safety assurances	Fraudulent product of lesser quality
Counterfeit	All aspects of the fraudulent product and packaging are fully replicated	Copies of popular foods not produced with same food safety assurances	Fraudulent product

In each case, fraudsters may not be following Good Manufacturing Practices (GMPs), Good Agricultural Practices (GAPs), or Good Hygiene Practices (GHPs).

Interestingly, these groups can be clustered into either ‘modifiers’ or ‘mimickers’ which is based on their dependence of interaction with the legitimate supply chain. *Modifiers* pertain to the five groups that alter the original business plan or IP, who either: Adulterate..., Tamper..., Over-run..., Thieve..., or Divert... the authentic product. These five grouped activities are reliant on intersecting or modifying the original product’s path. In contrast, those who Simulate, or Counterfeit (which is considered more damaging to brand trust) differ greatly to the other five as their aim is to Mimic an authentic brand undetected, deceptively generating a copy of the original. Mimickers are fraudster types that are of primary interest to this research, defined by their working in

parallel behaviour, undetected, where they strive to avoid the direct engagement of the authentic brands jurisdiction (Wilcock and Boys, 2014). Important to note here, is the idea that a company aiming to protect their own supply chain with high-tech anti-counterfeiting is targeting ‘modifier counterfeiters’ who attempt to intersect their genuine products and to use the technology to validate with their direct customers. However, it is the ‘mimicker counterfeiters’ who are deceiving in-direct customers that lie outside the original market plan which literature needs to expand on to develop strategies of deterrence.

In summary, this research defines counterfeiters as those who do not modify authentic products such as the adulterators or tamperers. They do not work for the manufacturing arm of the original company who over-run supply or thief from storehouses, nor divert distributions. Counterfeiters, and simulators to a degree, aim to work undetected, separate from the legit business, monitoring from afar, economically benefiting from easy replication of a branded product and intentionally deceiving customers.

The questions are posed:

- Can anti-counterfeiting be strategized to deter Mimicker fraudsters using design complexities that in turn build trust and a sense of premium?
- How does a growing in profit, SME protect against packaging Mimicking counterfeiters who work in parallel, undetected?

It is believed that by exploring past reports of counterfeiters attempts, failures and successes and mapping their tools for replication, a business can develop anti-replicant strategies.

2.1.9 Counterfeiters Capabilities

The Fraud Diamond identifies the importance of defining the *capabilities* of fraudsters; to scope out their profiles, strategies and tools. To map out counterfeiters capabilities, one must take the approach of thinking and acting like a potential criminal and consider what is advantageous to the fraudster whilst reviewing the tools they readily operate. FSAUK (2015) states that organised criminals target brands with high value products that are easy to imitate and have little, to no detection measures in place. An example of

example provides insights into high value and rare products exposed to everyday counterfeiting tools resulting in deceptive, hard to identify duplicated products. For businesses to increase deterrence of counterfeiting, they need to understand the types of tools used by counterfeiting. Once the combined tools and methods are defined, then businesses can plan deterrent strategies to disarm such capabilities.

Reid Fruits Tasmanian Cherries – An Easy to Spot Counterfeit

Reid Fruits is an Australian, Tasmanian company selling lush, premium cherries that are sought after internationally. The Australian Broadcasting Corporation (ABC) news online reported in 2015 the discovery of counterfeit packaging selling fake copies out of China and Vietnam. The article discusses how the Reid Fruits company adopted anti-counterfeiting technologies as a response to the threat to protect the future of their value-chain and protect IP. An example shown in Figure 12 demonstrates the authentic packaging design (left) to the counterfeiter's version (right) which is clearly a poor replication in some parts with others done well. The packaging design elements mimicked closely is the red and gold foiling background colours, the cherry and leaf image and the location of text. The elements more difficult to copy included the unique fonts, the stylised jumping kangaroo emblem and the golden badge printed top right of the real product; replaced entirely with a cut-and-paste Australian flag vector from online. Interestingly, the intricacies of fonts and detailed logos acted as hurdles against the counterfeiter's capabilities. The poor substitutions using online sourced images presents to consumers a means for suspicion and a check point for comparison to the original brand's website displayed information. The report by ABCNews (2015) concluded that apart from legal action, which is difficult and expensive, growers are encouraged to explore preventative measures and specifically, to make their packaging "more complicated to copy."



Figure 12. Authentic Reid Fruit Cherries (left) and the Counterfeit Packaging (right) (ABCNews, 2015).

Categorised Capabilities

From the previous examples and collated studies on packaging mimickers, there is growing evidence from reported case studies that counterfeiters are limited to the same common tools as the designers and manufacturers who develop product packaging. Tools of duplication of an authentic product can then be identified and counterattacks strategized. This research pinpoints Six Strategies (Figure 13) employed by fraudsters defined as counterfeiters' capabilities: **(1) Extend**, **(2) Reuse**, **(3) Copier**, **(4) Re-engineer**, **(5) Corruption** and **(6) Rip-offs** (Francis, 2017).



Figure 13. Counterfeiters Capabilities as defined by Packaging Replication (Francis, 2017).

Extend represents the counterfeiters who modify, conceal or adulterate a branded products information, such as extending a used-by-date to enable a retailer to sell a product after it has expired or is not suitable for resale. *Reuse* is the repurposing of the authentic packaging that is either used once and refilled or the original product has been removed and then the authentic packaging refilled with an inferior product (the original product is sold in another branded packaging to win awards, for example a premium wine bottles or water bottles). *Copier* is the use of cameras, photocopiers or high-resolution scanners to duplicate authentic packaging. *Re-engineer* is the more sophisticated process that uses creative programs such as Photoshop to recreate the authentic packaging. *Corruption* pertains to dishonest actors servicing the authentic brands supply chain using bribery or leadership pressures to thief the original brand's packaging designs and gain unauthorised access to their branding IP. *Rip-offs* are the

result of counterfeiters who simulate the brand's design personality with slight modifications enough to copyright and potentially avoid legal action, this form may or may not deceive consumers depending on their quality output.

From this defined list of capabilities, we can now limit the opportunities of the crime triangle by developing counterstrategies on each area. The aim is to disarm counterfeiter capabilities away from the easier options of reuse and copy to the more difficult skill-based option of re-engineering or legal protection measures for blatant Rip-Offs. This is where a brand can create complexities that form barriers counterfeiters cannot easily scale. The higher sophisticated levels are easier to defend if packaging is produced in-house and not outsourced within the country of counterfeiting threat.

Next, the impact of counterfeiting is briefly considered before moving into Chapter 3, reviewing consumers perceptions and the fragile formula of trust.

2.1.10 The Impact of Counterfeiting

Counterfeiting has been as quoted as “more profitable than heroin....easier than photo-copying....and with penalties like jay-walking” (Naím, 2006, Spink, 2007). It is paramount that businesses of all sizes need to be educated on the looming impact counterfeiting have on the damage of their brand and the risk to their consumers, with the cost only rising. If counterfeiting can be easier than photo-copying, then strategies modelled on identified capabilities (Francis, 2017) need to be appropriate and effective in disrupting the common tools that enable their practice. In greater consideration are the easier targets, such as SMEs, who come with less experience and weaker security systems in place (Needleman and Chu, 2014) and with limited financial or technological resources (Kennedy, 2016). Larger scaled businesses such as multinational brands, can either aptly protect their supply chain through due diligence and vetted networks built on supply chain management or respond with reserved funds for reactive legal actions. However, Spink et al. (2013) points out that illicit enterprises exploit weaker, exposed legitimate businesses such as that of SMEs by replicating the product and packaging with lesser quality or unsafe materials and ingredients. Although counterfeiting affects all sized businesses, SMEs are more susceptible to counterfeiting threats.

The food fraud threat is a global issue and the counterfeiting food market is estimated to cost the industry \$50 billion per year (Spink, 2007, McLeod, 2017). The Organisation for Economic Co-operation and Development (OECD) (2007) clarifies that they impact on multiple levels:

“They are of concern to governments because of (i) the negative impact that they can have on innovation, (ii) the threat they pose to the welfare of consumers and (iii) the substantial resources that they channel to criminal networks, organised crime and other groups that disrupt and corrupt society. They are of concern to business because of the impact that they have on (i) sales and licensing, (ii) brand value and firm reputation, and (iii) the ability of firms to benefit from the breakthroughs they make in developing new products. They are of concern to consumers because of the significant health and safety risks that substandard counterfeit and pirated products could pose to those who consume the items.”

Businesses go into exporting ventures with little preventative preparation and when faced with the reality of counterfeiting, are exposed to “lost sales, recalls and/or legal liability” Spink et al. (2012).

The Food Standards Agency UK and Scotland reported on the impacts on industry and consumer levels, highlighting a major issue to the lack of threat awareness. “Consumers are generally unaware they have bought substandard food, so seldom report offences” (FSA, 2016). Deceived consumers of fraudulent crime may not even know they are a victim and therefore businesses are not alerted, and counterfeiters continue to operate, resulting in damaging brands and diminished consumer trust.

This research now explores the consumer relationship aspect of trust and explores the attributes that build trust or on the contrary, when trust lacks, what cause perceived risk.

2.1.11 Section Summary

In summary, there are main findings from the literature pertaining to fraud, Food Fraud and counterfeiting. Of interest is deceptive fraudsters who act intentionally and motivated by financial gain (Spink et al., 2017). The expansion of the fraud triangle (Cressey, 1953) into the fraud diamond, enabling capabilities (Wolfe and Hermanson, 2004) clearly outline the factors that need to be in place for the Crime Act to occur (Albrecht et al., 2015). Spink (2010) advocates Anti-Counterfeiting teams (Guardians) and strategies (Hurdles) in place to exasperate fraudsters, his framework is a variation of the theoretical crime triangle yet proposed as the Fraud Opportunity.

Spink and Moyer (2011b) collates the types of Food Fraud incidences which further profile the tactics of counterfeiting fraudsters which is adapted for this research into two broad groups Modifiers and Mimickers; the later addressed in deeper scope and interest. A shift in research focus has been called towards preventative strategies rather than the established operational responses of detection, intervention and response tactics (Spink and Moyer, 2011b). In line with the proactive approach is the comparison case of proactive and reactive strategies presented by (Sincerbox, 1993) which clearly demonstrates the reduced counterfeiting rate over time by reducing the tolerance threshold. As in the context of gardening, weeding often, the job is easier as weeds are less established. New counterfeiting deterrence features are proposed to frustrate the efforts of counterfeiters and deter repeated targeting. However, if new deterrence features are required often, then for the context of SMEs, these features or elements should be cost effective and easily accessible which are further discussed in Section 2.3.

It is clear by the definition of deceptive counterfeiting in the context of food products, consumers are part of the solution whereas non-deceptive counterfeiting struggles with the underlying issue that consumers can be a part of the fraud-chain.

It is important to argue against the idea that brands are two-steps behind counterfeiters as stated by Moore (2016) but in fact, counterfeiters are lagging behind, reflecting authentic brands which is an advantage to exploit. This important reality can be leveraged to build strong and unique attributes that counterfeiters fail at replicating.

Identifying the drivers of risk especially to the open access of online resources and affordable high-tech equipment to duplicate packaging designs, strategies need to consider these points and look to the weaknesses of these tools in order to develop cost-effective interchangeable elements for SME brands that build trust.

Understanding the drivers and the capability enablers of counterfeiters will support managerial teams in preparing strategies focused on proactive preventative measures aimed to maintain and build consumer trust. The next section will explore the parameters of trust and perceived risk. Literature dealing with the impact of counterfeiting will be reviewed and proposed strategies on overcoming heightened risk considered.

2.2 Consumer Trust and Risk Perceptions

2.2.1 Introduction

A bonding trust relationship with China is key for Australia's food export plan as China is the second largest export partner after Japan and accounts for \$11.9 billion or 23.7% of food exports reported in 2017-18, and growing (RuralBank, 2018). Establishing and maintaining trust with Chinese consumers by offering high quality, authentic food products is paramount to continuing a robust trade relation with our overseas neighbour; especially in a culture where trust is found to be compromised due to Food Fraud awareness.

To recognise the building blocks in establishing early trust as well as the hinderances to the transaction in a doubtful environment, one must acknowledge that trust attributes are distinct for offline and online channels. Another contrast is found between recognised mega-brands and emerging SMEs. Trust can be strengthened or weakened. Opposing negative factors like that of counterfeiting risk hinder consumer-business trust transactions. They impact on consumers risk perceptions. It is vitally important to understand what causes the perception of risk that results in trust rejection. Risk assessment is a predecessor to trust and must be overcome before early trust is decided upon. Trust propensities levels can range from apathetic to intense scepticism and are believed to be formed by previous relationships and experiences, either direct or indirect. China is considered a risk adverse society with intense sceptical concerns for authenticity (Yan, 2012). Considering risk adverse societies helps to distil the required strategies to overcome their fear or perceived risk to establish a strong trusting relationship. Thus, in a world of doubt, this research is timely for the rapid growth in new-to-export emerging SME businesses that have little, to no brand recognition and who seek to establish early trust in high-risk Asian communities.

Section 2.2 begins by reviewing the contrasting literature that offers definitions of 'Trust' and its foundational attributes. The early trust formation concept of 'Initial Trust' is

presented that considers new and unfamiliar actors and engagements framing the substitutional attributes that need to be present for a trusting engagement to occur. It will then review an important factor of trust formation based on consumers expected 'Reward Attraction' that contributes to the belief that the trust transaction will be more rewarding than the potential costs. 'Perceived Risk' is a recognized term in literature used to describe a consumer's beliefs, propensities and hesitations used to assess a brand or product prior to purchase. This will lead the research in defining the theory of a 'Risk Society' and the resulting 'Social Trends'. In addition, the research presents literature on comparison studies that consider the theory of Different Worlds and reasons why the comparison of two cultures, exposed to different degrees of counterfeiting risk, can provide stark consumer insights. The focus will then be pinpointed to trust in the context of consumers online, considering e-Commerce and the coined term electronic Trust or e-Trust. Online consumer profiles will be presented with their search for online trustworthy cues that are strengthened through familiarisation, play and design sophistication.

In summary, this chapter explores the consumers expectations and perceptions based on trustworthy online commercial relationships. It scopes the fragile nature of trust which is hard to form and is easily broken. It presents the complications that are compounded by fraudsters. Finally, it seeks to identify ways to reduce perceived risk through: (1) trustworthy components that builds familiarity; (2) a sense of playful engagement; and (3) the impact of sophistication through merged design and security. This then leads into the next chapter Anti-Counterfeiting and Design-Driven Deterrents.

2.2.2 Definitions and Initial Trust

Definitions

Trust is engrained throughout history within the social fabric of society. It spans research disciplines and effects every consideration of people and things. Trust has been an embedded interest for all academic disciplines and industries and although researchers have referenced it on abstract and specific levels, the multi-disciplinary definitions overlap (Rousseau et al., 1998, Morgan and Hunt, 1994, Luhmann, 1979) and conflict (Wang and Emurian, 2005, Lewis and Weigert, 1985, Mayer et al., 1995).

A definition of trust can be expressed in that it is “a psychological state comprising the intention to *accept vulnerability* based upon positive expectations of the intentions or behaviour of another” (Rousseau et al., 1998). They frame trust as a “willingness to be vulnerable” which is commonly echoed throughout most definitions of trust. According to Taddeo (2009) it is defined as a *decision making process* to act on a relational transaction between “an agent (the trustor) and another agent or object (the trustee)”. Terms describing a potential trust transaction between two agents in the trading world is accommodated in these definitions such as trust partners: a Business and a Consumer. However, counterfeiting fraudsters are a disruptive third-party actor negatively influencing the trust relationship and vying for the position of the authentic business actor through illegitimate means. Theoretical concepts defining this three-way intersection are yet to be defined and the risk impact on consumer trust transactions overtime.

Parameters

Luhmann (1979) within his two works *Trust and Power*, maintains that there are three parameters of establishing trust. These are defined as (1) familiarity, (2) expectation and (3) risk. According to Luhmann, *Familiarity* is the varying degree in which a trustor knows the trustee or system, the motive for trust is defined as *Expectation*, and the differentiator of *Risk* from hope is the decision to act on their judgement. Familiarity between businesses and consumers is based on reputable brand recognition. For businesses with little to no brand recognition, such as emerging SMEs, their familiarity degree is considered weak and thus it is required to substitute familiarity cues or rely on the other parameters of trust. While Deutsch (1960) acknowledges the two actors of a

social-psychological trust transactions, he contends that it is a two-sided transaction. He states that the “initiation of cooperation requires mutual trust”. Doney and Cannon (1997) consider the mutual aspect as an exchange of the partners ‘credibility’ and the belief in expectation that their word or documented statement is dependable. Although definitions are not aligned and sometimes conflict on the topic, the collated summary of descriptions can piece map the landscape of meaning (Table 5).

Table 5. Trust Parameters: Summarised from Literature (Francis, 2019).

Reference	Trust Parameters
Rousseau et al. (1998)	Intention to accept vulnerability
Taddeo (2009)	Risky investment
Luhmann (1979)	Familiarity, expectation, risk-taking
Deutsch (1960)	Relationship of mutual trust
Doney, Cannon (1997)	Exchange partners credibility
McKnight et al. (1998)	Initial Trust - trustor with little knowledge of the trustee
Fung and Lee (1999)	Initial Trust formation and life cycle (1) information gathering and (2) reward attraction
Siau and Shen (2003)	e-Trust - hard to obtain, extremely fragile
Elangovan, Shapiro (1998)	Exploiters of Trust - opportunistic betrayal
Camerer (2003)	Behavioural Game Theory - strategic choices to win

Trust is well represented in literature throughout Social Psychology (Deutsch, 1960, Lewis and Weigert, 1985, Lewicki et al., 1998), Sociology (Lewis and Weigert, 1985, Barber, 1983), Economics (Bertrand et al., 2006, Williamson, 1993, Berg et al., 2008) and Marketing (Geyskens et al., 1996, Jarvenpaa et al., 1999, Doney and Cannon, 1997, Morgan and Hunt, 1994, Berry, 1995, Sirdeshmukh et al., 2002).

Literature further investigating consumer trust, through platforms of e-commerce and social commerce, is also well established (Gefen et al., 2003, Pavlou, 2003, McKnight et al., 2002). It has also been experimented within the confounds of Behavioural Game Theory (Camerer, 2003) which looks at trust from a perspective of strategic choices and alliances as well as vengeance and avoidance.

Initial Trust

According to McKnight et al. (1998), a concept of ‘Initial Trust’ goes beyond the preceding two theories of trust development of *calculative-based* theory (Coleman, 1990, Williamson, 1993) and the *knowledge-based* theory (Holmes, 1991, Lewicki and Bunker, 1995). Calculative-based research states that individual persons invest in the choice to trust based on logically deduced benefits over costs (Lewicki et al., 1998). McKnight et al. (1998) outlines the knowledge-based research as a relationship that develops over time which compounds trustworthy knowledge through the experience of one another. McKnight et al. (2002) argue for a combination of the two theories and propose a revised concept referred as Initial Trust, a vital abstract for this research.

Initial Trust is the commenced action of a trust decision where the trustor begins with little, to no knowledge of the trustee or object. The founding of one’s decision to trust is either by their own trusting temperament and/or by other convincing institutional cues portrayed by the trustee or object. In consideration of businesses attempting to emerge into foreign markets, striving to understand and harness consumer Initial Trust is essential for successful engagement stages. This concept of Initial Trust being able to be established without the trustor having prior background knowledge or experience of the trustee enables SMEs with unfamiliar innovations and little brand recognition power to take advantage of the opportunities needed to break new ground. Gefen and Straub (2004) summarise McKnight’s Initial Trust to comprise of “(1) beliefs dealing with competence (ability), benevolence, honesty (integrity), and predictability, and (2) trusting-intentions.” They acknowledge alternative cases identified by Elangovan and Shapiro (1998) as “*opportunistic betrayal*,” where the perceived contract of trust is compromised for deceptive self-gain. Counterfeiting is a form of trust built on opportunistic betrayal, resulting in damaged consumer trust and increasing community scepticism of unknown and known brands, as there are no guarantees of distinction between fraudulent or legit products.

According to Taddeo (2009), “trust is a risky investment” and is not without problems. Deutsch (1960) defines the problem of trust by suggesting if the trustor, co-operator, or actors within the trust relationship proceed to make “customary assumptions” of the trustee without any learnt familiarities, expectations can be askew of the real outcome. If a business, entering into a new market is unfamiliar to consumers, it needs to develop and portray cues of familiarity. Presented products that are very unfamiliar to consumers

will call for greater attention and scrutiny over the products attributes for trustworthy attributes and authenticity. Taddeo (2009) goes on to identify another form of failing in a trust transaction is the negative scenario of a co-operator intentionally seeking to benefit from a trust arrangement beyond the best outcome for the other. Counterfeiting causes such risk and has means of decreasing consumers trust.

Trust is not easily obtained and “is not only *time-consuming* to engender, but also *fragile* and *easily destroyed*” (Siau and Shen, 2003). The establishment and lifecycle of trust was presented in the research by Fung and Lee (1999) who outline an “e-commerce trust development life cycle” (Figure 14) that presents the factors that need to be present to form Initial Trust through to a continuous trust development cycle that is open or closed.

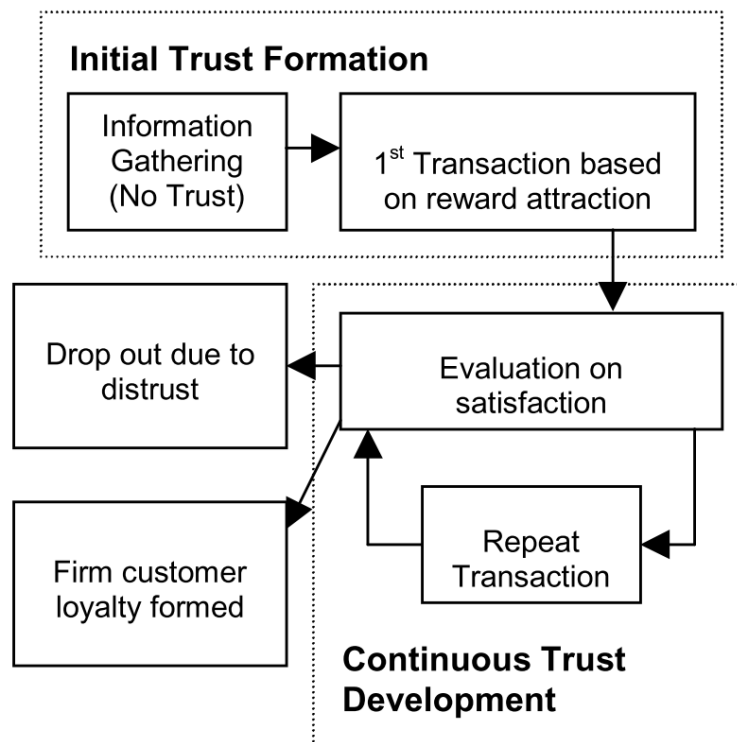


Figure 14. The e-Commerce Trust Development Life Cycle (Fung and Lee, 1999)

Within the Initial Trust formation cluster, shown in the diagram, the trustor, who begins with no trust, conducts *information gathering* about the unknown potential trustee. Depending on the significance of the information and whether it meets or exceeds expectations through presented trustworthy cues of (1) Accuracy, (2) Correctness, (3) Timeliness and (4) Usefulness, the trustor will then proceed to assess the *first transaction based on reward attraction*.

Fung and Lee (1999) argue a Reward Attraction as the compelling expectation that the trust transaction will be more beneficial than the costs or risks. A reward is a received benefit that can take the form of a physical product, service, relationship, information or action in return for the trust transaction. To expand on the factor of usefulness, Fung and Lee (1999) cite Janal (1995) on their identified web content that is essential to building trust: (1) company name, (2) logo, (3) mission statement, (4) headlines of the products and / or services, (5) notice of special events, (6) hot buys of the week, (7) what's new, (8) message from the president, (9) testimonials, (10) employment notices, (11) fun stuff and (12) date of last update. While it is noted that most attributes are self-evident, the two attributes of *testimonials* and *fun stuff* are undersubscribed on how these can be produced and applied.

Testimonials can consist of third-party acknowledgments, registering with certifying bodies or imagery of real places and people that can be further explored. Cheskin Research et al., (1999) and Fung and Lee (1999) point to Seals of Approval (SOA) such as “symbols such as Visa and Microsoft” instil a sense of security. Other SOAs can include identity badges such as the Australian Made Logo which brings with it the trusted regulations, robust processes and callout to place of origin recognised globally. Although Fung and Lee's research was not considerate of the counterfeiting context, the model can be adapted to express the reactive responses of consumers to such damaging experiences. In the very real scenario of a delivered counterfeit product, a customer can either (1) be deceived, or (2) discover the fake.

A deceived consumer will believe the product is authentic and after purchasing it will most likely drop out of the trust relationship cycle due to a low evaluation on satisfaction. A repeat transaction may or may not occur depending on the quality of the counterfeit and the correlation between the product and the promised reward attraction presented on authentic websites. On the other hand, a consumer who discovers a counterfeit product would be more likely to also drop out of any future trust transactions with the authentic brand. Post-discovery, the consumers evaluation of risk is now heightened resulting in the level of consumer confidence in the original brand drastically diminished.

Emerging exporting SMEs need to compete with fraudsters for Initial Trust.

Initial Trust is primed when the benefits or rewards to consumers outweigh the potential costs or risks. Once a trust transaction has occurred with the original brand and the product satisfies all reward expectations, then Initial Trust can be strengthened, and repeated trust transactions can move the relationship to loyalty. However, in contrast, when fraudsters win consumer Initial Trust, the resulting relationship will not be equally satisfying or at worst, harm the consumer and the brand in turn.

Counterfeiters are disruptors of Initial Trust.

They cause consumers to heighten their risk prior to purchase (Berg, 2004, Heinonen et al., 2012). Therefore, the behavioural process of 'perceived risk' and consumers assessment of it is now defined which will introduce reasoning for the concept of a risk society and the specific drivers identified as a focus of this research.

2.2.3 *Perceived Risk*

In the 2016 opening ceremony, the President of the International Olympic Committee declared “We are living in a world of crisis, mistrust and uncertainty” (Bach, 2016). Although disheartening, these are the words that summarise the sentiment of many of the world today. Many reasons amount to this movement nonetheless, this research focuses on the perceived risk of others and of objects, reasons of justified uncertainty and the methods in which consumers attempt to reduce their anxiety prior to purchase.

It was at the beginning of 1960 when the focus of ‘risk’ was proposed as a new area of interest by Bauer (1960). Perceived risk has now become a term in literature well defined and applied by a diverse range of disciplines including but not limited to: management (Mitchell, 1999), cross-cultural comparisons (Weber and Hsee, 1998, Jarvenpaa et al., 1999), apparel catalogue shopping (Jasper and Ouellette, 1994), food technology (Eiser et al., 2002), brand preference (Ha, 2002) and current interests are rapidly growing in the concerns of e-commerce (Featherman and Pavlou, 2003, McKnight et al., 2002, Corbitt et al., 2003).

Ha (2002) citing (Cox, 1967) states that the factors of (1) uncertainty, (2) choice, (3) adverse consequences, contribute to perceived risk. This research adapts the three identified risks and contributes them to the counterfeiting context (Table 6):

Table 6. Risk Factors in the Counterfeiting Context ((Francis, 2019) adapted (Cox, 1967; Ha, 2002))

Risk Factors	Counterfeiting context
(1) Uncertainty as to buying goals	Consumers are increasingly seeking international brands in response to local food safety scares, cautious of SME products with no brand recognition
(2) Which of several purchases (product, brand, model, etc.) best matches the buying goals	Counterfeiters are mimicking international brands and exposed consumers with heightened perceived risk are shifting towards self-validating, forensic information gathering for authenticity checks
(3) Possible adverse consequences if the purchase is made (or not made)	Food counterfeits pose a danger to health and safety and significant trustworthy cues are needed to overcome extreme perceived risks as proof of authenticity with preventative measures applied.

A conceptual model (Figure 15) is proposed by Ha (2002) that surveyed 124 Internet Auction Participants in South Korea on their perceived risk. The study used controlled variables presenting on brand information, word-of-mouth and customized information with independent variables assessed on “(1) performance risk, (2) psychological risk, (3) financial risk and (4) time-loss risk” (Ha, 2002). While the findings confirm brand recognition as an important trust factor, sufficient brand and product information is required to supplement unfamiliarity and can reduce consumer’s perceived risk factors. WoM from trusted friends and family is a factor that reduces perceived risk and significantly influences consumers own perceptions of the unfamiliar product. When considering negative experiences, risk exposure to one member can be passed on through WoM as perceived risk to another.

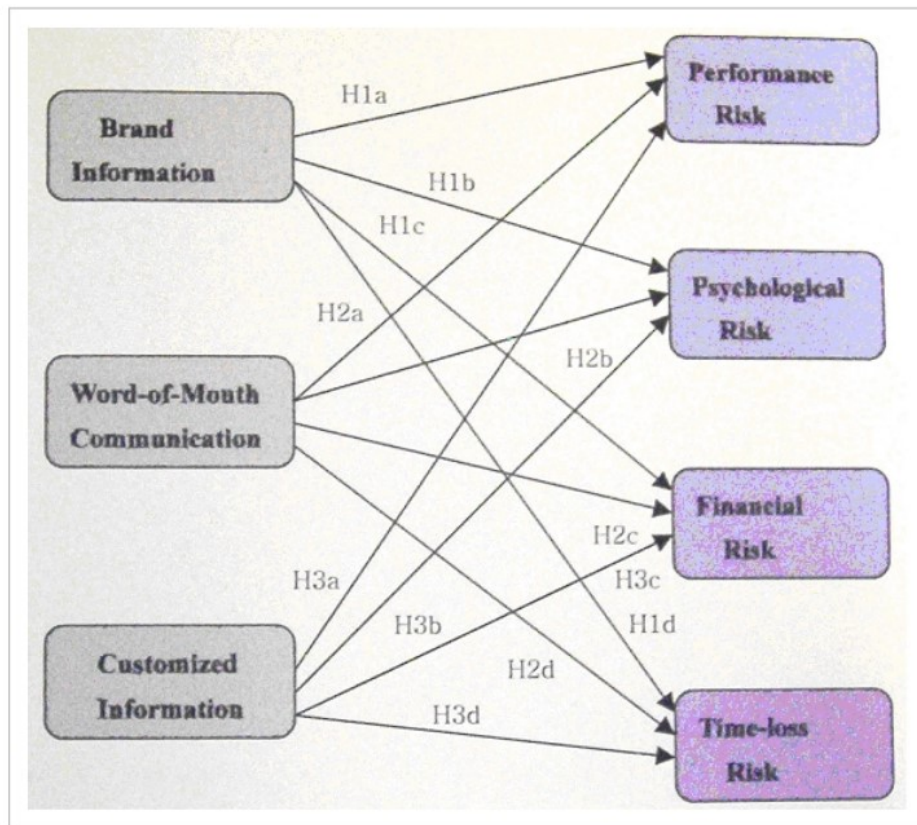


Figure 15. Perceived Risk Conceptual Model (Ha, 2002).

Perceptions have impacts.

According to Paul Slovic (2000) in his book the Perception of Risk, the impact degree is resulted “from an ‘unfortunate event’ (e.g. an accident, a discovery of pollution, sabotage, product tampering).” Counterfeiting is also deemed as an unfortunate event causing

consumers perceived risk. The risk-perception literature identifies not only the impact degree caused by the type of the event, but also secondary ramifications magnified by social awareness through media, costs overtime and other noted impacts effecting the company, industry or group involved.

Exposure can be direct or indirect experiences.

Consumer perceptions can be altered. Perceived risk can be heightened by exposure to others alerted state. That is, others experience of counterfeiting can impact others through reported incidences and threats. In the research by Slovic et al. (1984), this impact is termed “*Signal value*” which describes others who mirrors the discernment of the event’s new information pertaining to the possibility of “similar or more destructive future mishaps”. Although a person may have never experienced a fraudulent product, the awareness of the threat can influence an individual and a collective groups behaviour. The hindsight phenomenon has also been studied (Fischhoff, 1975, Slovic, 2016) showing that if one is alerted to a certain events occurrence, then our feeling increases that its reoccurrence is unavoidable. Fischhoff (1975) identified that misperceptions can greatly cause cynicism, defensive assessments on past decision-making processes and limit what has been learnt from experience. This means consumers when faced with the reveal of a counterfeit, often blame a brand for the incident rather than their ability to judge authenticities.

Risk causes impact socially.

(Kasperson et al., 1988) considered the ripple effect caused by cultural, psychological, political and at social levels. This is further explored in the next section which looks to investigate the impacts of risk to a society as a whole.

2.2.4 Risk Society Theory and Trends

Risk Society Theory

Risk Society theory established by Ulrich Beck has gained significant recognition in academia and is widely cited through multidiscipline literature including policing (Ericson et al., 1997), management (Shrivastava, 1995), medical (Hardey, 2001), Law (Giddens, 1999), Food Systems (Fonte, 2002), Food trust (Berg, 2004, Almas, 1999, Yan, 2012) and among others.

In his book *Risk Society: towards a new modernity*, Beck (1992) argues that the risk which characterise the move from an industrial to a modernity society would contribute and establish a global risk society. According to Beck, modernity brings with it technological change that introduces new unique risks that society is constantly adjusting and responding too. He argues that the global affect goes beyond environmental and health risks alone and includes other factors pertaining to contemporary social life, insecurities and the trend shifts we are seeing in traditions, customs, family structures, employment and personal relations. The risk society predicts a global cross-cultural phenomenon which affects all countries and all social classes.

Food-safety issues are an increasing concern for consumers which according to Yan (2012) confirms Ulrich Beck's observations of a risk society occurring in China. Yan states that the rapid advancements bring "fear of various kinds of risks, resulting in a new psychological state among those who live in post-industrial societies" (Beck, 1992, Almas, 1999). Almas summarises Beck's risk society theory in the following five points:

- (1) *"Scientific and industrial advancements bring various new risks and dangers that can reach into future, global communities worldwide.*
- (2) *The perspective of science and technology have transitioned from saviour to destroyers resulting in problems they cannot solve alone.*
- (3) *Risks are internal and necessary outcomes of modernity, not external problems.*
- (4) *Unconstrained science and technology are causing political concerns on the impact of undesirable risks and hazards.*
- (5) *Politics are forms of conflict equally about the distribution of undesirable things, dangers and wealth distribution."*

The developments of society through rapid developments in online technology and trade relations opens the door to expanding ungoverned channels and flexible unrestricted consumer to consumer exchanges of products and services. This new digital world presents new risks that are less researched and unrestrained from regulators. Counterfeiters can exploit unregulated frameworks and the flexibilities found through online trading (Heinonen et al., 2012, Wall and Large, 2010). The impact of risk exposure, such as counterfeiting, can move societies towards an aggregated heightened risk. Evidence of this is found in literature dealing with risk in China.

Social Trends

There is a mounting interest in literature concerning the theory of a risk society in the context of a Chinese society. Disciplines represented include Asian cultural studies (Thiers, 2003, Wishnick, 2005), Criminal Law (Xiaoming, 2009), Social and Political studies (Webb, 2006, Zhang et al., 2007), Food Safety (Yan, 2012, Lora-Wainwright, 2013). “The Chinese society has arguably been affected more by food-safety scares than has any other on earth” (Yan, 2012).

Consumers have become increasingly aware and risk conscience on food purchases more than ever. Lora-Wainwright (2013) states that although citizens partake in the responsibility to protect themselves from food scares, individuals also resent regulations that are believed to be weak and ineffective.

Yang (2010) points out that forms of netizens protests in their various forms often are persecuted with severe punishment resulting in dispersed individuals who feel alone and silenced. Yang provides an example in the case of Zhao Lianhai in his conquest against the melamine infiltration into powdered baby formula. Although, he argued that support for citizens can come from scientists and experts, they often represent corporate agendas and NGOs who promote awareness campaigns, avoiding the questioning of governments and regulations.

Chinese individuals are growing in mistrust.

Their critical voices are unheard, and their perceived risk of fraudulent food scandals is on the rise. Consumers faith in the bodies and institutions that should provide quality assurance is in question and so consumers respond by taking matter into their own

hands. Emerging food brands need to empower consumers by considering consumer centred authentication tools and methods. Chinese consumers are scrutinising product packaging and brand presentation for clues on their investigation of counterfeit evidence. They review the small details and further seek additional references to confirm information and cross-reference product claims prior to purchase. This is very different between the Chinese and Australian communities where Australia is exposed to very little counterfeiting reports and firsthand experiences. These differences between cultures are believed to expose and comparatively contrast the vast differences in expected securities on food product packaging.

The question is then posed:

Do two cultures with comparative risk propensities expect significantly different security elements when considering food packaging?

2.2.5 *Different Worlds Theory*

Cultural and international social differences have been explored and defined throughout literature. Fay (1996) states that the “philosophy of social science is one centred on the experience of sharing a world in which people differ significantly from one another”. In the book *Children of Different Worlds: The Formation of Social Behaviour*, Whiting et al. (1992) writes on postmodern ideas and holds to the theory that a child’s interpersonal behaviour profile can be predicted based on the learnings of the company in which the child keeps, and the time spent between the varied categories of individuals. (Whiting et al., 1992) state that “they learn and practice patterns of behaviour that characterize their most routine interpersonal interactions.”

As we are now interconnected through social media and WoM, our influences come from shared media that is newsworthy-based or emotionally triggering. Therefore, news of counterfeiting is a hot topic. It is shared among friends and families, who partaking in the experience indirectly, growing concern on a social level. The book “*The Logic of Comparative Social Inquiry*” by Przeworski and Teune (1970) state most comparative studies employ cross-culture investigation as it reveals “differences among systems taken into account as they are encountered in the process of explaining social phenomena observed within these systems.” The process of comparison involves the definition of the population being observed, a sample extrapolated for comparison and the reduction of the inter-systemic differences. Such differences between social systems need to be minimised. Przeworski and Teune (1970) explain that populations selected based on the ‘Most Similar System’ Designs often compare similar countries natured and social ordered alike, for example the comparison of the Anglo-Saxon and Scandinavian countries....

“...which are seen as good samples because these countries share many economic, cultural, and political characteristics: therefore, the number of ‘experimental’ variables, although unknown and still large, is minimised.”

Comparison of two countries with notable different cultures and social behaviours opens questions on the research design and how it maintains the maximum level of Inter-systemic similarities rather than differences. The profile questions, wording and visual representation need clear translation for the countries of investigation and the control

variables need to be closely streamlined to exit any noise. This research will adopt the 'Most Different System' Design which aims to profile the two varied countries of Australia and China using common demographic questions visual representations and direct translations into native language surveys. All response variables are comparatively dichotomized as depicted by Przeworski and Teune (1970) to minimise confusions and misrepresentations lost in cultural interpretations.

Worlds between cultures can be distinctly different as well as commerce channels. The transition from bricks and mortar retail shops to e-Commerce platforms have also been of great interest within literature and consumers distinct trust attributes for both differ greatly. The research will now consider electronic trust or e-trust and its essential components.

2.2.6 e-Trust

e-Commerce is a booming industry in China and is on the rise. Compared globally, China surpasses rated regular usage of online purchasing as shown in Figure 16, with over 50% of all Chinese citizens shopping online on a weekly basis according to PWC (2017).

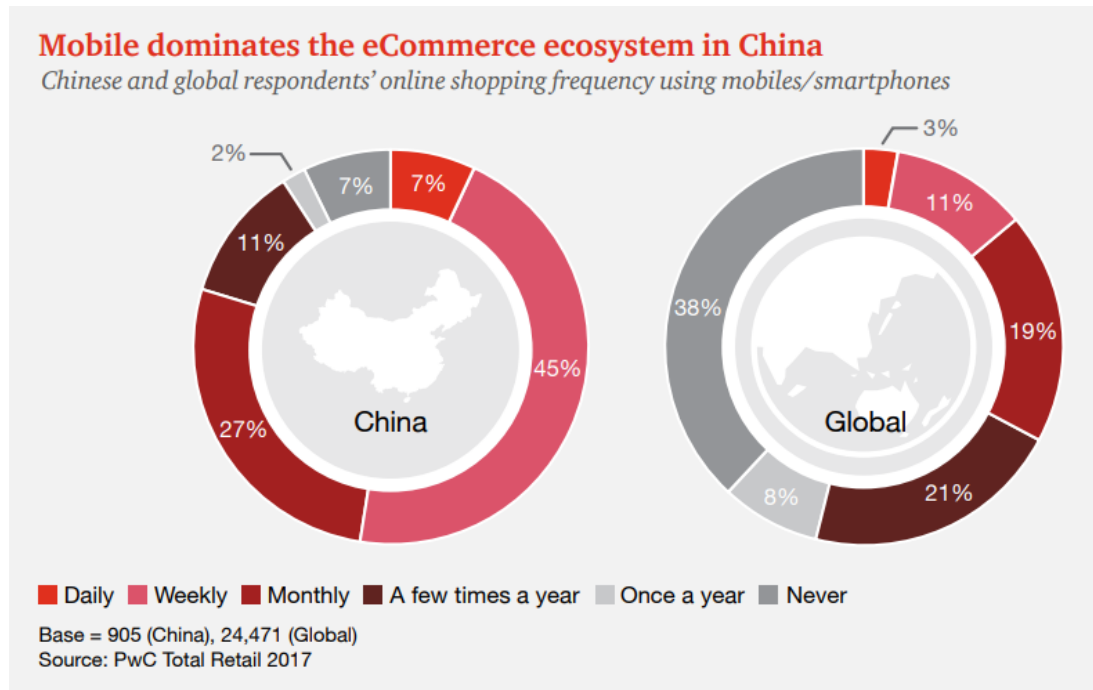


Figure 16. Total Retail Report on China and Global eCommerce Comparisons (PWC, 2017).

China claims the largest eCommerce trading market and is forecasted to hit \$1.6 trillion in 2020 (ExportGov, 2017). Purchases made online in China for 2016 have been reported to hit USD\$366 billion and predicted to grow between 21% (Euromonitor, 2017) to 34% (Goldman Sachs, 2017) by 2020 as quoted in The Economist (2017).

PWC (2017) portray the online and offline comparisons of both China and Global users as shown in Figure 19. This indicates the significant usage of mobile activated grocery orders in China researched 41% and purchased 42% compared to Global research 13% and purchased 10%. In contrast the In-store comparison figures suggest that China is moving away from In-store purchases with only 24%-28% approximately opting to purchase through bricks and mortar stores. Whereas, the lion-share of other nations prefer In-store, approximating at 53% research and 70% purchase.



Figure 17. Online and Offline Comparisons across China and Global Summaries (PWC, 2017).

PWC list the top 3 categories for growth as Food, Luxury, and Sports and Wellness. McMillan (2018) states that Chinese tastes are changing and becoming more Western with people eating more meat, dairy and processed foods and with this new appetite, opens more opportunities for international foods to be sought after online. The growing adoption of e-commerce and the 'mobile' subset m-commerce has expanded transactions to be conducted beyond business contexts, offering place-of-purchase flexibility and enabling consumers to browse and purchase products in domestic and transit settings also known as 'anytime shopping' (Young et al., 2009, Siau and Shen, 2003). Emerging technologies are challenging traditional retail sectors and pushing the boundaries of casual shopping behaviours well into the digital age. Traditional shopping will remain but with technological enhancements. For example, Euromonitor (2017) identifies the ranked number 1 grocery channel as Alibaba's Tao Café, which uses emerging technology and facial recognition to create a cashless checkout experience, enabled by a smartphone Taobao app.

Key disruptors of traditional shopping behaviour are driven by (1) economic slowdown, (2) the rise of the millennial shopper and (3) technology (PWC, 2016a). These drivers have consumers keen on products with emphasised value and functionality. Purchases with a shift towards experiences and transparent information enables consumers to self-

educate through online research and engagement. Alibaba, Tencent and Baidu Chinese e-commerce giants, among others are integrating “mobile, social and commerce” technologies enhancing the online consumer experience (Korporaal, 2016). Some make use of social forms of interaction and are founded on relationship-based e-commerce (Martinsons, 2008) that includes WoM marketing such as WeChat (Lien and Cao, 2014). Chinese consumers are more connected digitally than ever and have access to mobile e-commerce purchasing which includes food products online sold through exponentially growing mega channels such as TMall Fresh and wholesalers such as Alibaba also unrestricted to counterfeiting threats.

The body of research exploring online or electronic consumer trust also known as e-trust (Luhmann, 1979) is significant and well established in literature (Belanger et al., 2002, Vila and Kuster, 2011, Shankar et al., 2002, McKnight et al., 2004). e-trust considers consumers trust online and their assessment of websites architecture and experience, brands perceptions and products authenticity and value.

e-Trust and Security

Belanger et al. (2002) explores the attributes of building trust which are privacy, security, and online site. Security in their study, and in many others, is defined similar to that of Hoffman et al. (1999) where it is concerned with protection against “informational theft”. Specific studies addressing antecedents and consequences of trust are found by Jarvenpaa et al. (1999) who investigated cross-cultural differences.

Kim et al. (2009), in their study of customer online loyalty, investigates e-satisfaction and e-trust with an additional assessment of ‘etail quality’. Etail quality, as defined by Wolfinbarger and Gilly (2003), is measured on the entire e-commerce experience which in detail are distinguished into four factors of consumer perceived quality and satisfaction being: “website design fulfilment/reliability, privacy, security and customer service.” Marketing and brand protection literature as seen here, define security as the protection of information security, which is more so related to credit card details or personal profile information. A smaller body of literature is dedicated to consumers e-trust and their perceptions of security in the sense of product protection, enhanced packaging or anti-counterfeiting online. Literature on packaging advancements is reviewed in the next section concerning security against counterfeiting threats.

e-Trust presented by Unified Stakeholders

Shankar et al. (2002) outlines the stakeholders involved with online trust as “Customers, Suppliers, Distributors, Regulators, Stockholders, Partners and Employees”, all of which may vary in their needs and expectations of e-trust. This is imperative for exporting businesses to align all stakeholders employed in the development and delivery of product trust. Future studies need to collaborate with business wide stakeholders to identify the unique needs specific to their responsibilities.

e-Trust is fragile. It takes only one arm of a business that does not emulate trust signals to cause a consumer to become sceptical and disengage in the ‘Initial Trust’ pursuit. Trust building elements for online purposes that are applied to product packaging requires all business stakeholders to participate in the co-creation and selection of each solution so to meet their specific supply chain and end consumer needs.

A question is posed for research concerns: ‘Can a business model be developed to align all managerial stakeholders of each primary supply chain arm to participant and collaboratively create elements of e-trust for packaging?’

2.2.7 Profiling e-Commerce Consumers

Consumer profiling, also known as market segmentation, is widely used by marketing and business management researchers. Profiling enables experts to identify, compare and target consumer demographic identifies, trends and expectations.

The comparison study by Donthu and Garcia (1999) between internet shoppers and non-shoppers is considered one of the first to investigate the insightful differences (Keng Kau et al., 2003). Donthu and Garcia present variances that were significantly large in demographic profiles, claiming (in 1999) that online shoppers are “convenience seekers, innovative, impulsive, variety seekers, and *less risk averse than Internet non-shoppers*”. Grabner-Kraeuter (2002) argues against this, stating “Many consumers are *sceptical* or *suspicious* about the functional mechanisms of electronic commerce, it’s in transparent processes and effects, and the quality of many products that are offered online”. This research aligns to view of consumer-scepticism found by Grabner-Kraeuter (2002) and argues that it is on the rise due to additional risks found in counterfeiting.

Consumer Scepticism Influencing Profiles

Consumer scepticism, arising from the online transaction perceived risk, will result in unmet expectations. Counterfeiting adds to this scepticism. In the modern context of consumers becoming aware of fraudsters and authentic brands competing for their Initial Trust, perceived risk is on the rise. Thus, impacting and redefining traditional consumer profiles with risk as the definer. Current market segmentation cannot solely be credited on demographics alone; trust propensities and expectations of authenticity need accommodation.

This research poses the question: *Does segmentation of consumer profiles based on trust propensities impact expected trust elements compared across country and micro-cultures?*

Traditional Consumer Profiles

Previous studies have defined consumer groups based on personality traits representing a common group. For example, in their book “The unmanageable consumer: contemporary consumption and its fragmentations”, Gabriel and Lang (1995) identified

the nine faces of the consumer: (1) The Chooser, (2) The Communicator, (3) The Explorer, (4) The Identity-Seeker, (5) The Hedonist or Artist, (6) The Victim, (7) The Rebel, (8) The Activist, and (9) The Citizen. Although, these definitions are an attempt to compartmentalise consumers into manageable profiles, marketing fields still remain with forms of doubt (Lien, 1995).

The Individual Experience

With rapid technological change, consumers are looking for increasingly personalised experiences, customised for the individual. According to Boedeker (1995), two types of shopper groups have been identified as ‘traditional’ and ‘new-type’. New-type profiled consumers are those who look for entertainment and heightened shopping experiences in contrast to traditional product purchases. ‘New-type’ consumer profiles, deemed as ‘always on’ (Baird and Fisher, 2005), are seeking innovative user experiences. Exploring and researching a product is easier than before with continual networking access offered by wireless internet. Chinese consumers can dig deeper into products and are looking for more sophisticated experiences to build trust.

As consumers move from traditional bricks and mortar retail stores to online, their trust attributes are reaching back to what they lost from the instore environment and are looking for online experiences to accommodate trustworthy cues.

2.2.8 Trustworthy Cues for Online

Consumers, at varying degrees, remain sceptical of e-commerce's trustworthiness and ability to satisfy all needs in comparison to the bricks-and-mortar retailers (Siau and Shen, 2003). They argue that "without social cues and personal interaction such as body language, the observation of other buyers, and the ability to feel, touch, and inspect products, customers can perceive online businesses as riskier in nature". Liu et al. (2015) concurs, stating offline shopping lacks in the physical interaction between shopper-and-product tactile handling to judge quality and value. Counterfeiters are attracted to online environments due to the fact that consumers cannot physically inspect prior to purchase (Heinonen et al., 2012).

The question here is asked, can social cues and sensory interactions be regained through fabrications and enhanced retail online experiences?

Design matters.

The design construction of a website is an essential strategy of Internet marketing and a building block of trust for consumers (Hoffman et al., 1999, Shankar et al., 2002). According to Zhang et al. (2009) the website's characteristics in terms of professional presentation, design and engagement are the building blocks for trust. Other researchers go further to suggest that a website's design attributes should be tailored to targeted shopping preferences based on consumers various ages, educational and income backgrounds (Lightner, 2003). This view is strengthened by a commonly cited survey conducted by DigitasLBI (2015), titled *Connect Commerce*, which stated a number of findings including the growing need for online retailers to:

- (1) Personalise consumers shopping experiences.
- (2) Innovate the retail experience: stores to become more agile, more digital, more connected and smarter at using data.

According to DigitasLBI's survey, "personalisation is key driver to online and offline sales with 62% of respondents claiming they buy more and/or more often when met with personalised retail experiences. A further 27% actively look for personalised offers when shopping online and 75% log in to e-commerce websites that cater for their personal

preferences based on previous behaviour (40%) or to get product personalisation (34%).” Tailor made and enhanced multimedia shopping experiences establish trust and reduces social uncertainty according to Gefen and Straub (2004). International trade is causing brands to research micro-markets and foreign cultures in order to offer products that are personalised to their tastes and expectations. Therefore, it is posed, Does anti-counterfeiting applications and the communication of them online need to be tailored to international cultures targeted by local brands?

Research exploring web attributes that promote trust are well founded (Cassell and Bickmore, 2000, Lightner, 2003, Bart et al., 2005, Belanger et al., 2002). An example is taken from the study undertaken by Cheskin and SA (1999), in which six features of Web sites were identified to augment trustworthy sensitivities. These features include: “(1) safeguard assurances, (2) the marketers’ reputation, (3) ease of navigation, (4) robust order fulfilment, (5) the professionalism of the Website and (6) the use of stat-of-the-art Web page design technology”. Literature clearly shows that while the professionalism and design presentation of a website can impact on a consumer’s trust of it, research is required to translate these learnings across to counterfeiting and the perceptions of them. Acceptance of online securities and protection measures could be influenced through varying design degrees also.

Cassell and Bickmore (2000) explore human interactions with online interfaces and how to inspire a “cognitive state of trust”. Their research focuses on how people engage with small talk to build trust and eventuating to open dialogue on the purposed topic of interest such as real estate sales encounters. They explore natural human dialogue engagements labelled “Interaction Rituals” in which they have applied to avatars, virtual assistants and fabricated online store environments. They outline three competencies that involve a cognitive state of trust which are “(1) Perceiving other people as knowing the nature of the type of interaction about to transpire; (2) Representing their own self-interests in the interaction; and (3) Being responsible enough to try to ensure the interaction does not result in negative consequences for the trusting person.” The latter is significant in building repeatable robust trust. The satisfied customer, perceiving the purchasing experience and the quality/function of the end-product as meeting their expectations and needs, can be encouraged to repeat the transaction relationship again, nurturing a positive WoM promoting customer. Negative consequences in the form of unmet expectations hinders efforts to build repeatable sales.

Bauer et al. (2002) outlines that once trust is placed in a company, the consumer anticipates their needs and expectations will be fulfilled. This reinforces their review of literature that shows a viewpoint shift from mass marketing towards a relationship management approach. They clearly define three key constructs of social psychology essential for successful relationship marketing which are “trust, satisfaction, and commitment”.

While traditional retail and e-Commerce differ, both require attributes of presentation and engagement to provide a holistic experience that act as “cues” affecting the establishment of trust (Giddens, 1990). Here Giddens suggests that there are ‘cues’ which exist in traditional bricks-and-mortar retail as well as online. Their common ground is design and user-experience. Traditional cues can be emulated and transferred to online, fabricating what has been left behind in the traditional physical retail world. These can take many forms, for example, physical products have natural surface textures and emulating these surfaces through high-resolution product shots portray the tactile surfaces through reflections and lighting. Emphasising these textures, consumers can use their imagination to approximately feel a product. It is important to note that the product must deliver on the promises of the traditional cues emulated through packaging design. For example, a study by Gunaratne et al. (2019) investigated the impact of chocolate packaging design on consumers sensory experiences. The research demonstrated consumers discord between their heightened product expectations, obtained by the presented packaging design cues, and that of the actual chocolate product. The findings concluded, the packaging designs had influenced consumers expectations yet, the chocolate product lacked the ability to fulfil established perceptions and thus, the designs over promised. This points to the influence design has on product perceptions and the importance of building trust through packaging cues that concur with the product’s premium status. Trust cues can be taken from traditional modes such as textures, lighting and lustres found in in-store environments, such as the designs demonstrated in Gunaratne and colleagues’ study. However, cues must be true to the product quality and meet consumers overall product expectations.

Another example is taken from the scenario of window shopping. While reflections off storefront glass windows or the shadows drafted by neighbouring products may not be greatly noticed, these small details contribute to the appeal of the display. A novel thought is to translate such traditional cues for online use. Sensory details add complexities and sophistication to the shopping experience and are a nostalgic reference.

In fact, reflections, like that seen when peering through a store-front window, softly layered over product images, could hinder counterfeiters in downloading a product's artwork for duplication, acting as a watermark as such. Other features include 380 degrees product rotation interactions. This feature allows the product to be envisaged from all sides with reflections occurring rotated. The reflections are necessary to hinder duplication. The aim is to create trustful consumer engagements and complexity for counterfeiters. These abilities are easily obtainable through 3D designers or the upskilling of the existing designers employed to create the original product packaging.

2.2.9 Perceived Risk Reduced by Positive Experience Design

Perceived risk reduction has been considered through ‘positive experience design’ that is moving from the interests of education (Dewey, 1938), to multi-disciplines of Technology (Hassenzahl, 2010, Baird and Fisher, 2005) and Service industries (Pullman and Gross, 2004). A sense of risky engagement is a form of anxiety and is believed to be reduced by creating positive engagements through purposeful play, aesthetics, consumer rewards, transparency and sophistication.

Positive Playful Personality Traits

An interaction that encompasses multiple levels of engagement and emotions is the form of play. Literature is well represented on the topics of online ‘play’ and ‘playfulness’ (Webster and Martocchio, 1992, Shobeiri et al., 2013, Li et al., 2001, Hackbarth et al., 2003). The study of Webster and Martocchio (1992) observes user engagement of system interfaces and the factors of (1) Involvement, (2) Positive mood, (3) Satisfaction and (4) Learning, that influence a transition from *anxiety-to-playfulness*. Their view is to encourage focused research of positive influences on Human-Computer Interaction (HCI) through play. Shobeiri et al. (2013) assessed Playfulness as one of the four experiential elements identified by Mathwick et al. (2001) alongside aesthetics, customer return on investment (CROI), and service excellence (Figure 18).

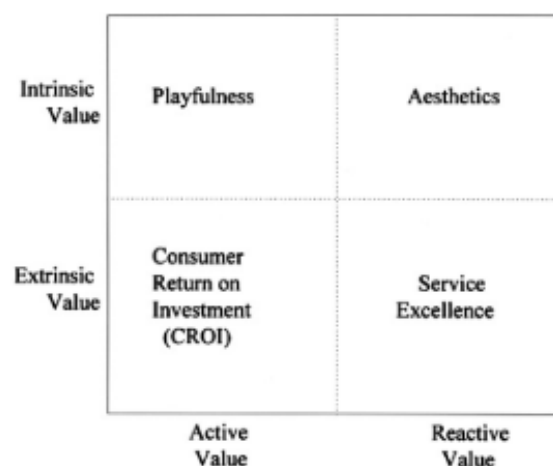


Figure 18. Playfulness and Other Experimental Elements Influencing Perceived Personality Traits of a Website ((Shobeiri et al., 2013) adapted from (Mathwick et al., 2001, p.42)).

Shobeiri and colleges measured the factors against perceived *personality traits of a website*. The variables tested on perceived website personality traits in relation to the four factors were: enthusiasm, genuineness, solidity, sophistication and pleasantness. Their findings indicated that *Playfulness* is positively connected to the perceived websites personality traits of *enthusiasm* and *sophistication*, like as much is *Aesthetics* however, aesthetics also has a strong association with perceived *pleasantness*.

This indicates that Aesthetics or Design-Driven strategies can reduce risk perception. This study provides insights into how objects, like a website or a product, relay personality traits to consumers that can reduce risk. Assessing the perceived anthropomorphism of an online product enables businesses to identify, refine and adopt their risk reducing ‘personalities’ that align with their brand style to encourage users towards a positive experience.

Playfulness moves users from anxiety to fun.

Shobeiri and his colleges’ research conclude that playfulness, aesthetics and service excellence are primary risk reduction attributes whereas consumer return on investment is secondary. Rather than superior product/service attributes alone, enhanced ‘customer experience’ is the new positioning ideal to provide enjoyable, unique, and memorable online engagements.

Positive Realistic and Purposeful Experiences

Research assessing the immersive virtual experience in light of e-commerce was conducted by Li et al. (2001) argue that “*visual, tactile, and behavioural simulations in 3-D visualisations* are likely to create a sense of presence, which in turn can enhance richer consumption experiences”. Presence being that of the positive simulated real experience created in a fabricated environment. Research conducted by Hackbarth et al. (2003) examined online interaction, usefulness and playfulness in which perceived ease of use is considered. They state that a systems experience is positively linked to a users’ ability to spontaneously interact. This is dependent on two factors of playfulness and anxiety. Although users may be considered playful, in their study they specify playfulness as a system-specific trait with the user of experience changing over time. Initially, unknown interfaces evoke anxiety however an experience of playfulness increases

through the familiarisation of the user. Playfulness mitigates anxiety, increases familiarisation and heightens perceived ease of use.

Positive Interactions

Engaging consumers and providing them opportunities to interact online provides them a sense of site ownership and invested interest strengthening trust. Hoffman and Novak (1997) state that “trust is best achieved by allowing the balance of power to shift toward a more cooperative interaction between an online business and its customers.”

With the rise of uncertainty, playfulness can provide a reassurance, empowering consumers through familiarisation and experimentation. With this said however, playfulness is not enough on its own as a guarantee of security. It does however, move consumers from a negative, anxious standpoint to a positive perspective and the layered attributes together build a sense of authentic personality which is hard to replicate. Additional measures of quality assurance would build on the positive experience and continue the trust protection cycle.

“Whether a web site is an extension of a familiar off-line company, or whether it is the only touch point with an unknown company, consumers must be confident that they have significantly more to gain than to lose when entering a transaction” (Egger, 2001).

Online education of security features using playfulness are further investigated in the context of currency as presented in Section 2.3 Anti-Counterfeiting and Deterrent Design.

2.2.10 Section Summary

A combined definition of Trust is proposed as the intentional acceptance of vulnerability based upon positive expectations of another's intentions. *Initial Trust*, as defined by McKnight et al. (1998), is established overtime using information gathering and reward attraction. The *Information Gathering* is to satisfies the need to substitute the lacking familiarity of an unknown brand (such as an emerging SME actor). This is to judge its authenticity on claimed trustworthiness. The *Reward Attraction* is the appeal of the transaction meeting or superseding expectations, the perceived reward outcome of the trust investment. A reward attraction must outweigh the *Perceived Risk*. After the Initial Trust formation, the evaluation of satisfaction is assessed which in turn impacts on repeat purchases. In the context of counterfeiting, consumers are either deceived by the counterfeited goods however, the product most likely will not meet expectations, resulting in damaged trust. If the consumer is not deceived, the counterfeit crime act has been discovered and the brand is then avoided. Exposed consumers to counterfeiting can experience the crime act directly through experiences and indirectly through WoM. Perceptions impact consumers behaviours and even indirect exposure to counterfeiting can drive up perceived risk and cause consumers to reject the brands offerings. Therefore, brands need to compete with fraudsters to win Initial Trust.

As China is an early adopter of innovations of products and systems (such as the expansion of consumer-to-consumer online commerce), it aligns to the Risk Society Theory. The theory that with rapid technological and digital advancements, regulations and policing of such systems will not easily keep up in providing adequate governance to ease anxieties. Heightened perceived risk drives product-validating tactics though intense critical searching and self-assessments. Markets, including the food industry, are found saturated with counterfeiting reports and discoveries, Chinese searching behaviours are significantly comparable to different worlds that are considered a lower risk society, such as that of Australia. Chinese consumers forensically investigate information that is presented on various levels. They seek third-party information that confirms a brands authenticity and may even visit the country of origin for self-checks. Identified personality traits as identified in the literature can be emulated from a website. Brands and/or products can ease perceived risk by introducing anxiety reduction techniques taken from education disciplines. Playfulness, Aesthetics and Sophistication

are significant drivers of relieving concerned consumers. These factors have been widely utilised, especially in the context of currency trust and protection.

The following section will now review the Anti-Counterfeiting phenomenon which consists of the major actors, their overall constructs, motivations and outputs in the form of technologies and strategies. A review of the role of design and how Design-Deterrents are also presented as a complimentary alternative for emerging Small to Medium Enterprises.

2.3 Anti-Counterfeiting and Deterrent Design

2.3.1 Introduction

Anti-counterfeiting is the overarching field of research and development that focuses on the proactive and reactive responses to the anticipated threat of a counterfeit crime. According to the Merriam-Webster (2019) dictionary, anti-counterfeiting describes ‘any technology or measure that is opposed to, or used for, the *prevention* of counterfeiting’. This definition requires expansion to accommodate the intensifying studies and developments dealing with counterfeiting *detection* and *deterrence* methods. Anti-counterfeiting, as referenced in this research, recognises the two responses, that are not always mutually exclusive, and that function from either position of the crime act (Figure 19). With a primary research focus concerned with the proactive deterrent hurdles (Spink et al., 2012):

1. Proactive Deterrent Hurdles (PDH) (positioned prior the probable crime act),
2. Reactive Detection Responses (RDR) (positioned post the committed crime act).

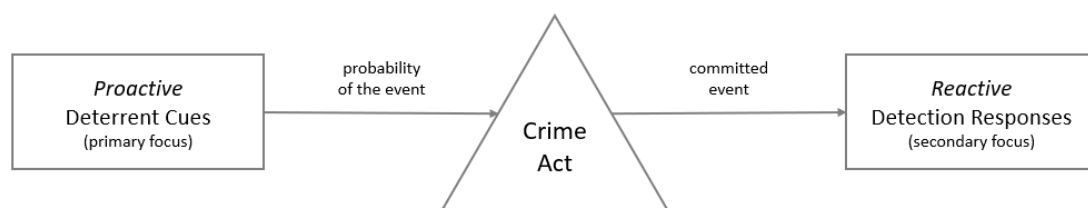


Figure 19. Anti-Counterfeiting Response Stance from a Preventative or Detective Perspective of the Crime Act.

Deterrent strategies are the frontline defence against the Crime Act. Every brand needs to assess their exposure to the unique fraudster types to identify the profiles which may attempt committing the Crime Act. By identifying potential fraudsters, deterrent strategies can be formed and implemented. If deterrent cues fail, then the fraudulent Crime Act is enabled, and if committed, damaged brands are then reliant on reactive

detection responses to identify and deal with the fraudsters and damaged market. This overarching overview of the problem identifies the importance of deterrent hurdles and their guardian role in brand protection. Deterrent hurdles however, range in complexity and cost. The anti-counterfeiting packaging industry and academic development research is weighted towards the connective, high-tech applications, pushing for specialised outsourced commercial services that require costly investments. This research questions whether the high-tech approach is a good fit for all?

This research adapts Rene Descartes principles of seeking truth through a method of employing radical doubt in a world promoting a one-directional approach to a multi-complex problem.

The Disruption Theory is also adopted to assess the anti-counterfeiting phenomenon by taking an eagle eye view of its principle constructs, actors and identified problems to form the theory of the independent problem-solver dilemma which is currently unquestioned in literature.

From here, the research reviews the role of uniquely designed, *in-house* protected, deterrent strategies that empower new-to-export SMEs, whom of which may not have the resources to fund post-crime act responses. Spink et al. (2016) prompts for a shift in focus 'from reactive detection to proactive prevention'. Although it is acknowledged here that both deterrent and detection packaging enhancements are of value, the two functions are not always mutually exclusive elements. The research does propose that the two responses are of un-equal importance, with prevention through deterrence as primary importance. Especially in the context of emerging SME businesses seeking cost-effective, low-tech brand protection that require low operational business plans. A non-monitored circulation model is discussed later when case studying currency banknote securities.

In summary, Section 2.3 highlights the underlying issues brought about by the service-orientated offerings within the Anti-counterfeiting industry; subjectively driving businesses to adopt high-tech packaging in the guise of connectivity, security and trustworthiness. Following on, a critical review of the relevant academic literature is presented from the two identified Anti-fraud actions. Investigations and learnings are drawn from the Reserve Bank of Australia's (RBA) released polymer banknotes, a high-risk counterfeiting target. The purpose, benefits and overall function taken from the

formation of the RBA Design Advisory Panel including the design and development processes as well as the distribution and circulation models that could be transferred to the food exporting industry is considered.

The research will then lead into the next major part of investigation which is the value of design and its role in consumer acceptance. The theory of aesthetics and intricacy is briefly considered. The ability to enhance or detract appeal and trust by manipulation through design is investigated. A research question is presented on the role of design in security. Finally, a brief look into businesses hesitation to invest in anti-counterfeiting is reviewed and the need for understanding its value and how to improve its success is discussed.

Overall, a summary of key findings and gaps in literature will be concluded which will then lead the research into the methods and analysis section of this thesis.

2.3.2 Theories of Approach

Applied Radical Doubting

This research uses principles taken from the Cartesian methods of seeking pathways to truth by employing *radical doubt* to challenge a world promoting a one-directional approach to a multi-complex problem. In understanding the application of radical doubt one must briefly look at Descartes *dilemma*. Solomon et al. (2012), depicts Descartes confliction when enticed by the emerging school of thought of science and all its new empirical investigatory methods on the physical and testable attributes of the world, would cast-off the unseeable and metaphysical foundations of our being and origin as untestable. Solomon and his colleges state that Descartes was...

“both an enthusiast of the new science - in fact he was an important contributor to both science and its mathematical foundations – and a religious man. (However) He could not tolerate the idea that science should replace the orderly, meaningful worldview of Christianity with Godless, amoral universe of mere “matter in motion.” Neither could Descartes ever agree that science should reduce human existence- in particular, the thinking self- to another mere machine.”

To debate and test the dilemma of a growing academic body moving towards a scientific approach which aggressively rejected any thought or knowledge conceived prior, Descartes used *radical doubt*. Radical doubt adopting a doubtful stance to strip back his Scholastics-view and all that was conceived and pre-learnt and assess all constructs with criticism. This form of critical reasoning was used to evaluate the proposed authenticities, including the advancing scientific approach, to finally re-establish his argued reality which was then founded on the reasoned unity of metaphysics and physical pillars. This logically derived reality then formed the firm foundations for Descartes to further test each reasoned truth uniting his faith with his trust in scientific mechanisms (IEP, 2019).

Translated to this research, this radical doubt approach is still relevant to today and has been used to question and debate the unchallenged, progressive majority, promoting a one-way direction, and whom are disregarding the importance of existing alternative methods.

The advancing direction taken by the Anti-counterfeiting industry is rapidly expanding in high-technology and digital connectivity. This movement, like the rapid popularity growth of scientific reasoning in Descartes context, is seen to be advancing society. Although, serving a great need and purpose, little critical reviews are being made on its approaches and whether they are accommodating to all sized businesses and effective against the numerous fraudster types. Due to the uncritical and self-promoting nature of the industry, unmet needs are being overlooked especially in the scope of SMEs. By stripping the issue to the core problem and bringing “all the things which may be brought within the sphere of the doubtful” (Descartes, 1641), including the industry and academic problem solvers, we can then begin to make sense of foundational truths which can be constructed on.

Innovative Disruption Theory

In addition to adopting a view of doubtful reasoning on all anti-counterfeiting actors and directions, the theory of *Innovative Disruption* is also integrated. Innovation Disruption uses a critical and holistic view to map the current and projected forecast of activities, actors and networks of a phenomenon. This map is then used to consider possible new methods of action that have potential to improve performance or outpace current technological progress. Christensen (2006) portrays three descriptive stages that define the process of building a theory of disruption; visualised as a pyramid (Figure 20), and paraphrased below:

- (1) **“Observation:** *develop abstract constructs that elevate above the complex detail to illuminate the phenomena and its operations,*
- (2) **Classification:** *classify the phenomena into categories defined by their attributes into frameworks or typologies,*
- (3) **Defining Relationships:** *“explore the association between the category-defining attributes of the phenomena and the outcomes observed” (Christensen, 2006).*

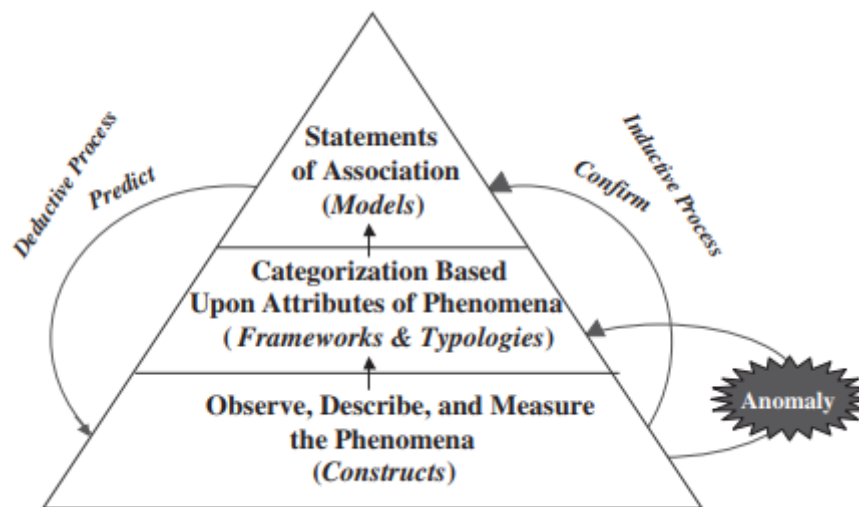


Figure 20. The Process of Building Theory (Christensen, 2006)

The research from here will critically address the three steps of the Disruptive Pyramid in the context of anti-counterfeiting through an inductive process. To (1) observe and identify the abstract Constructs, (2) classify the Frameworks and Typologies, and (3) link the predicted Models of defined relationships.

2.3.3 *The Dilemma of the Anti-Counterfeiting Constructs*

Progressive advancement in the connectivity of things using emerging technologies is an enticing field for modern academics and experts in multi-disciplines (Coulton, 2015). Smart technologies and the enhanced networks utilising the Internet-of-Things (IoT) including applications for anti-counterfeiting purposes is forecasted for significant growth and is anticipated to breach \$26.7bn by 2024 (Schaefer and Cheung, 2018). Brands are encouraged to adopt advanced technological developments from scientific and industry circles to slowdown and frustrate counterfeiters who need to acquire the expertise and technical knowledge to replicate such applications (Yang and Fryxell, 2009, Bansal et al., 2013). The activities from *development* through to *commercialisation* for use is considered here as the *anti-counterfeiting phenomenon*.

Viewed from an abstract overview perspective, the anti-counterfeiting phenomenon includes constructs of actors stated as intentional ‘problem-solvers’. These problem solvers include the primary roles of the research and developer (academic), the service provider (industry), and the adopters (brands). In addition to these actors, an observational review made on the problem solvers that act as a benchmark of high-risk security (currency banknotes case study) is presented. Finally,

Thus, Section 2.2.3 serves to critically review the identified four problem-solver constructs of the anti-counterfeiting phenomenon perceived through a radical doubt approach:

- (1) the Commercial Construct;
- (2) the Academic Construct;
- (3) the SME Construct;
- (4) the High-Risk Target Case Study;
- (5) the Framework and Typologies of current constructs;
- (6) the Design-Driven Model – an Alternative

2.3.4 The Commercialisation Construct

Observations of the Anti-counterfeiting industry have been reported in this section. The construct of commercialising anti-counterfeiting technologies and the problems that arise from such an approach are considered.

Background

Anti-counterfeiting industry bodies, referred to in this research, are either educators or service providers. Educators can include newspapers ((Economist, 2017, ABCNews, 2015, ACBR, 2019, WTR, 2019), industry alliances with government bodies (International Anti-Counterfeiting Coalition (IACC), The Anti-counterfeiting Group (ACG), World Trade Organisation (WTO)), and promotional platforms such as the Active and Intelligent Packaging Industry Association (AIPIA). Service providers are numerous and expanding developments of anti-counterfeiting applications. They often have a portfolio of products and services that are intended for commercial use within multiple product packaging industries. Commercialisation is the defining factor for industry service providers and although universities partake in the development and review of anti-counterfeiting applications they are considered separate and are dealt with in the next section. In the case where a business is launched due to academic development, then they are considered part of the industry body.

This section frames the anti-counterfeiting industry as a response construct to the ever-evolving threat of fraudsters. However, this research considers the position of the risk society theory that with rapid technological progression, the industry itself, with the pursuit of high-tech, is ushering in risky unknown problems. Using a doubtful view of all actors, the perceived anti-counterfeiting ‘problem solvers’ are proposed as a problem in themselves. Identified problems considered from literature include:

- (a) trends towards high-tech,
- (b) portfolio redundancy,
- (c) multi-categorisation,
- (d) limited empirical evidence for claims,
- (e) lack of critically reviews,
- (f) associated clustering,
- (g) advancement upkeep, and
- (h) technology - consumer preference gap.

a) Trends Towards High-Tech

The anti-counterfeiting packaging industry is positively striding towards a high-technology, service-based response to equip businesses in counteracting the potential and acted upon counterfeit threats. High Technology is the type of applications that makes use of digital connectivity through an online register for supply chain management or via the Internet-of-Things (IoT). Future interconnected products are considered to eliminate counterfeiting. Li (2013) argues that packaging imitations will be eradicated and no longer a problem as unique serial numbers and tracking technologies will govern and protect distributions across the globe. This claim, however, is inconsistent with the growing counterfeiting operations amongst implemented track-and-trace monitoring systems. As counterfeiting is an elusive trade, deceptive fraudsters aim to avoid the same jurisdiction of authentic brands to minimise detection (Wilcock and Boys, 2014) meaning that high technology systems and devices protect the operating jurisdiction of the authentic brand whilst counterfeiters deceive elsewhere.

More importantly, the anti-counterfeiting high-tech industry is forecasted for growth (Wilson and Kinghorn, 2016), yet it is unestablished whether it is the optimal approach for emerging SME businesses considering their limited resources for early operation. Prasad and Kochhar (2014) concludes that “development and implementation of smart packaging depends on the acceptance and cost-effectiveness for industry and consumers”. The industry’s development of new technologies means a constant review and upgrade approach. Thus, research is needed in dealing with the assessment of anti-counterfeiting measures against brand and consumer trust appraisals of perceived effectiveness. Rapid technological reissues or releases need re-evaluation with users within shorter time cycles to adjust to reissued or released developments.

b) Portfolio Redundancy

As counterfeiting tactics are ever probing, anti-counterfeiting in the packaging industry is frequently perfecting existing and releasing new options of technological applications that respond to parts of the counterfeiting problem whole (Wilson, 2015). Service providers have invested interests in their established portfolios and naturally market their applications over their competitors without empirical significant evidence of comparative effectiveness. This disjointed and subjective offering of independent services makes decision making for businesses a difficult task to identify what will add-value in the form of effectiveness against their risk level and what increases positive trust

perceptions with their consumers. In the “Handbook of Research on Counterfeiting and Illicit Trade”, Yang and Sonmez (2017) posit that independent, self-governing anti-counterfeiting services are a segmented approach that is ineffective. Involvement of all decision makers from “managers to employees to consumers” using a holistic and layered approach is a requirement for effectiveness against counterfeiting (Wilcock and Boys, 2014, Yang and Sonmez, 2017).

c) Multi-categorisation

Anti-Counterfeiting Technology (ACT), within the services industry is often intermingled with terms of control and quality. This can be misleading as such relations can lead to the acceptance that Anti-counterfeiting encompasses technologies or strategies dealing with issues outside of counterfeiting such as spoilage or temperature tracking. To add to this confusion, it is often extended under the larger arm of Smart Packaging, which again is “classified in many ways – ‘active’, ‘intelligent’, ‘smart’, ‘diagnostic’, ‘functional’, and ‘enhanced’” (Kerry and Butler, 2008) and is defined by Schaefer and Cheung (2018) as “a packaging system with embedded sensor technologies” applied to common packaging for improved performance and function such as storage, quality, monitoring and tracking, protection, engagement and life cycle. Although, forms of anti-counterfeiting do belong to this definition, not all forms make use of connective sensor technologies. To investigate this further, a review of currency banknotes will be case studied to examine products and systems that utilise alternatives to monitored or connected circulation models whilst still providing adequate anti-counterfeiting deterrent measures.

d) Limited Empirical Evidence for Claims

Research exists on the comparison of grouped anti-counterfeiting levels such as Overt and Covert and Forensic features based on advantages and disadvantages (Li, 2013, Bansal et al., 2013, Francis, 2017). Li (2013) presents a table of summarised technologies grouped under such headings as shown in Table 7. However, there is limited empirical research backing the stated claims of the anti-counterfeiting industry and their effectiveness (Chaudhry et al., 2009), compared across technologies and against consumers perceptions. Technologies and strategies have been marketed as commercially available for all sized businesses to enhance packaging sophistication, yet assessment on whether they are applicable for the budgets and needs of all sized businesses has not been addressed. Although, research has been considered on the assessment of product warning labels (Spink et al., 2011), more research is needed for

the independent comparison of anti-counterfeiting technologies and consumers trust perceptions of them to justify the claims of increased value to the business and consumer.

Table 7. Types of Anti-Counterfeiting Technology (Li, 2013)

Categories	Product Authentication Verification		Product Tracking and Tracing
Technology	<u>Overt</u>	<u>Covert</u>	<u>Machine-Readable Technology</u>
	• Holograms • Optically variable devices • Color-shifting films • Color-shifting inks • Security thread • Fluorescent inks • Intaglio printing • Security paper • Watermarks • Sequential product numbering	• Security inks/coatings: reactive inks, UV inks, IR inks, and thermochromic inks • Hidden printed messages • Digital watermarks • Taggants (biological, chemical, or microscopic) • Cryptoglyph	• Radio Frequency Identification (RFID) • Electronic product codes (EPCs) • Barcodes • Laser marking • Optically stored marks
Advantages	• User verification • Improved and more secure • Deterrents to counterfeiters	• Low implementation costs • No need of regulatory approval • Easy upgrading • Flexible implementation	• No manual data collection or entry • Machine readable • Convenient tag reading • Digital networking capabilities • Encoding and security features from a single source • Traceability and anti-counterfeiting protection integrated into a single label
Disadvantages	• User training • Subject to imitation and reuse • Possible false assurance • High security requirements • Commitment on the supply side • Appropriate disposal procedures needed	• Easily imitated • Costly if more security options are required • Risk if the device is solely administered by component suppliers	• No one-stop platform technology available • Remote-access security requirements • Overhead costs

e) Lack of Critical Reviews

There is much for businesses to choose from when considering the offerings presented from industry. The Active and Intelligent Packaging Industry Association site (AIPIA, 2019) reviews and promotes packaging supplement categories (Figure 21) under the headings: Printed Electronics, Brand Protection, Shelf Life Extension, Augmented Reality, Mobile Commerce, Supply Chain Control, Smart Labels, Condition Monitoring, Consumer Engagement and Fighting Waste (AIPIA, 2019). Although, the AIPIA is one of the most informed and widely spanning reporter on Smart Packaging categories including Anti-Counterfeiting applications, it is observed that it does not critically review these service providers. Rather, it acts as a newsworthy mouthpiece for technological service providers and the companies that apply their offerings on pack.



Figure 21. The AIPIA's Categories of Smart Packaging Reviews (2019).

f) Associated Clustering

The clustering of the technological applications (Figure 21) are grouped either by technological type: printed electronics or smart labels or function: consumer engagement, brand protection, fighting waste or even by retail channel: mobile commerce. Anti-Counterfeiting would be expected to be found under brand protection and yet it is attributed to the groups of printed electronics, supply chain control, smart labels, consumer engagement and even the increased sophistication of augmented reality. Although, this may function well for some business managers investigation into specifically known problems, for the purposes of anti-counterfeiting responses, it is vaguely represented. In contrast, alternative methods of clustering anti-counterfeiting applications have been offered and adopted throughout history that are descriptive of their purposeful outcomes. Spink (2007) collates these terms under seven Anti-Counterfeiting Actions that are not limited to packaging advancements but also incorporate strategic approaches and to manage the problem, these are:

1. *Overt*
2. *Covert*
3. *Forensic*
4. *Track-and-Trace*
5. *Authentication*
6. *Investigation*
7. *Regulation*

Overt elements are detectable by all, plainly visible, and act as landmarks for consumers to navigate and orient their trust. Such elements are act as a visual symbol implying a security application or even security graphics inside background patterns which are recognisable from a consumer point of view. The Overt action is a clear Proactive Deterrent Cue, warning potential fraudsters of added security or sophistication.

Covert technologies embedded into packaging are hidden from plain eye. They require activation tools such as a RFID scanner or UV light emitter device for supply chain

monitoring and tracking. They function to prove true brand ownership when authenticity is in question, confirming counterfeiting efforts if suspected. The Covert action can be a Proactive Deterrent Cue if warnings of its presence is provided for example, a symbol that states a product is protected using a covert technology. If the Covert technology is not hinted to counterfeiters and remains truly covert, it is only a Reactive Detection Response.

Forensic is the scientific investigation of a product's identity to deem if it is authentic. This can be using DNA testing on products or using hidden trace elements that prove place of origin. This can also be completed on high valued product packaging such as a premium wine bottles and their corks or labels. The Forensic action is a Reactive Detection Response.

Track-and-Trace is the term used to describe system-based applications that can capture and export location-point data that shows when and where a product was distributed and finally activated in store and prior to consumption. Track-and-Trace systems may use QR codes that activate a smart phone application (app) allowing the GPS position of the phone to be sent directly to the holder of the Track-and-Trace management software alerting them of the district the product was activated in. It is important to note that these systems can track part or whole of the system monitored depending on granularity desired.

Authentication is now a term used to describe the confirmation to a consumer of a product's true origin and quality. This has often been done through apps that potentially may require a secondary code or numeric number to be entered off the pack label, unique to that pack and by doing so, the app will validate the GPS location and the serial number uniqueness and thus, alert the consumer that the product is indeed authentic. Future applications may not be limited by an app and instead could expand into interactive inks or applied devices that offer more information for self-validation.

Investigation is the assessment before, during and after risk exposure or the Crime Act and scopes out the necessary actions in which a business is recommended to adopt in order to thrive in the reviewed marketplace. Investigation is a necessary continual procedure to keep learning about the new and ever-changing risks presenting themselves overtime. Those who do not frequently investigate are those that will be caught unsuspecting.

Regulation is term describing the need to be ever alert of the imposed and issue releases of trade relations, policies and procedures that a business must follow to be compliant within the market governance.

All listed Actions are of due importance and should be considered by every business prior to executing their expansion plans.

g) Advancement Upkeep

Maintaining awareness of reissues and advancements for the rotation of anti-counterfeiting technologies is essential for staying ahead of trailing counterfeiters with recommended changeovers between 12-18 months (Bansal et al., 2013). This does require regular knowledge upkeep, reviewing of business models and costly investments to maintain an informed position of packaging enhancements and rollouts. Schaefer and Cheung (2018) present an adaption from Khan and Turowski (2016) identified relationship of technology and business model development over time (Figure 22) and state that there is research opportunities in reviewing (1) *What is offered* and (2) *How to offer efficiently* to reduce the operation demands of businesses. Currently, the anti-counterfeiting industry is continuing to create vast multi-services to cater for all food packaging needs including security devices for anti-counterfeiting and what is the most effective is in question. This presents further questions for SME businesses and their ability and willingness to invest time and money into updating and re-educating on these areas to stay ahead.

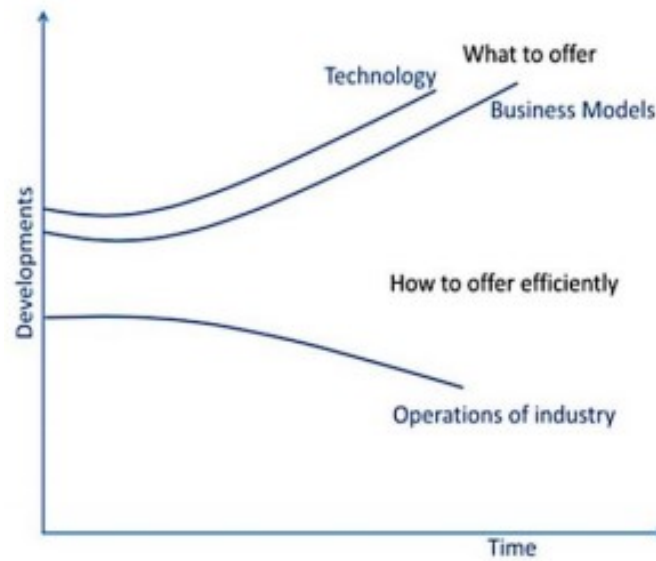


Figure 22. Relationship of Technology and Business Models (Khan and Turowski, 2016, Schaefer and Cheung, 2018)

h) Technology - Consumer Preference Gap

A plethora of service providers have, and continually are, being established to offer digitally connected deterrent and detection applications marketed to protect brand IP and enhance consumers trust. These service providers subjectively promote their applications as trustworthy. They communicate their applications as added premium value to consumers without seeking independent testing of their perspectives and preferences of them. Consumer trust can make or break a brands growth and adoption into market (Prasad and Kochhar, 2014). Therefore, when considering fraudsters and their attempts to mimic original brands, how does a consumer assess a product online to justify its authenticity, prior to purchase? What are the levers that promote trust through visuals of product packaging and what causes the rise in scepticism and results in product rejection?

Literature on anti-counterfeiting technologies and strategies (referred to as security elements) will now be reviewed. A focus will be on deterrent elements that engage or inform consumers as consumers are partners in the deterrent strategy. These will then be used to form clusters and categories of securities elements used in the research studies to test against consumers perceived trust.

2.3.5 The Academic Construct

Background

Although literature dealing with Anti-counterfeiting is a young field, it is ever expanding throughout multiple disciplines and is of intense interest in the engineering sciences focusing on chemistry, physical and material innovations contributing to packaging design (Spink et al., 2012, Sun et al., 2017, Sandi et al., 2018, Fan and Wang, 2003). Anti-counterfeiting is growing in documentation in criminology (Spink et al., 2013, Hollis and Wilson, 2014), business, brand protection and marketing circles (Schultz et al., 1996, Staake et al., 2008), as well as the computer and systems technology fields (Cheung and Choi, 2011, D. Jiang et al., 2008) yet there is a great need for further expansion of research to address the complex and every evolving phenomenon of counterfeiting.

Researchers have great interest in the development and testing of counterfeiting prevention and deterrence using physical attributes (Spink et al., 2011) whereas others have attempted to recommend strategic frameworks and actions to approaching counterfeiting (Schultz et al., 1996, OECD, 2007, FSA, 2016). The testing of the physical attributes as referred to here is the dealing with the chemical or physical property trials undergone to validate the function of the attribute. Anti-counterfeiting approaches with the aim to study the control of the supply of replicas, has been proposed (Green and Smith, 2002, Grossman and Shapiro, 1988, Schultz et al., 1996, Spink et al., 2019, Chaudhry et al., 2005). In contrast, Ha and Lennon (2006) argue that efforts and strategies offered to regulate the supply of product counterfeits has not reduced the growth of the illicit industry and therefore, have not been impactful.

Strategies of Action

Anti-Counterfeiting Strategies (ACS) for action have been examined at a multi-national level (Chaudhry et al., 2005), with most experts in agreeance that best practice considers a layered and holistic strategy (Yang and Fryxell, 2009, Yang and Sonmez, 2017). Experts of anti-counterfeiting strategies have challenged governments, management and supply chain stakeholders to have a zero-tolerance policy towards counterfeiting and in turn, their recommendations and strategies are to strengthen this view (Chaudhry and Zimmerman, 2013, Li, 2013). In contrast, Schultz et al. (1996) consider other alternatives to a zero-tolerance approach. They assessed ten courses of action measured against the

World Trade Organisation's (WTO, 2019) commitment measures, that are to reduce counterfeiting growth. They utilise a quadrant matrix (Figure 23) to plot the ten actions on a +ve and -ve crossbars, to compare actions and visualise their effectiveness. The ten actions towards counterfeiting risks (Schultz et al., 1996) (below), controversially range from the extremes of 'Do nothing' to 'Cede the industry', with proactive actions in between:

1. "Do nothing	<i>Ignore the counterfeits if they are not threatening the brand materially,</i>
2. Co-opt the offenders	<i>Negotiate with the counterfeiters to make them part of the firm's legitimate channels of distribution,</i>
3. Educate stakeholders at the source	<i>Convince government leaders that protection of intellectual property is in the country's long-term interests,</i>
4. Advertise	<i>Use the power of advertising to let consumers know how to identify a counterfeit, that purchasing counterfeits is stealing, and that the genuine product has more cachet,</i>
5. Investigation and surveillance	<i>Hire investigators to determine the perpetrators and distributors of counterfeits and inform the authorities,</i>
6. High-tech labelling	<i>Develop labels that are difficult to duplicate without inviting detection,</i>
7. Create a moving target	<i>Continuously change aspects of the product in ways that are difficult to quickly duplicate (e.g., the design),</i>
8. Legislation	<i>Work with government officials to have legislation enacted that better controls counterfeiting,</i>
9. Coalitions	<i>Work with other industry members to fight the counterfeiters,</i>
10. Cede the industry	<i>Leave the market where the counterfeiting is being done."</i>

Interestingly, the action proposed for packaging as summarised in point six is to adopt 'High-tech labelling' echoing the Industries push towards high-tech solutions. Although well intended, this terminology is misleading businesses to consider anti-counterfeiting to be expensive and unobtainable if such investments and upscale of human resources for digital monitoring and management, cannot be met. Ideally, the recommendation

made should provide enough scope to encompass sophisticated Deterrent Packaging innovations that a business can employ to advance structural and label packaging elements through design-based strategies such as destructive layering. This subliminal high-tech push for businesses may discourage SMEs in exploring export ventures.

While technology may have relevant and effective answers for some, it may not be a suitable answer for all. Shultz and Saporito's study, does show interesting results in identifying two recommendations which are firstly High-tech Labelling and secondly, a Moving Target. These two actions are reported solely in the positive/positive quadrant (top-right). This indicates that packaging innovations and a dynamic approach to releasing anti-counterfeiting attributes can impact on plotted effectiveness.

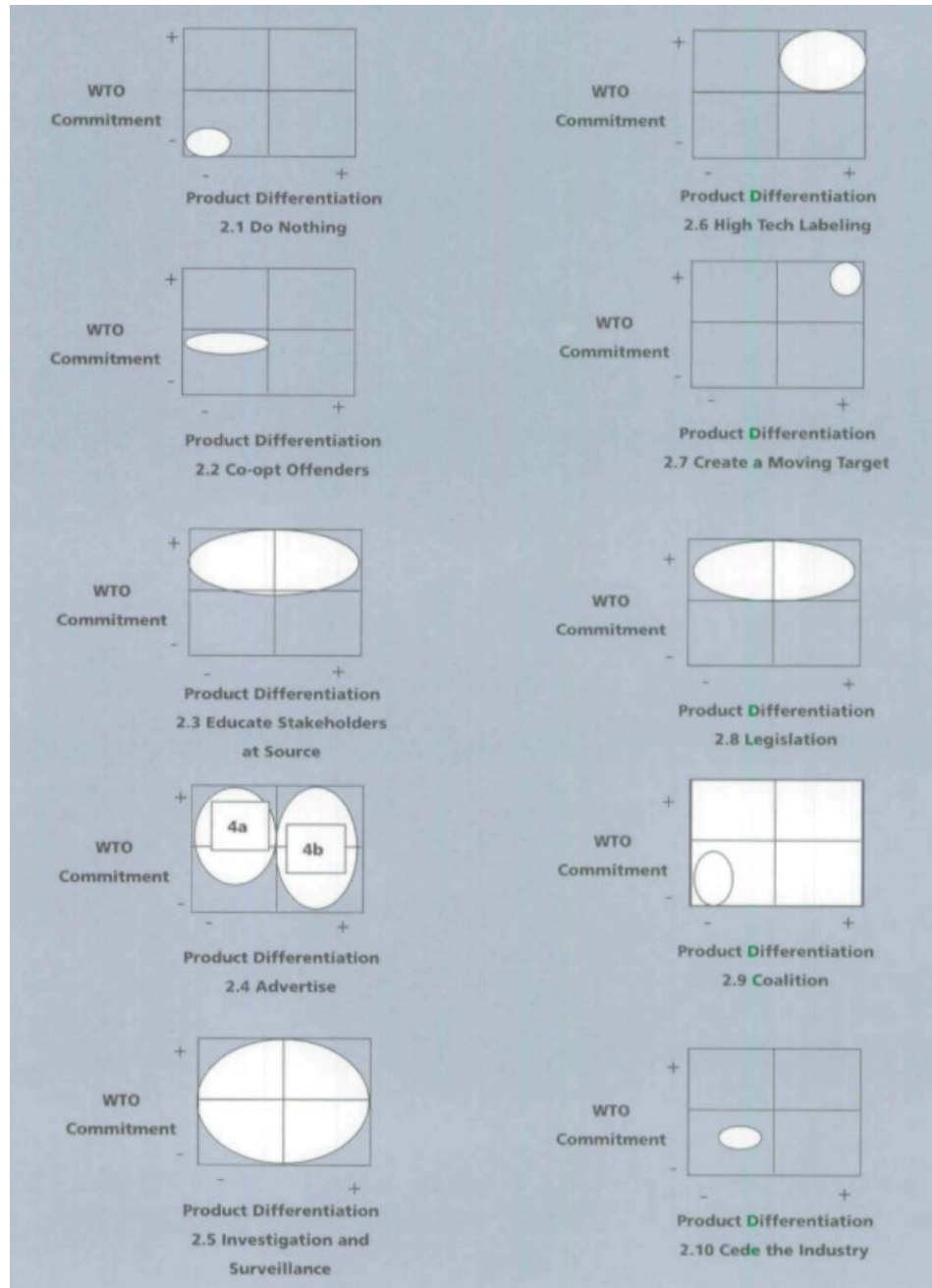


Figure 23. Ten Courses of Action Tested Against WTO Commitment (Schultz et al., 1996)

In the industry report by PWC (2016b) titled “Food Fraud Vulnerability Assessment and Mitigation”, they propose a Food Fraud mitigation framework (Figure 24) that outline the 5 steps of (1) **Access** vulnerability, (2) **Develop** a strategy, (3) **Deep Dive** and define risks, (4) **Integrate** identified risks with enterprise risk management (5) **Introduce** controls and **Reassess**. This process reflects the Design Thinking model that has been expanded and adapted for assessment and response to ill-defined problems, an approach introduced later.

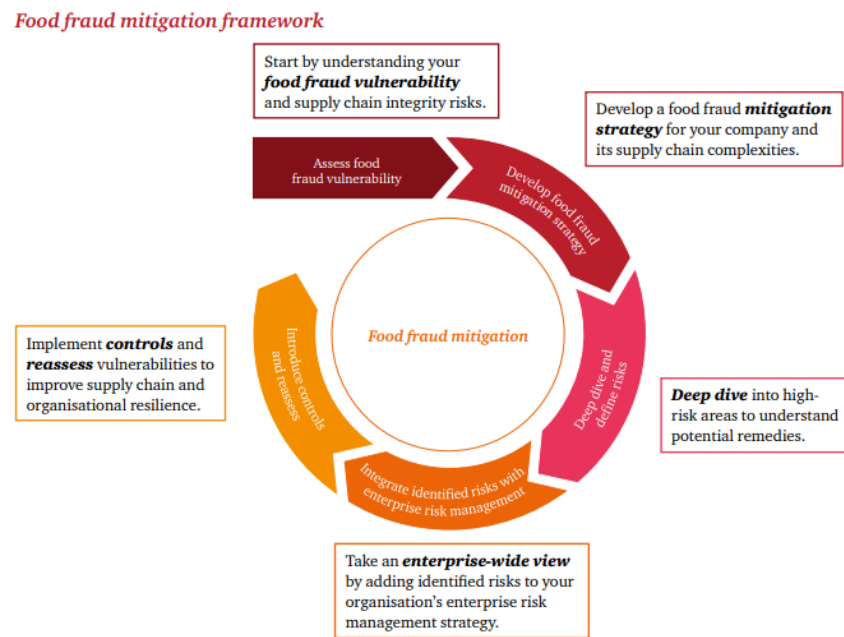


Figure 24. Food Fraud Mitigation Framework: proposed by PWC (2016b).

The Brand Manager - Perceptions of Anti-Counterfeiting

A standalone study undertaken by Yang and Fryxell (2009) investigated 130 foreign brands marketed in China and surveyed Chinese manager's on their perceptions of the brand positioning and anti-counterfeiting effectiveness. This study shows the impact of business presentation and brand awareness as a protection agent against the threat of counterfeiting risk. It also reports that anti-counterfeiting applications can actual act as a hinderance to brand position. Similar to the study of Yang and Fryxell (2009), this research sets out to question the appropriateness of anti-counterfeiting applications. In addition, this research seeks to test if their perceived trust of them can be influenced through design.

Another survey study conducted by Chaudhry et al. (2005) again addressed multi-national manager's perceptions of the IP protection environment and their strategies of entry. It also investigates their chosen anti-counterfeiting tactics adopted and their reflective assessment on the tactic's effectiveness. It does not accommodate the view taken by SME businesses on anti-counterfeiting tactics and their effectiveness on IP protection. Chow (2010) contends that managers of Multinational Corporations (MNCs) and their approaches towards counterfeiting at the time of study, is founded on reactive responses. Reactive detection methods are based on short-term intimidation and legal fights, with managers reporting that they found themselves vulnerable to more

counterfeiting threats as they focused on chasing the identified perpetrators. Chow's study identifies that managers of MNCs undervalued deterrence strategies or failed to apply them and therefore, recommends re-evaluation for future approaches to integrate deterrent strategies including packaging design and allocating responsibility to the right people. These learnings are also applicable to SMEs who can apply the insights. Chaudhry et al. (2009) surveyed managers who rated presented product elements on "price (88%), point of purchase (88%), slight difference in brand name (75%), and packaging (56%) as important influences on consumer determination of the legitimacy of a product". Packaging is a critical testbed for consumers to judge authenticity and has power to influence. Noted also, was that managers perceived consumers as "fairly sophisticated decision makers" indicating they are advancing in detection strategies of their own. Table 8, referenced from their study, shows a compilation of research published from the Business Horizons journal.

Table 8. Frequently Used IPR Actions to Combat Counterfeiting (Chaudhry et al., 2009) adapted (Review of Literature References).

Targeted at consumers • Use special packaging and/or labeling • Emphasize benefits of genuine product • Provide lists of legitimate channel members • Emphasize warranties and after-sale service • Offer site licenses • Offer reduced price, related product lines	Targeted at host/home country governments • Register trademarks and patents • Educate local law enforcement • Injunctions against counterfeit goods • Lobby for more stringent laws/enforcement • Seek assistance from tax authorities
Targeted at distribution channels • Educate channel members about counterfeits • Encourage distributors to notify manufacturer about counterfeit goods • Provide warnings to distributors/retailers • Give financial incentives to reject counterfeits • Solicit dealer suggestions to develop tactics • Use tracking devices, such as RFID tags • Monitor and investigate channel members	Targeted at international organizations • Monitor policy of UN/ECE Advisory Group • Participate in IACC actions • Use the TRIPS of WTO • Monitor the actions of WIPO • Participate in multilateral organizations • Lobby for stronger global IPR protection
Targeted at pirates • Establish internal enforcement team • Use surveillance program in retail outlets • Warn counterfeiters of possible legal action • Develop supplier quality assurance program • Aggressively cut prices • Use covert actions	
Targeted at the internal company • Educate employees about copycats • Use acquisition and/or joint venture strategy • Establish factories in lower cost countries	

Source: Adapted from Bush, Bloch, and Dawson (1989); Globerman (1988); Green and Smith (2002); Chaudhry and Walsh (1996); Cordell, Wongtada, and Kieschnick (1996); Harvey (1987); Olsen and Granzin (1993); and Wee, Tan, and Cheok (1995).

From these clustered strategies, Chaudhry and colleagues summarised manager's ranking of importance on the most effective anti-counterfeiting actions as listed in Table 9. Registered trademarks/patents are found to be the most recognised action on effectiveness against counterfeiting. Anti-counterfeiting technology applications, in

themselves, are not often trademarked or patented unless they are developed by the original business for their sole usage. However, other product and packaging security elements, in the form of design-driven attributes, can be uniquely created and claimable as a trademark or patent by businesses. Such design-driven attributes will be reviewed further in the technological review section to follow.

Table 9. Managerial Ranked Most Effective Anti-Counterfeiting Actions (Chaudhry et al., 2009)

IPR Action	Directed At	Rating
Register trademarks/patents	Governments	4.40
Encourage distributors to notify manufacturer	Distribution channel	4.07
Educate employees about counterfeit goods	Internal company	4.07
Educate channel members	Distribution channel	3.93
Warn distributors and retailers about possible penalties	Distribution channel	3.93
Obtain local police support	Pirates	3.87
Encourage enforcement of existing laws	Governments	3.80
Pursue injunctions against counterfeiters	Pirates	3.73
Monitor information sources for anti-counterfeiting developments	Internal company	3.40
Monitor and investigate retailers and distributors	Distribution channel	3.33

Scale: 5 = very effective; 4 = somewhat effective; 3 = neither effective nor ineffective; 2 = somewhat ineffective; 1 = very ineffective; 0 = did not use.

The Consumer - Perceptions of Anti-Counterfeiting

Although there is a considerable amount of literature reviewing the anti-counterfeiting efficiency from a managerial point of view (Chaudhry et al., 2009), and research dealing with consumers behaviours and intentions when purchasing non-deceptive counterfeit goods (Gino et al., 2010), very few reports deal with consumers expectations and trust perceptions of anti-counterfeiting applications (Chaudhry and Cesareo, 2017). There is a glaring gap in research for consumers appraisal of anti-counterfeiting elements proposed on product packaging and their perceived trust or risk of them.

In the survey study of managers perceptions of anti-counterfeiting effectiveness conducted by Chaudhry et al., (2009) found that in general, “managers were not likely to target actions at consumers” yet anti-counterfeiting strategies were focused on educating their internal supply chain. This approach disregards the advantage of leveraging the reality that consumers are part of the solution. There is value obtained from informed and engaged consumers and by doing so, identifies your intentions as a business to protect consumers interests and display management of the problem.

A telephone study by Bamossy and Scammon (1985) considers 38 participating consumers assessing their exposure to deceptive counterfeiting. The findings indicated a limited awareness of counterfeiting showing the deception was successful. Much has changed since this study and online commerce is opening thoroughfares for fraudsters to operate undetected. Consumers exposure to counterfeiting is on the rise and their awareness is heightened. Further research is required to investigate these risk perception shifts and the impact on expected security.

Technological Review

Within this section, technologies and security prevention measures in the context of anti-counterfeiting literature and industry examples are reviewed. It is acknowledged here that the technologies and strategies reviewed is limited and provide an example of the breath of scope that is covered on the context of anti-counterfeiting and deterrent design.

a) Digital Enablers or Smart Tags

A Digitally Enabler can take the form of many applications (e.g. QR codes, RFID Chips, NFC applications, Bluetooth Sensors and Smart Tags etc.). When included for packaging, they are printed codes or applied devices that allow a reading device (such as a smart phone) to activate it and access more information. In some cases, the reading device's details are provided in return to allow for data gathering, market research and monitoring of activated GPS location. Digital Enablers can be utilised throughout the supply chain and/or for end consumer engagement. Their review is summarised here:

Quick Response (QR) Codes, have been used in many applications and are now often fixed to food packaging to enhance security and consumer engagement. Advancements in database generated codes can now produce unique codes for FMCG enhancing their resistance to counterfeiting. Beyond this, researchers such as Sun et al. (2018) argues that common versions are easily counterfeited in the context of Identification Documents (IDs) due to access of advanced printing techniques. They propose a half-tone QR code that enhances laser perforated security documents as a secondary security element that is believed to be difficult for counterfeiters to replicate. Further exploring QR codes with active inks was tested by You et al. (2016) that considered a concept using fluorescent inkjet printing nanoparticles on drug capsules directly, to produce a multifunctional QR code on each pill. This study shows the use of food safe fluorescent inks that could be considered on other food applications.

QR codes and Physical Unclonable Function (PUF) technology, has recently been developed and commercialised (Physical Unclonable Function, PUF – defined below) to create a random unique identifier layered by spraying over a common QR code that is reimaged for cataloguing (Arppe-Tabbara et al., 2019, Sandi et al., 2018). These developments are showing that the printed QR code is still a relevant packaging enhancement and has not been superseded by other technological developments. However, these findings also indicates the common QR code is not sufficient in itself.

Radio Frequency Identification (RFID) Chips are adhered to packaging or tags and often used in retail stores to protect against theft and stock management. A reader device can be used within approximately up to 1-meter proximity to activate the RFID unit which then pings recorded identification coding back to the device. It can now also be used for track-and-trace purposes enabling supply chain to scan and report shipments and distributions. Cheung and Choi (2011) present a track-and-trace system for RFID-based anti-counterfeiting and investigate application issues of selecting the RFID tag type, product application, programming and tag locking, all in the context of bottled products to measure the reliability of tag moving speed to scan accuracy.

Near Field Communication (NFC) are a multi-use technology that when applied to a product can act as an anti-counterfeiting attribute while enabling authentication and engagement with consumers. It requires another device to be in close proximity to activate the chip, usually a smart phone in which the activation can toggle through more information via multiple scans.

Bluetooth Smart Sensors, presented by AIPIA (2019) is a commercially available smart sensor consisting of a battery free, blue tooth chip that is the size of a postage stamp. It adheres to a printed antenna on either plastic or paper and is recyclable. Providing any type of information from product weight, temperature data and GPS location to brands and consumers alike.

b) Physical Identifiers

Holograms (Figure 25, left) are created by the interception of a laser streams by an object or surface which is captured on holographic substrate through either “angular image or laser technology” (Ruchir et al., 2010). Holograms can be generated by 3D images or Computer Aided Design (CAD) using 2D diffraction patterns. Substrates and formats are available in “holographic shrink sleeves, blister packaging aluminium foil, holographic induction cap seals, polyester-based tamper evident labels, and holographic hot stamping foil” (Ruchir et al., 2010) but they go on to report that regardless of the holograms application, counterfeiters have managed to duplicate this anti-counterfeiting measure within South-East Asia. They are best used as a layer that reflects and disrupts high-resolution photography and scanning.

Precision Engraving Holograms can be achieved in steel, plastic as well as in chocolate (Figure 26, right). Nano engraving is a premium security technology achieved through etching free-from 3D metallic master moulds used in plastic or chocolate injection moulding, blow moulding, compression moulding, sealing and laminating manufacturing (Crutchley, 2014).



Figure 25. (left) Security Printing Combining Hologram Overlay (PuraGroup, 2019).

Figure 26. (right) Nano Engraving of Chocolate Mould Surface (Crutchley, 2014).

It is noted here that Nano Engraving can produce a holographic effect on the surface of moulded forms such as plastic or chocolate which are classified in this research as a form of Design-Driven Deterrents. They are listed under technological advancements as they blur the technological and design domains which are not mutually exclusive.

Taggants, as assessed by Sun et al. (2017) in their study of ‘Anti-Counterfeiting patterns encrypted with multi-mode luminescent nano-taggants’ have developed a covert anti-counterfeiting printed technique with taggants being activated with various wave light frequencies. This would be suited for detection methods and tracking within supply chain. Another commercially available version of this is *spray adhesive DataDot* (2019) that are Graphene Quantum Dots (GQD) sprayed onto products of all industries to validate their authenticity (Figure 27). The dots can be laser etched with a numeric code or marked with identifiers of ownership.

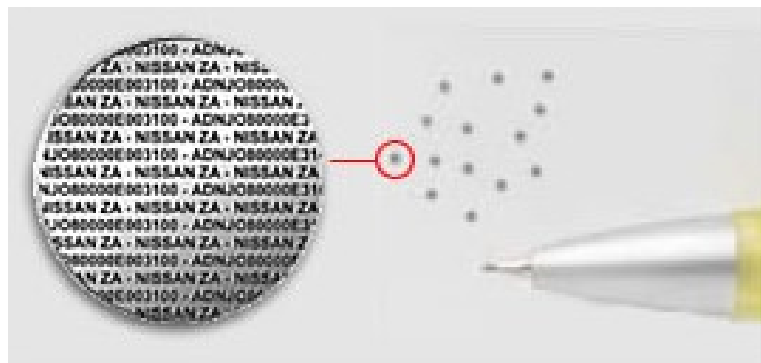


Figure 27. Spray Adhesive Graphene Quantum Dots (GQD) (DataDot, 2019).

Fingerprinting is an overarching term used in literature that encompass all applications that enables the random identification attribution creating uniqueness in each product manufactured. It is often at a micro scale and can be used for authentication purposes using a microscope enabled smart phone or lab testing. The advantages are noticeable in cost saving when the security element is embedded into the actual printing process (Babu et al., 2010).

Physical Unclonable Functions (PUFs), a form of fingerprinting, was initially used for authenticating silicon chips. Currently, they have expanded into other domains of security formats. They can be coupled with other technologies to strengthen engagement and security such as QR codes and RFID chips or act as a stand-alone anti-counterfeiting option. PUFs use random, non-deterministic patterning of physical attributes that either

naturally vary through the manufacturing process (e.g. silicon polymer formations) or are created using a taggant spray or modified polymer medium. These attributes create a unique physical attribute or pattern (D. Jiang et al., 2008) that can be digitally identified for forensic testing. Consumer validation requires enhanced smart phone cameras and access to the encrypted register of PUF patterns. Testing of a products uniqueness can be repeated using the variable physical characteristics either through graphical cataloguing of the PUF or of its frequency identification code with anti-counterfeiting benefits herald as unclonable.

Micro Reflective PUF particles, as studied by Babu et al. (2010) tests the concept of covertly distributed reflective micro PUF particles that are embedded into a products surface or in a document (the product referenced here is a consumer product and the document could be its labelling). The reflective particles can be uniquely registered and recalled for end-user authentication purposes. This process could be very valuable for structural packaging designers and branding managers.

Wrinkled PUF Taggant, Bae et al. (2015) tests their graphically and spectrally encoded taggant concept using a silicon encased polymer in which its particles 'wrinkle' to generate a unique 'fingerprint-like' surface offering replicant resistant properties and reliable authentication. Tested on a passport, jewellery and watch pieces, a portable microscope attached to a smart phone could authenticate it by decrypting its unique identification code or projected image.

c) Enhanced Traceability (ET)

Enhanced Traceability (EC) (Yiannas, 2019) in which *Blockchain Technology (BT)* is a derivative, is praised by service providers as the end-stop to counterfeiting (Wilkie, 2018). It essentially is an encrypted digital ledger which takes a group of transactions clustered as a 'block', linked to other blocks which then forms a network into a chain. Each transaction through the supply chain and distribution of the product adds one more block to the chain. This means that the most recent transaction block creates a + one entry to the previous formula which ever increases until it arrives to the consumer. Yiannas (2019) lists the networked stakeholders that participated in a mango fruit export pilot involving blockchain data input by "farms, packing houses, transportation companies, importers/exporters, processing facilities, distribution centres, and stores". It is promoted on the basis that to attempt counterfeiting of the registered chain, it would

require the fraudster to recreate the whole chain in its complex entirety or start again. However, weaknesses in the chain are possible if the fraudster could get someone to work for a trusted partner and enter fraudulent information. Enhanced Traceability is often found in a trifactor with Logistics Tracking and Encryption technologies all in which operate on digital transactions of *cryptocurrency*. Willing consumers can authenticate a product by scanning the unique product code (e.g. QR code, RFID or NFC) to access the selected consumer facing information through apps or directly through smart phones. As each product is uniquely identified on a register, once it has been consumer authenticated, it is then marked off the register. Therefore, a counterfeiter attempting to interfere with the unique code without the aid of a trusted inside employee, will find that the products authenticity checks will fail and draw unwanted attention. Although, Enhanced Traceability systems can be effective if the network is trusted and manageable, they do require investments of labour time, updating and monitoring expertise and facility upscaling and ongoing costs. These attributes may not meet needs of emerging businesses which requires addressing through research.

Design-Driven Deterrents

Design-Driven Deterrents are often associated with marketing and promotional products. Often overlooked by businesses and designers on the merits of their counterfeiting deterrent effectiveness. They rely on in-house developments or trusted design departments compared to outsourced service provider of anti-counterfeiting. The design-driven deterrents reviewed here are considered as deterrent hurdles, used to increase sophistication of a product and its packaging, decreasing the likelihood of counterfeiting attempts.

It is stated here as a warning that Design-Driven Deterrents should never be sourced from online creative sites as many design departments do so today. Security lies within the secrecy of the design developments. Most elements are based on the ideas identified by Chaudhry et al. (2009) that IP trademarking and copyright are the highest ranked effective strategy against counterfeiting threats. Education to increase public awareness of the sophistication of the product design is essential without revealing the trade secrets of the IP development. In summary, elements considered include (a) Packaging Design (Destructive, Unique), (b) Security Printing, (c) Watermarking (Design based connectivity), (d) Covert Design, (e) Security Patterns (IP protectable), (f) Layering Complexities.

a) Destructive and Unique Packaging Design

Shrink Wrap Packaging – Reported claims from manufacturing professionals state that products that utilise heat-wrapping that shrinks over the top of products with the integration of holograms or designs support deterrence of counterfeiting (Li, 2013). Smirnoff presents a product range using a peelable shrink-wrap that destructs when opened (Figure 28). This layering, awarded for its branding effect (Pfrang, 2011), is considered a novel deterrent to fraudsters who otherwise would consider reusing the packaging.



Figure 28. Smirnoff Vodka showing Peelable Fruit-Skin Branding on Shrink Wrap Destructive Packaging (Pfrang, 2011).

Distinct Structural Packaging Design can be used again for novel anti-counterfeiting measures against fraudsters who would have to design and recreate the packaging. Figure 29 depicts form fit packaging for Newton shoes that is distinct in shape and unlikely to be outsourced from an off the shelf packaging supplier.



Figure 29. Newton Shoes with Unique, Custom Form-Fit Packaging (Nastu, 2009).

b) Security Printing

Micro Characters - Chen et al. (2018) research studies graphically applied micro-characters, hidden using half-tone printing that functions for security products and currency anti-counterfeiting means with the aspect that integration does not disturb the artistic branding or design appeal. Micro printing and micro characters have been used to hide information or deter counterfeiters in currency banknotes (which will be later discussed).

Intaglio Printing and Guilloché Patterns traditionally uses metal-plates that are finely etched either through physical abrasions or chemical erosion that then produce master plates with fine designed grooves that ink fills then to print fine intricate lines difficult to produce on a laser or offset printer (Figure 30). Within the FMCG, learnings taken from this traditional process can still be applied to graphics using alternating line thicknesses, overlapping and fading lines, gradients of colours over the patterns achieved to increase sophistication of background patterns of labels or surface textures of product designs.

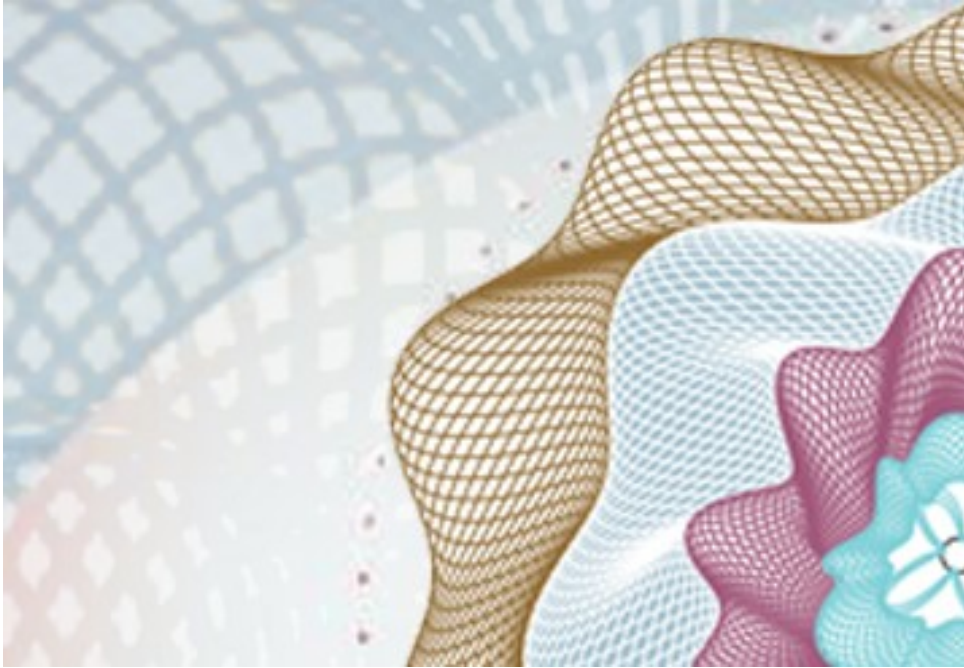


Figure 30. Example of Intaglio Printing and Merging Overlapping Lines.

Transparent Windows with Overlaid Moiré Patterns - Fan and Wang (2003) state that “frequency varying patterns” that align either on the front and back of a product or in the case of currency banknotes, the adjacent sides match when paired. This pattern matching is an indication of high tolerance cutting and precision pattern placement that enables a consumer to judge on quality of product output. When a product is transparent, the patterns on both sides are visible and a moiré pattern appears when the misaligned lines are viewed from different angles. Li (2015) researched the effects of Moiré Patterns on food packaging with the intersecting fringe patterns expressed (Figure 31).

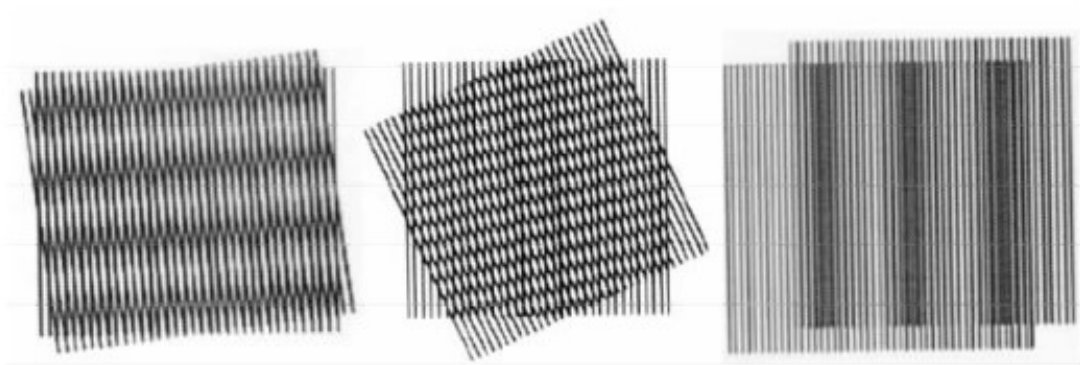


Figure 31. Moire Patterns using Two Layers of Intersecting Lines at Adjacent Angles (Li, 2015).

c) *Watermarking*

Watermarking has been researched on products and images, initially as a physical underprint or white wash element that comes in degrees of visibility. On security documents it has been used as a hidden covert attribute often applied to labels as a verification tool. White ink has now been developed to print onto white backgrounds only to be revealed through light reflection thus, avoiding detection from high-resolution scanners. The term is also used for anti-counterfeiting of copyright images that are protected by either a transparent, but visible marking that can be traced, or at least difficult to remove. This technique should be used in connection with other anti-counterfeiting applications. Watermarking can also be physically impregnated into labels or structural packaging prior to the printing process.

Digital Watermarking, is a new development that as the name indicates is digitally-based. Holliman and Memon (2000) define digital watermarking as the “process of embedding a digital signal into multimedia content such that the signal (the watermark) can later be extracted or detected for a variety of purposes including authentication or identification”. Their research compared three instances of watermarking on still images that were either visible or invisible and identified that although difficult to duplicate, digital watermarking is vulnerable to counterfeiting if poorly executed. This indicates that technologies can fail in their protection purposes if not design with counterfeiters in mind. This again confirms the research question of does design-embedding of technology delivery into the overall product experience impact on anti-counterfeiting technology success?

Kaufmann (2019) advocates that “*invisible digital watermarking* opens consumers channels”. The campaign he supported trialled intelligent displays on point of sale units that consumers scanned branded areas that had an invisible printed watermark resulting in further information on the product through the free app. According to Kaufmann, the elements were created through online web press software. Although, this technology offers security through its use of a hidden marking to activate a consumer app, the marking is pre-designed and therefore, replicable if the design is identified. The security benefit is that the invisible watermark is registered and only activates the app when acknowledged through the phone’s camera. Thus, a counterfeiter would have to hijack the digital design watermark code to replicate. This approach is only effective if consumers are made aware through thorough education of the strategy.

d) Hidden Elements

Ziljak et al. (2010) test hidden graphics under normal lighting conditions and that are revealed under InfraRed (IR) light. Both images are achieved simultaneously using only standard CMYK printing inks. The independent graphics (Figure 32 (left) and Figure 33 (right)) are produced by separating the distinct colours via their wavelengths using computer algorithms. The purpose of the two images enables authenticity checks to be made if duplications are attempted. Ziljak and colleagues state that the process of duplicating the image will lose the two wavelength graphic separations thus, is a simple method to produce covert elements hidden from plain eye that does not disrupt business unique branding.



Figure 32. (left) “Image of Cathedral Under Daylight” (Ziljak et al., 2010).

Figure 33. (right) “Image of the Cathedral Scanned with an IR Camera under 665 nm Barrier Filter – Transformation of Impression in IR Graphics” (Ziljak et al., 2010).

e) Non-Periodic Tiling in Patterns

Although patterns can be considered a form of security printing, they also can be implemented in structural packaging and the surfaces of products themselves such as the moulding of chocolate. Thus, distinct patterns (including Guilloché and Moiré patterns) that create complexity and hard to copy are further elaborated here.

Voronoi tiling, are patterns made from mathematically defined tessellation tiles that use discrete random points on a surface to dictate regions calculated by closest proximity

boundaries (Figure 34), like that found in school catchment zones or city post office regions. The random tiling of a plane can enable designers to create a unique pattern for each business that if adopted can be subtly by integrated into the background of labelling or impregnated into the moulding of products and packaging. Further, digital registration of these patterns can be captured for verification if authenticity is in question.

While commercial patterns cannot be patented, a unique, in-house created pattern such as a Voronoi pattern could be IP protected. This is because the pattern is generated by a systematic mathematical equation in which the specific formula could be patented. The security behind such patterns lies in the non-repeating cells that can be reduced in size and layered with noise omitting reflectors, to deter fraudsters in attempting forgery. Communication of the pattern sophistication is also essential for consumers to understand its critical purpose.

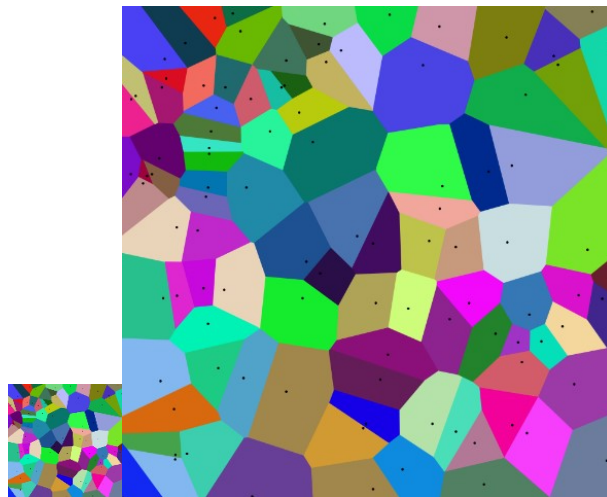


Figure 34. Voronoi Tessellation, Convex Polygon Regions – Resized (Sourced Creative Commons)

3D Non-repeating Patterns make use of 3D modelling via Computer Aided Design (CAD) software. This is to produce images with perceived added depth and complexities to logos, text, images, backgrounds or surface modelling. The theory is to create blockades where counterfeiters would usually refer to scanning to duplicate an image. Blockades, such as that of reflectors and moiré patterns that merge when replicated, force fraudster to compete by re-engineering the 3D CAD image. An example of intricate 3D modelling is shown in Figure 35 of a Superman logo integrated with aperiodic tessellation patterns.

An example of enhanced backgrounds and textures is presented in Figure 36. Firstly, 3D modelling, then becomes a prerequisite skill to commit the fraud crime in aim to eliminate the common counterfeiter. Secondly, enhanced backgrounds, of small details and specialised textures and shapes, are harder to distinguish with copiers, driving counterfeiters to either attempt difficult replication or look for an easier target.

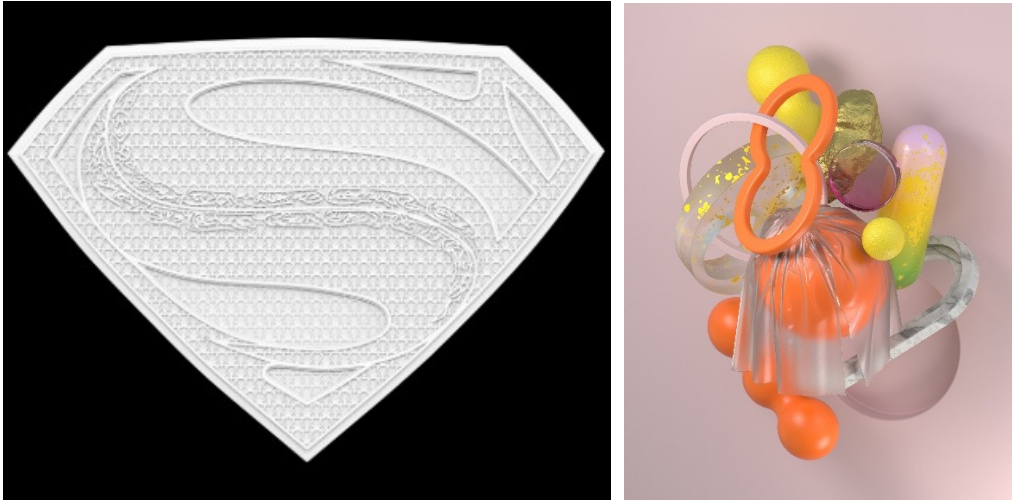


Figure 35. (left) 3D Logo with Aperiodic Tessellation Patterns (Do3D, 2019)

Figure 36. (right) 3D Modelled Abstract Geometrical Composition showing Varied Textures, Forms and Colours (DepositPhotos, 2019).

f) Disrupting Modifier Tactics

As described earlier in Section 2.1 Fraudsters and Counterfeiters, two types of counterfeiters have been identified, namely Modifiers and Mimickers. Modifiers are counterfeiters that use existing brands IP such as designs, products and marketing material and modify it in a way that enables them to exploit the brand's reputation. For example, counterfeiters have been reported to cover up a brands logo so that consumers cannot seek more information about the product from the original website. To demonstrate this, two similar images are shown as representations of a hypothetical brand's promotional marketing campaign selling almond milk. Figure 37 (left) presents the authentic promotional material depicting the original brand logo located in the top right-hand corner whilst, Figure 38 (right) indicates the same image with a simple modification using an online sourced image of the same almond nut placed over the brand logo. This modification was simply achieved using Powerpoint.

To overcome similar online issues suggestions include (1), to avoid sourcing imagery through online image-banks such as Shutterstock and should either create their own or outsource to a reputable design consultancy all their super-realistic or stylised photographed product shots – these could be then trademarked, (2) logos should be integrated into or behind products similar to the principles of a watermark so to not easily be overlapped or removed from the scene, (3) information about the company should be embedded within images for example small legible text on the almond nuts to create fun within planned complexities. These tactics use design to create intricate hurdles against counterfeiting.



Figure 37. (left) Almond Milk Promotional Scene with Brand Top Right (Deposit Photos, 2019).

Figure 38. (right) Francis (2019) “Modified” Brand Promotional Scene using Online Sourced Almond (adapted DepositPhotos, 2019).

g) Layered Design Complexities

Unique Designed Complexities can be achieved by considering complexities in design. For example, the bottle and label design by freelancer Cubbon (2019) of the Fynoderee Manx Dry Gin product (Figure 39). The design uses a *Profile-Cut Label* that not only creates a point of difference from a marketing perspective, it also provides deterrence through complexity. A counterfeiter would consider this against other simpler Gin products and would prefer an easier design to copy. Whilst increasing the premium feel of the product the label uses varied raised textures achieved through gloss printing and hand-sketched elements. The bottle design is a custom shape, not easily sourced from off the shelf designs which could be enhanced by a certain custom colour additive. The lid theoretically could use wood sourced from the country of origin that further acts as a DNA reference for detection tactics. All elements together heighten the deterrent hurdles that reduce the likelihood of counterfeiters attempting replication.



Figure 39. Unique Label Profile and Custom Bottle Shape with Layered Textures and Complex Elements all Combined Deterrents (Cubbon, 2019)

Unique Artworks or Specific Photographs of people or places also create complexity for counterfeiters. Artworks commissioned by a business from local artists can then be used for increased complexity in background branding if the artwork is owned by the business and not sold again as re-prints. Figure 40 shows a complex artwork that randomly layers paint thickness's, randomised textures and alternating line-thicknesses, multi-coloured gradients and varied saturations of hues. Re-engineering replication would be close to impossible, and counterfeiters would turn to photography and scanners to duplicate the artwork. To disrupt the photographic process, reflective overprints or holographic laminates can be adopted that burst light when scanned. These are the same principles taken from identity documents. To further strengthen anti-counterfeiting deterrence, destructive packaging elements could be applied through small hidden perforations across the artwork (for counterfeiters trying to reuse the artwork of packaging). Also, a cylinder packaging or bespoke pack shape would hinder online duplication and reproduction through downloaded images (counterfeiters would be forced to re-engineer the artwork). Some companies have also used this to shrink wrap these artworks over the authentic product, again acting as a destructive packaging feature. Once the original artwork has been created for restricted access only, the artwork is enabled for IP protection and design registration for further value-add to the business.



Figure 40. Unique Artwork with Layered Paint, Colour and Textures (Guseff, 2019)

2.3.6 The SME User Construct

Advantages and Disadvantages

Businesses are in two mindsets about counterfeiting. They are aware of the threat and yet they question the cost and management of brand protection using anti-counterfeiting measures as the method is unclear (Kennedy, 2016). Ruchir et al. (2010) in their research collate literature on anti-counterfeiting developments for the medicine industry, another high-risk category being targeted by counterfeiters. They briefly summarise the advantages and disadvantages of anti-counterfeiting technologies under the two categories Overt and Covert as shown below in Table 10. The benefits of anti-counterfeiting are for consumer appeal and engagement, supply chain management and counterfeit deterring. The potential disadvantages are the increased investments and research validation required for selection, operation and consumers acceptance. Businesses education of the range and options available to them is also required for them to make an informed decision on what is added value.

Table 10. The Advantages and Disadvantages of Overt and Covert Technologies (Ruchir et al., 2010).

Technique	Advantages	Disadvantages
Overt	User verifiable Can add decorative appeal Can be a deterrent to counterfeiters	Requires user education May add to cost May rely on covert features for authentication
Covert	Can be simple and low cost to implement Needs no regulatory approval Can be easily added to or modified	Need strict secrecy If widely known or used, may be easy to copy More secure options add complexity and cost

Cost to Value Ratio

Anti-counterfeiting technologies add costs through the purchase, setup and management of their related systems. Businesses are questioning their potential return on investment and therefore more research is required on the value for consumers and their perceptions of them. SMEs weigh every cost and it is essential that the selection and application of securities is executed according to best practice. The return on investment must equal the outlay or profit the businesses incentivising continued upgrades or developments.

Costs are incurred if brand protection is carried out or not. Bamossy and Scammon (1985) state that “Indirectly consumers pay the costs of counterfeiting through higher prices necessitated by corporate expenditures on trademark protection. Directly they also pay in the form of dissatisfaction with counterfeit products, personal injury from faulty counterfeit products, and confusion regarding avenues for redress”. Although, there are costs either way, businesses lacking awareness, will disregard counterfeiting threats until they face the problem, causing a fall-back on reactive tactics. Deterrent strategies are key to success, and the promotion and education of them, such as that presented by (Francis, 2017).

Effectiveness and Appropriateness

Businesses are concerned with the effectiveness of anti-counterfeiting elements as some are believed to be easily faked and certainty of their protection and appropriateness is in question. Deguillaume et al. (2010) frames the issue of the easy ways counterfeiting thrives through the access of online digital content, graphic editing tools and high-quality manipulation without authorization. Another concern for businesses is the appropriateness of an application on their food category when considering consumers expectations. Therefore, this research questions would consumers recognise and consider valuable, specific anti-counterfeiting, such as security printing on meat packaging?

Education or Discovery

In the survey study conducted by O'Callaghan and Kerry (2016) assessing consumers attitudes towards smart packaging technologies on cheese products when considering shelf life expectation and high-tech applications, consumers were more willing to accept products when education of the applied technologies was clearly provided. This indicates

that applied technologies to food packaging require purposeful and transparent meaning for consumers to adopt the enhanced packaging. Consumer centred design that empowers informed decision-making supports acceptance of new, unfamiliar technologies. Alternatively, discovery is also a form of excitement and companies can leverage WoM through the appealing aspect of discoverable elements. Discovery is a risky option, the technology requires novelty, newsworthy status to engage the WoM phenomenon, thus, the delivery of the initial reveal is to be strategically planned.

Vulnerability Assessment

Businesses are seeking answers with industry suppliers of anti-counterfeiting promoting their portfolio of solutions. However, fuelled by technology suppliers, said businesses skip the vital vulnerability assessment of selecting the appropriate countermeasures and adopt the most low-cost, justified solution that they have been educated on. Similar to a medical procedure, a specialist doctor must diagnose the problem in-depth, well before the treatment takes place. A move towards a vulnerability assessment is essential to identify specific businesses unique levels of risk exposure and the availability of appropriate solutions that mitigate such threats (Spink et al., 2017).

Trustworthy and Dependable

Businesses are encouraged to connect their product packaging and supply chain to the Internet of Things (IoT) through networked digital Enhanced Traceability (ET) solutions. Although, larger businesses with expendable investment funding may seek such services, SME businesses may not have the means to upscale in increased business resources and management of such systems. They require trustworthy and dependable solutions that do not require more manpower. Maintaining trust with consumers is imperative.

Solutions and learnings can be taken from other high-risk targets that have developed robust and reliable printed security graphics and deterrent designs such as that used in currency notes. Literature dealing with currency securities and the learnings of design-driven intricacies are now considered for the food industry.

2.3.7 High-Risk Target Case Study

Background

Currency banknotes have always been threatened by counterfeiters who range from everyday cheaters to professional organised fraudsters. Discovered by the Secret Service in the 1990s, high school students used common everyday inkjet printers to runoff replicas of U.S banknotes (Sincerbox, 1993). In today's context, replication of banknotes is a constant threat and although all banknote amounts are targeted, more effort is made for mid to higher values. An example is provided in The Guardian which interviews and gains insights into a master counterfeiters operation, demonstrating the efforts undertaken to replicate a US \$100 banknote (Franklin, 2016). A photograph taken from the article (Figure 41) depicts a paid worker in the process of soaking a fraudulent bill to soften the banknote fibres whilst manually inserting the security strip for forged authenticity. This syndicate represents organised crime and multiple actors play a part of the fraud chain.



Figure 41. Paid Workers Thread Security Strips by Hand into Individual Bills as revealed in The Guardian (Franklin, 2016).

Interesting to note, Benjamin Franklin was famous for stifling counterfeiting within his time using impressive and intricate patterns of printed, raised leaves embedded into

banknotes designs for authentication and complexity-based deterrence. Today, counterfeiter's tools and tactics are evolving and advancing, with banknotes targeted by multiple perfectionists uniting to contribute their artwork skills for the duplication and reproduction of illicit currencies. Although not void of risk, polymer banknotes and their increased complexities have been a disruption to this phenomenon.

Australian Banknotes Counterfeiting Detection

Currency counterfeiting has been a constant risk in destabilising consumer trust and causing unmerited inflation. Education of currency securities aimed at retailers and the general public to aid in the recognition and self-detection of fake notes has been improving. Examples of building educational trust building exercises can be found on the RBA website that step through each security element in an interactive, playful engagement. Public trust of the monetary system must be maintained and therefore, this case study enables the food industry to learn from the researched and tested in action procedures that the RBA has executed and refined over time.

Consumer self-detection of counterfeits can cause rippling problems for consumer trust in the currency system. Therefore, revealing openly online through transparencies of counterfeit detection has been adequately executed by the Research Bank of Australia (RBA, 2018). They offer open sourced detection data reports to ensure consumers can optionally be informed or learn methods of how to avoid being deceived. Regarding the food industry, agribusinesses have stated that they do not want the public to know they have been counterfeited. However, as per the currency case study, detection transparency in a formal report or spreadsheet indicates you are aware of the issue and publicly announcing the issue is detected which shows you have good intentions for your consumers. Attribute of benevolence and integrity as shown through transparency are trust building elements.

The RBA (2018) report data has been graphed (Figure 42) showing counterfeit detection of \$5 banknotes from 2003 to 2018, a negative trendline has been plotted to indicate the reduction of counterfeits over time. Noteworthy is the plateau of detected counterfeits since the release of the latest September 2016 new generation polymer note, lasting over a period of approximately 2-years. This could indicate a significant impact on counterfeiting deterrence from the renewed sophisticated banknote anti-counterfeiting applications.

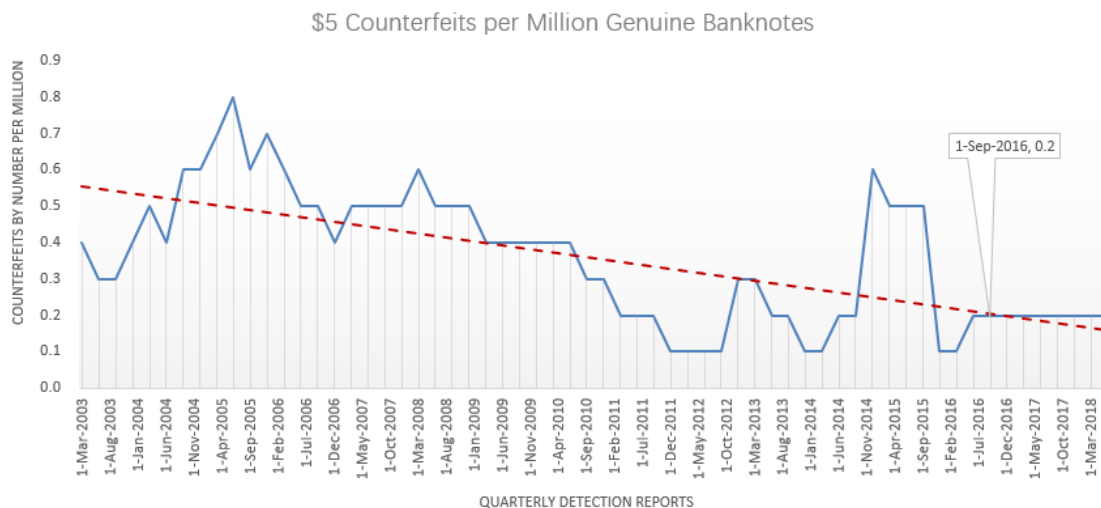


Figure 42. Reserve Bank of Australia Counterfeit Detection of \$5 Banknotes with Added Negative Trendline showing a 1-Year Plateau Period from the Issue of the New Polymer Banknote Released on 1 September 2016 (adapted from RBA data, 2019).

The number of counterfeits detected in 2015-2016 per Australian banknote denomination (Figure 43) shows \$50 banknotes contributing approximately 84% of the detected counterfeits over 2 years with \$100 equating 14%, \$20 2% and both \$10 and \$5 banknotes equally contributing less than 0.2%. This example supports the claim that counterfeiters target all areas of product value categories. However, they increase their focus on higher-value chains for easy profits. Testing across similar food categories ranging from common valued products classed as “everyday” compared against higher valued products such as “premium” products, would enable observations to be made on whether consumers security expectations shift across the two value levels.

COUNTERFEITS DETECTED IN 2015/16

	\$5	\$10	\$20	\$50	\$100	Total
Number	29	51	448	22,063	3,656	26,247
Nominal value (\$)	145	510	8,960	1,103,150	365,600	1,478,365
Parts per million	0.2	0.4	2.8	34.5	11.4	18.6

* Figures are preliminary and subject to upward revision due to lags in counterfeit submissions to the Reserve Bank.

Figure 43. Australian Banknotes Detected in 2015-2016 based on Banknote Denomination (RBA, 2018).

The report compiled by Brown et al. (2017) on Recent Trends in Banknote Counterfeiting, with a primary focus on Australia and its comparison globally, increased threats to currency notes were reported on the rise. Detected counterfeits in 2015 on average were reported by country (Figure 44). Australia was ranked as the 5th highest country behind Brazil, United Kingdom, Mexico and the Euro area. Acknowledged here are the missing data plots from the US and China sectors. Brown and colleges also reported on the comparison of substrates with polymer notes still be highly targeted (Figure 45) graphing the polymer note detected fraud attempts rising however, the new note was issued after this graph report.

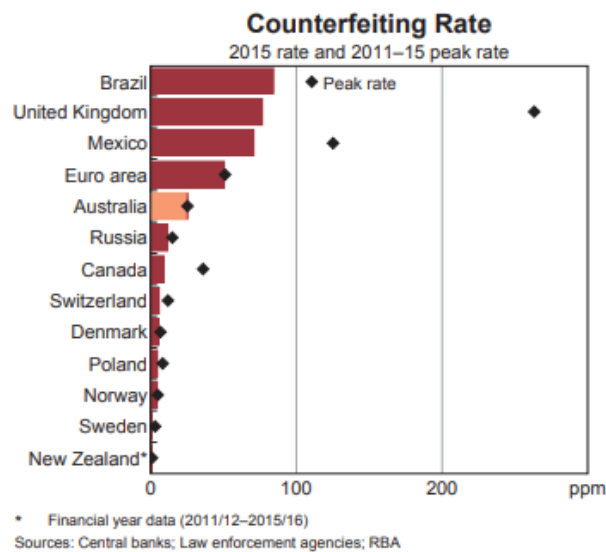


Figure 44. Counterfeiting Rate as at 2015 showing Yearly Rate and 5 Year Average Peak Rate (Brown et al., 2017)

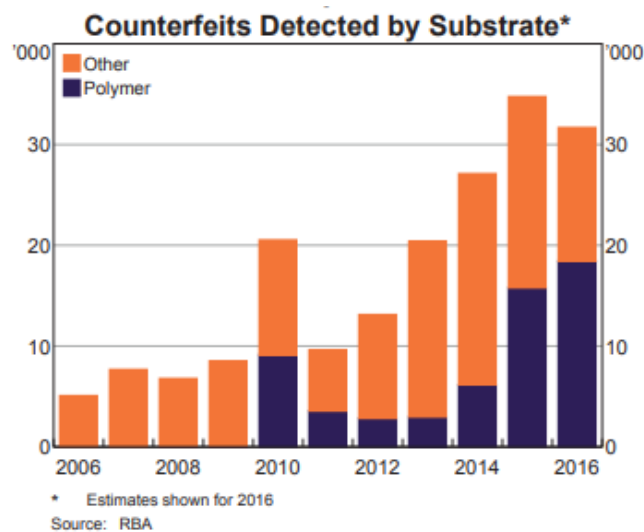


Figure 45. Counterfeits Detected by Substrate reported in 2016 (Brown et al., 2017)

Polymer Banknotes Reviewed

Arppe and Sorensen (2017) argue that polymer banknotes use deterministic methods of design, that is determined for reproduction manufacturing and claim that new generations would benefit from a non-deterministic, random PUF integrated application. They acknowledge the only non-deterministic identifier used in the referenced banknotes is the unique serial codes. From assessment purposes of the euro banknote, they cluster the State-of-the-art anti-counterfeiting tag attributes under 4 colour coded groups based on their integration method being blue, green, yellow and orange (Figure 46). The groups being:

1. *“Patterns can be printed on the surface of the material (blue), or*
2. *Engraved in the material (green),*
3. *Taggants or larger features can be embedded in the material (yellow), and*
4. *Patterns can be made by texturing the material (orange)”*
(Arppe and Sorensen, 2017).

The euro banknote anti-counterfeiting attributes are common among new generation polymer notes using microprinting, raised printing, colour changing inks, holographic strips and holograms, infrared inks, printed window, fluorescent fibres, special paper and luminescent inks. The Australian polymer banknotes have additional features which makes them one of the most effective currencies in the world, these include: top to bottom windows, overlaid flying bird images to create movement when rotated, reversing 5 inside the federation pavilion, iconic badges stylised by designers, matching opposing edges with continuous patterns and more recently a taggant inserted into the note which on their official website is referred to as a ‘tactile feature’ summarised in Figure 47.

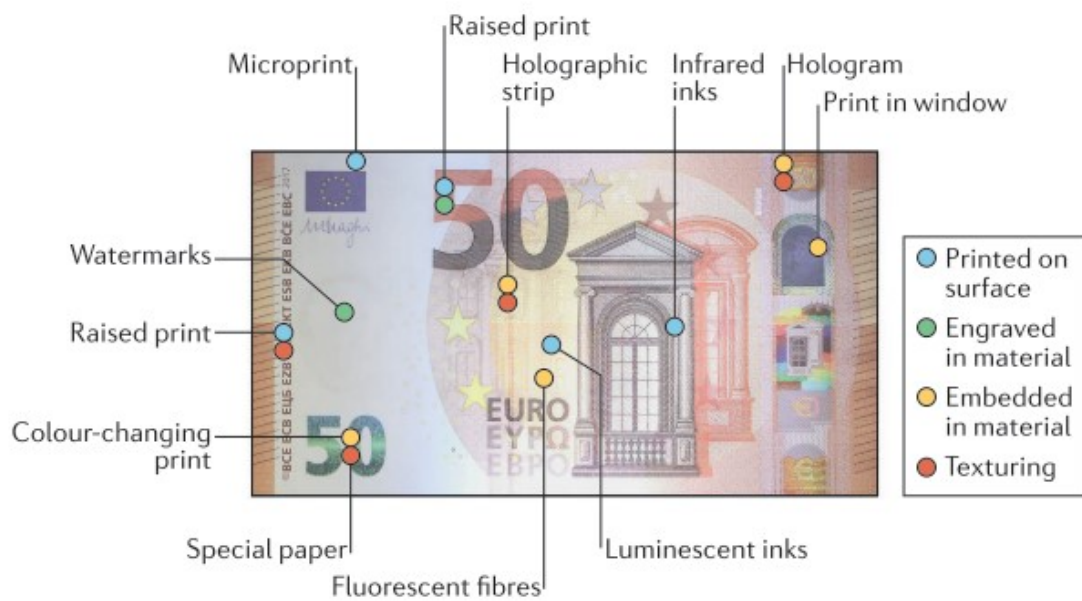


Figure 46. Cloneable Anti-Counterfeiting Tags used in Euro Banknotes (Arppe and Sorensen, 2017) adaption of the Euro Banknote.



Figure 47. Specimen of the Australian \$5 Polymer Banknote (Reserve Bank of Australia, 2016)

The Scaling of Anti-counterfeiting Costs to Product Value

Arppe and Sorensen (2017) state that the security level is dictated or scaled according to the value of the product it is applied to such as a given proportion. They provide an example comparing the cost of tagging FMCG such as medicine blister packaging compared to brand name timepieces and the investment in anti-counterfeiting scaled accordingly. In the context of banknotes, we do not see this apparent scaling of security features increasing due to the products value. For example, the \$5 polymer Australian banknote has the same level of security as to the \$100 polymer Australian banknote. The scaling may be relevant across categories such as food to luxury fashion items however, within a family of products such as the context of banknote values, the security levels do not change. This is a research question to be investigated concerning security expectations across categories and families.

In summary, from the literature and the review of banknote securities compared across countries, five areas of security influencers have been identified:

- (1) Design-based elements and Design-driven securities
- (2) The Fitness of securities for the product needs (banknotes currently exclude PUF systems)
- (3) Security Identity Connections as links to country of origin
- (4) Their perceived Resistance or effectiveness by consumers (website and WoM driven)
- (5) Security Status doesn't scale according to Product Value, family of product with same security level (\$5 banknote has the same security features as the \$100 banknote).

Education acting as a Deterrent and Building Consumer Trust

Online education can be a double-edged sword. It can act as a deterrent strategy showcasing to potential fraudsters the impressive display case of adopted security measures whilst educating consumers and building trust of ones presented benevolence, integrity and ability (Siau and Shen, 2003, O'Callaghan and Kerry, 2016). Education of the public and their acceptance of new generational changes and issued releases is essential for consumer trust to be maintained (Sincerbox, 1993). The RBA's website is structured to educate and inform the public, clearly presenting the Australian Banknotes (issued and to planned future releases), their security features (listed with details,

engaging visual animations and informative videos), statistics on distribution and circulation transparencies including detection of counterfeits over time, strategies on how to detect a fake and what to do if discovered, legal responsibilities, playful games to engage younger audiences and finally resources for the many stakeholders and users of currency (including police, teachers, visually impaired and collectors). The website is thorough and instils attributes that build consumer trust founded on informative transparency, playful engagement and sophisticated presentation of information. As the official RBA website is designed to deter potential counterfeiters by utilising informative yet warning transparency of information, it acts as an excellent website format for agri-businesses to reference from and adjust to their unique brand profile in order to educate consumers and warn off threats.

Education is also called for employees within organisations and members along the supply chain including all decision making stakeholders. Chaudhry et al. (2009) promotes the need for programs directed to educate employees and align their awareness of the threats to develop best practice for the brand company's goals. Educators of such programs may be outsourced or resources that can upskill on anti-counterfeiting concerns and options is called for.

The Distribution and Circulation Model of Polymer Banknotes

The distribution and circulation of currency banknotes utilises a non-monitored circulation model until banknotes return to money exchangers or financial institutions which at this point counterfeits can be detected. It is questioned whether this non-monitoring whilst in circulation model can act as an option for businesses that choose not to upscale packaging with digital connective technology. Therefore, a closer look at currency notes deterrent strategies and their learnings could be design transferred to the food industry on a modified for need approach.

Counterfeit Deterrent Strategies and Learnings

New generation currency banknotes depend on many elements and multiple incorporations overtime to deter the threats of counterfeiting fraudsters (Sincerbox, 1993). He goes on to say that visual inspection alone is insufficient and attributes that enable identification, selection and rapid response tactics, enabling authentication is key.

As banknotes are manufactured on a ‘reproducible process’ they therefore are exposed to highly skilled counterfeiting, a unique identifier in the form of a serial number is printed onto each unique note which is registered on an external database, ensuring counterfeits cannot remain indefinitely in circulation (Arppe and Sorensen, 2017). Sincerbox (1993) urges a program of continually evaluating deterrent features through demanding tests to validate attributes effectiveness in the context of real-life judging against common wear and tear as well as resistance to advanced threatening modifications and attempts of duplication. This frequent iterative process is similar to the design process methodology. Therefore, strategic planning for long-term is required with consideration of counterfeiters advancing level of expertise in reprographic systems (Sincerbox, 1993). This long-term view leads away from the one-solution, high-tech approach the anti-counterfeiting industry is promoting. It calls for a change in the way anti-counterfeiting is being delivering.



Technical Advisory Group

The RBA (2019) consulted all the stakeholders of the supply chain from “key users of banknotes, including banknote equipment manufacturers, retail organisations, financial institutions and the vision-impaired community”. They also were recommended by the

National Materials Advisory Board to form a Design Advisory Panel who would be subject-matter experts responsible in reviewing, guiding and directing the security features advancements (Sincerbox, 1993, RBA, 2019). This model can be used for the food industry as supported by the position taken by Spink et al. (2012), who urges for fraud guardians and hurdles to be in place. SMEs may not be able to employ more staff to act as champions of the anti-counterfeiting phenomenon and so this research identifies a need for the architects of packaging to become educated in anti-counterfeiting measures and integrate security elements into packaging overall designs. Designers are best placed to become the product protection advisors needed for businesses of all sizes. As per the development and release of the active polymer banknote, guided by the established Design Advisory Panel, so too should the food industry urge design and technology educators to accommodate security design to create future multi-professional teams that act as ongoing guardians of their commercialised artefact.

2.3.8 The Design-Driven Model – An Alternative

Design is an important component of product acceptance and engagement and brings value not only to businesses but to consumers alike. Lockwood (2007) states that “Design has the ability to add value in many ways, including economic, social, and environmental criteria.” He says that it can influence consumer preferences, premium pricing positioning and market adoption. Within the study, Lockwood focuses on business criteria, outlining 10 categories that measure the framework of the value of design:

1. *“Purchase influence/emotion,*
2. *Enable strategy/enter new markets,*
3. *Build brand image and corporate reputation,*
4. *Improve time to market and development processes,*
5. *Design return on investment (ROI) / cost savings,*
6. *Enable product and service innovation,*
7. *Increase customer satisfaction/develop communities of customers,*
8. *Design patents and trademarks/create intellectual property,*
9. *Improve usability,*
10. *Improve sustainability”*
(Lockwood, 2007).

Considering anti-counterfeiting within this listed context one could postulate that ‘design’ could be the driver of anti-counterfeiting success and improved perceived value of its integration. (Lockwood, 2007) appraises the longitudinal study conducted by Hertenstein et al. (2001) that investigated 51 firms listed on the American stock market. The results demonstrated that enterprises that invested into design and rated high on designed products were statistically significantly more financially positioned as perceived by the firm’s managerial respondents. This study shows measures statistically that design adds value and therefore, design embedded anti-counterfeiting should have more value than non-design embedded anti-counterfeiting attributes.

Design for Deterrence

Learnings taken from the politics and cultures of the graffiti communities can provide a greater understanding of how the integration of design can be used for deterrence and therefore, how these lessons can be translated across to anti-counterfeiting purposes. The cross-reference to graffiti does not simulate or compare its act to the fraudster crime.

It does however, acknowledge the effect design contribution makes and how it can lead to a shift in perceptions through the respect of its value.

In brief, graffiti and its 'aesthetic criteria' is driven by many motives. In the in-depth, independent research paper by Werwath (2006), graffiti styles and its artists are summarised into two groups based on their intentions for generating visuals and messages on public and private environments. The first group intends towards mass communication and the aim is to 'culturally frustrate'. The second group is motivated by 'individual expression', often striving for public recognition of their contribution of artistic mastery. Werwath (2006) continues by outlining the three graffiti types, commonly identified within the graffiti community, which are (Type 1) a Tag (the basic form): the writing of one's stylised name, in a seemingly random manner, and considered to mark a territory or to proclaim one's identity and presence in the community; (Type 2) a Throw-up: is a more advanced form, using fonts of recognisable styles such as 'bubble writing' or 'wild-style' to create a more intricate design; and (Type 3) a Piece or Masterpiece: often portraying a scene or recognisable personalities with a message – this type of graffiti usually is coordinated with multiple collaborators. Interestingly, it has been observed that graffiti deemed at the Masterpiece status are often left untouched for longer periods of time indicating that the quality of design and investment of resources and effort into the artwork creation demands respect and warns off the potential random taggers and throw-up artists who commonly avoid the area considered as an acknowledgement of its present value to the community.

Evidence of using deterrent design to shift behaviours of unwanted anti-social/anti-capitalism acts has been explored in the context of graffiti. One of Melbourne's most recognised decorated wall is the 'Welcome to Sunny Fitzroy' graffiti mural (Figure 48) painted by Everfresh Studio, a graffiti crew that are commercially available to upgrade public and private wall spaces to increase its value through beautiful murals and reduce 'mindless vandalism' (EverFresh, 2019).



Figure 48. Welcome to Sunny Fitzroy, Melbourne by EverFresh Studios
(Photograph: Graham Denholm, Timeout, 2019)

Through their intricate planned designs that integrates bold Mambo-esque characters that call to a pride-of-place' message (Dovey et al., 2012), whilst minimising available negative space for tagging, Everfresh has created a 'masterpiece' artwork that has proven to deter repeatable graffiti and is accepted as a valuable identity landmark to the community, including those of the graffiti groups. This iconic wall, through intricate master design was established in 2009 and still today is unmarked by graffiti taggers and the like.

It is acknowledged that other studies have shown that tagging still occurs on installed murals, such as the study undertaken by Craw et al. (2006). They investigated the effect of a commissioned Mural placed in a high-targeted area known for repeat graffiti occurrences to observe if the mural deterred graffiti from the claimed space. It is argued here that, the mural used was not of masterpiece status. Compared to the professional 'Welcome to Fitzroy' mural using master graffiti crews to pull together a complex and purposeful design, this mural shown in Figure 49 taken from Crew and colleges study, uses childlike imagery and allows for much negative space which was the first areas to be tagged. This study shows in contrast, the need for high quality designs that bring together not only an artwork, but a sense of identity that portrays a capability unmatched and desirable, resulting in deterrence by design.



Figure 49. Mural in Targeted Hot-Spot Re-Vandalised (Craw et al, 2006)

Designing for Consumer Trust

Large design firms within industry have reported on the attributes one can design into to strengthen consumer trust. FROG, an internationally recognised design firm that has specialised in user-centred design released a report titled “Designing for Digital Trust” (FROG, 2018). They echo the literature on the attributes of trust established in Chapter 2 yet present it in a new light. According to FROG, the four pillars that bear equal importance are: (1) Competency, (2) Reliability, (3) Empathy, and (4) Consumer Orientation. The convincing presentation of *competency* is transparently revealing your true capabilities and unchallenged credibility. Offering insightful expertise builds one’s reputation and showcases your knowledge base. *Reliability* is being consistent and dependable; availability and accuracy of information. *Empathy* is showing respect to consumers, not always directly but also through indirect means, this could be through your website or posting positive and negative customer satisfaction ratings, personalising the relationship between brand and customer. Which leads into *customer orientation*, meeting their needs and responding with equal values. Partnering with

consumers through design and sharing intimate transparent nuggets of information about your business which is difficult to create or market.

Experience design is the design approach that aims to create emotional connections with customers (Pullman and Gross, 2004). Marketing movements are shifting away from the product orientation purchase towards the experiential drivers that one can obtain through the product. With this in mind, designers can use imagery to cross-reference key locations of their business on the philosophy that consumers are seeking the quality produce from that region. This providence story inbuilt within packaging labelling is powerful not only for selling the authenticity of the product but also enabling consumers to cross link these locations with personalised photography from the original location. One must not purchase professional photography of a location that could again be sold onto a third party. The unique photo can be traced for further validation to its actual location and with the addition of reflective layering, this indicate image can then be enhanced to become part of a complex deterrent layer.

Lockwood (2007) posits that design can have a “positive effect on the customer’s emotional relationship with a brand”. Therefore, it is questioned; *Does design effect anti-counterfeiting’s acceptance by consumers? Do designers play an integral part in equipping, integrating and empowering anti-counterfeiting acceptance?*

Designers as Anti-Counterfeiting Guardians

It has been established that anti-counterfeiting strategies proposed within literature have pointed to hiring and allocating responsibility to the right people (Chow, 2010). Designers are trained and equipped to act as the product packaging development experts and are best placed to upskill in anti-counterfeiting tactics to establish protection methods into their design practices for new product packaging developments. Chow (2010) goes onto say that education and training is required for a long-term strategy. Changes in design education is called for with Universities and Design Schools to adjust their programs to accommodate the ill-defined problem of counterfeiting and how designers can contribute to the embedded hurdles that frustrate and deter fraudsters.

Within Industry, businesses of all sizes require experts that inform the product packaging process to champion and unify the growing knowledge of anti-counterfeiting strategies, tactics and technologies on offer. Designers of product packaging immerse

themselves in multi-industry collaboration to scope and source solutions to complex problems through empathising all stakeholder needs centralised on user's perspectives. Designers, as anti-counterfeiting guardians, would pave the way for agri-businesses to make educated choices towards long term best practice.

2.3.9 Section Summary

The anti-counterfeiting industry is embracing a high-tech, digitally connected approach that centres around rapid advancements responding to the ever-evolving issue of counterfeiting. High-tech is promoted as best-practice and an all-solution to fraudster threats however, there is a lack of research assessing consumers trust of them and new risks and problems are being ushers in. New-to-export SME communities are hesitant in adopting anti-counterfeiting options as the industry promoted applications require upscale in operational investments and management resources.

Alternatives to high-tech applications have been reviewed. This is to collate options suitable for a range of SME brands considering the Design-Driven Deterrent model of increasing product and packaging designs sophistication to void common counterfeiters that would otherwise target with ease. Cost-effective alternatives in contrast to high-tech, aiming for proactive strategies that frustrating fraudsters capabilities. Embedded intricacies using overt and covert tactics learnt from high-risk targets of currency bank notes. The review of literature finds that there is a need for cost-effective, multiple easy applications, unique to each SME brand that reduces their overall operational efforts. High-tech applications demand more in contrast yet have their place for future applications when SMEs grow in status and consumer demand.

A research gap exists assessing consumers perceived trust and effectiveness of anti-counterfeiting elements and comparison expectations across cultures. A secondary area of investigation requires the education and involvement of SME brands in the co-creation of options taken from both high-tech and design-driven deterrents for their specific operational needs. This research would benefit managerial learnings of how anti-counterfeiting is best presented as a tailored multi-pronged approach, bespoke for each brand. This research takes a primary focus into consumer perceptions of security elements and questions, what builds trust of authenticity and what causes a perception of risk and scepticism?

The role of Design is questioned as ...

- (1) ...a form of security, and/or
- (2) ...the governor of security technologies, making or breaking their success?

This research proposes a shift in thinking from rapid release high tech applications to consider the problem from a wholistic strategic approach. Transforming design professionals, currently the creators and managers of product and packaging at all levels, to become specialised guardians and informants on how to protect IP and integrate technologies and design strategies effective for individual business cases. Designers who intimately understand the individual needs and risks of each SME business are primed already for upskilling in anti-counterfeiting measures. Those who are the best placed to compete on packaging architecture and integration of deterrent agents. This calls for a shift in design education.

2.4 Summary and Implications

2.4.1 Key Theories Summarised

A significant body of research relates to fraud; the actors, their intentions and drivers as well as specific analyses dedicated to the impact of the fraud crime. Definitions are given in the foundational fraud triangle (Cressey, 1953) and its expansions to accommodate the varied contexts fraudsters operate with the necessary enabling capabilities (Wolfe and Hermanson, 2004). The theoretical framework presented by Dorminey et al. (2012) presents the probability vector between the perpetrator and crime in which two responses of deterrence and detection are positioned on either side of The Act. An adaption is made to reveal responses to consumer trust impact (Figure 50). Successful deterrence, consumer trust is maintained. Success in detection, the crime act has occurred, exposing consumers to risk and trust is damaged. A focus shift from proactive deterrent strategies in contrast to reactive tactics reliance is needed (Spink et al., 2012).

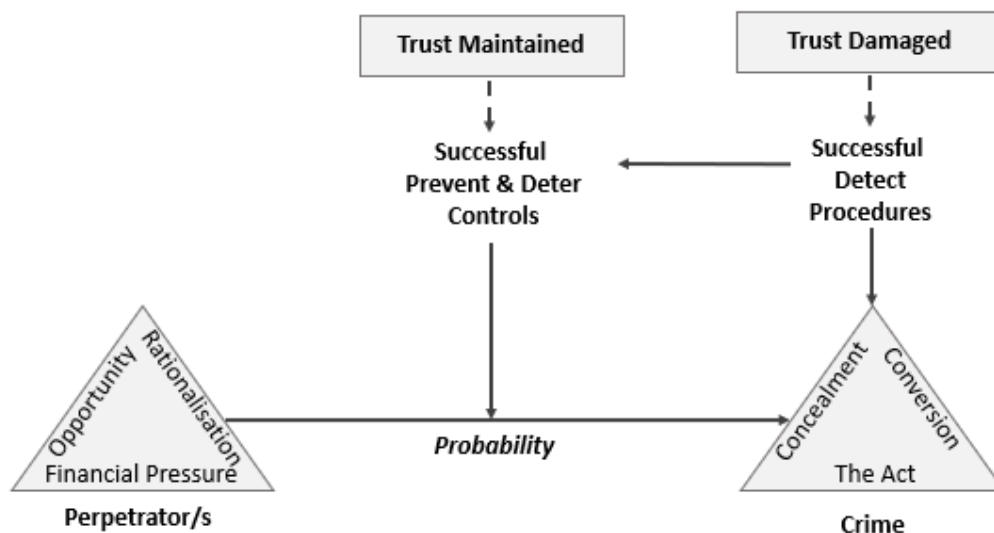


Figure 50. The Anti-Fraud Professionals Response adapted to show Trust Impact (Francis, 2019b) adapted from (Dorminey et al., 2012).

Consumer Exposure Impact

Drawing on the Social Cognitive Theory and Risk Society Theory, if the crime act occurs, consumers are exposed. Food Fraud 'exposure' can be direct or indirect. People are

impacted by direct experiences and indirect events. “Human beings are able to symbolically perceive events conveyed in messages, construct possible solutions, and evaluate the anticipated outcomes” (Bandura, 2008). Perceptions have behavioural ‘impact’ and “the impact degree is resulted from an unfortunate event (e.g. an accident, a discovery of pollution, sabotage, product tampering, or counterfeiting)” (Slovic, 2000). Exposure impacts perceived risk. The hindsight phenomenon states that if one is alerted to a certain events occurrence, then our feeling increases that its reoccurrence is unavoidable (Fischhoff, 2003).

Perceived Risk Impacts Searching

Global societies transitioning from a society based on communal and manageable systems to a rapid digital world of unregulated online trade are framed as a risk society (Beck, 1992), where heightened and variable risks are causing e-trust to be harder earned. Consumers, deemed as ‘exposed’ to counterfeiting, have heightened perceived risk and therefore, scrutinize gathered information. “Consumer search in a counterfeit culture is more complex than in societies where most of the brands are authentic” (Gentry et al., 2006). Another compounding issue is that the act of online navigation has been shown to negatively impact a user’s original information searching intentions compared to offline searching due to distractions and complicated networks (Francis, 2006, Francis, 2004). Not only does a consumer need to forage through marketing advertisements and multiple competitor offerings calling to reorient the user to their products or services, now counterfeiters are adding a new challenge for consumers to exploit shrewdness. Therefore, it is imperative that consumer’s searching motivations are nurtured and attentions uninterrupted to maintain the focused goal for a consumer to distinguish authenticity from fake. Use of cross-linked information that feeds transparent levels of information is necessary in distilling trustfulness, however, consideration must be made for the looming fraudsters who also seek to benefit from information reveals. Gentry et al. (2006) and colleges go on to state that one major contributor to trust formation is recognition through “familiarity cues”. Emerging SME’s are unfamiliar and begin with ‘No Trust’ and therefore, familiarity must be borrowed to overcome perceived risk.

Competing for Initial Trust

Initial Trust (McKnight et al., 2002) is the commencement of trust when the trustee has no knowledge or recognition of the trustor. Fung and Lee (1999) using McKnight and

colleague's foundational concept of Initial Trust, structured a framework on its establishment and development cycle Figure 51 which is adapted to show the context of counterfeiting and the need for SMEs to compete with fraudsters for consumers Initial Trust.

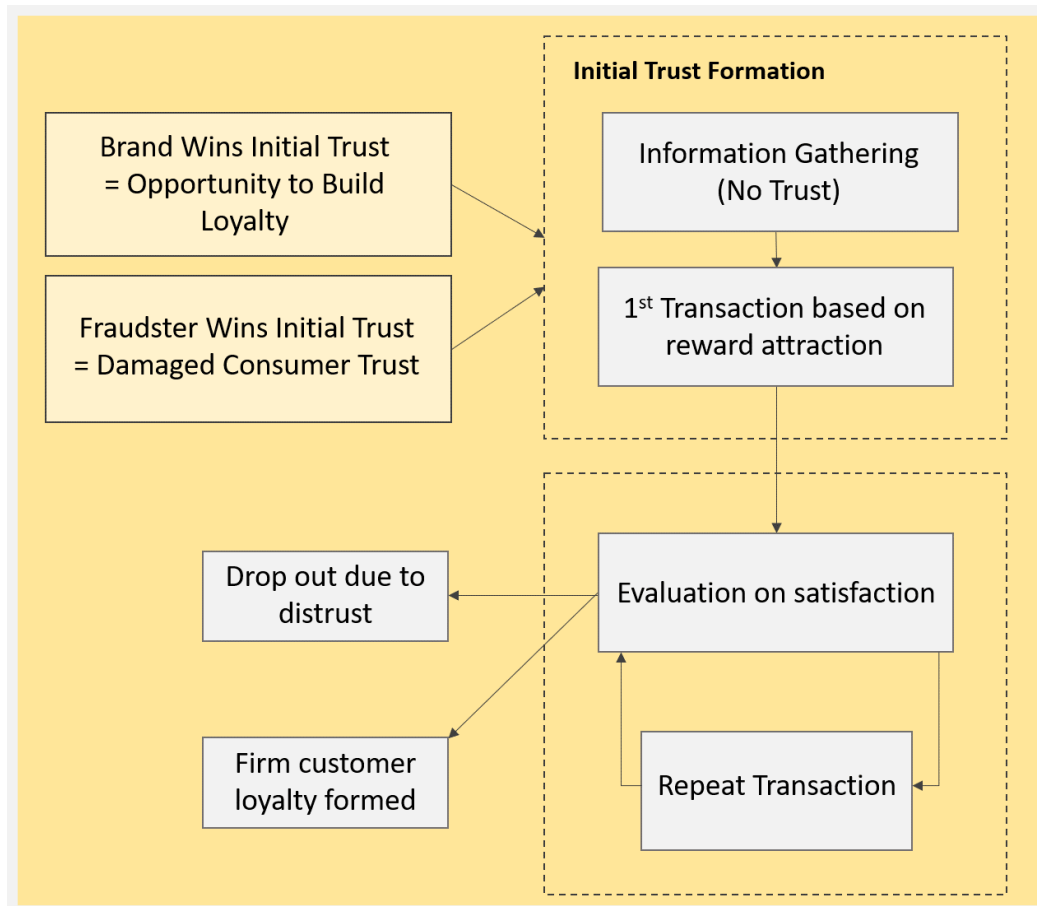


Figure 51. Francis (2019b) adapted Trust Development Cycle framework (Fung and Lee, 1999) depicting Brands competing with Fraudsters on Initial Trust.

In this model, brands have a responsibility to provide satisfactory Information and Attractive Rewards that outweigh potential perceived risk. The research has established that SMEs are uncertain on methods to measure brand protection activities on value and their effectiveness with consumers (Kennedy, 2016). Thus, further research is called for to assess consumers acceptance and perceived effectiveness of brand protection applications to report validation measures to managers on the value returned on investments.

Trust Influencers of Security

Influencers of trust taken from literature and the banknote case study have been summarised into five areas of influence (Section 2.3.7) which are to be tested in the research studies: (1) Design, (2) Fit, (3) Links, (4) Resistance, and (5) Premium.

2.4.2 Identified Knowledge Gaps

The review has exposed numerous gaps in the literature throughout the three areas of investigation; counterfeit fraud studies, consumer trust investigations and anti-counterfeiting technological reviews and strategies. From these areas, five areas have been identified for further study:

- (1) Consumers perceptions of anti-counterfeiting and influencers
- (2) Engaging design professionals to research and develop design-driven deterrents based on counterfeiting capabilities
- (3) Influences on building trust through Design-Transfer of missing elements such as familiarity
- (4) Comparative risk society studies surveying expectations on security for food packaging
- (5) Alternative models accommodating SME stakeholder unique business problems and needs incorporating education, anti-counterfeiting options and a co-creation strategy for tailored strategies.

These five areas of research are discussed further below.

Whilst literature has reviewed consumers perceptions and buying intentions on counterfeit goods from a non-deceptive context, there is a knowledge gap in the area of consumer's appraisals of anti-counterfeiting technologies and strategies and whether design can influence this trust. SMEs, with limited resources for high-tech investments, are seeking alternatives to brand protection and therefore, research assessing design-driven deterrents is necessary to reveal their value to brands and consumers alike. Research is needed for comparing security technologies based on consumer trust of effectiveness and status of value in the context of food packaging.

Food Fraud is still a young discipline and the anti-counterfeiting industry is embracing a high-tech approach. However, counterfeiters are ever-evolving and therefore, experts in design and methods of reproduction need to be engaged for consultation and guidance in establishing alternatives to short-lived technological releases. Investigational research

employing design professionals to further define counterfeiter capabilities and respond by developing design-driven deterrents for SME resource options is required. Platforms that can educate and empower brands to build their own tailored responses is recommended. Research that offers deeper insights into the validity of design-driven deterrents and their effectiveness is called for.

Another research gap is the investigation into building trust through design-transfer. Trust perceptions as previously identified are strengthened through familiarity. Brand recognition is key to communicating the quality and value of a product. Emerging SMEs with little to no familiarity, have to build familiarity whilst competing with copy-cat fraudsters for consumers Initial Trust. Therefore, research is needed to determine whether familiarity can be transferred from existing products that are socially recognised and trusted on their security attributes. Borrowed familiarity could empower emerging SMEs with little to no brand recognition. The concept uses 'familiarity security cues' from a recognisable security product (e.g. banknotes) to be transferred across to unfamiliar products (e.g. food packaging), to assess if this positively impacts on trust.

Cross-cultural comparison studies are lacking in the observations between a high-risk society and a low risk society and their expectations of security trust elements. Societies such as China with a high rate of counterfeiting seizures is believed to impact on consumers perceived risk and thus their expectations on security elements are comparably different to lesser exposed countries such as Australia.

Finally, it has been established that SMEs and their specific needs to brand protection are lacking insights. Although, industry relies on recruiting service providers to promote their anti-counterfeiting portfolios to businesses, this model does not accommodate SMEs limited resources and avoids addressing their unique problems and needs. Research aimed at co-creating new models that engage SME stakeholders to assess anti-counterfeiting options against their business strategies is called for.

2.4.3 Research Hypothesis and Questions

From the research gaps, a primary hypothesis is developed to guide the research studies planned for action. The concepts identified in the literature review for developing the Primary Hypothesis (A) include the terms: Food Fraud, risk exposed consumers, forensic information gathering behaviours, reward, trust of security elements, Initial Trust, product authenticity, fraudsters and deterrence. The objective of each study is to address the respective research questions and Secondary Hypotheses (B) constructed to investigate overall, the primary hypothesis. Therefore, the study research questions, primary and secondary hypotheses are as defined:

Primary Hypothesis (A)

If Food Fraud exposed consumers, relying on ‘forensic’ ‘information gathering behaviours’, are ‘rewarded’ with ‘trusted security elements’, then Initial Trust of product authenticity can be established, and ‘fraudsters’ deterred.

Secondary Questions and Hypotheses (B)

Study 1 – Qualitative Consumer Appraisals – Pilot Study

Study 1 Research Question:

Does design impact consumer’s acceptance and perceived value of anti-counterfeiting securities applied to food packaging?

Study 1 Hypothesis (B1)

If security elements are design-driven, then consumers will positively accept them as trustworthy and valuable compared to non-design-driven elements.

Study 2 – Qualitative Industry Appraisals – Anti-Counterfeiting Workshop

Study 2 Research Question:

Would an anti-counterfeiting workshop, facilitating multiple stakeholders through co-creative strategies that use design-driven deterrents and anti-counterfeiting technologies, positively impact on exporting SME decision making and planning?

Study 2 Hypothesis (B2):

The anti-counterfeiting workshop model will positively impact on the exporting SME business' decision making and prompt a plan of action.

Study 3 – Quantitative Consumer Survey – Security Expectations

Study 3 Research Question:

Do cultures of varying 'trust propensities' comparatively expect different levels of 'security' to trust unbranded products authenticity across 'food categories', 'packaging formats', 'demographic profiles' and product 'status levels'?

Study 3 Hypothesis (B3):

If cultures are exposed to risk, then their expectations of security, information and design will be greater than cultures with little risk.

2.4.4 Theoretical Framework

The Theoretical Framework (Figure 52) visualises the Primary Hypothesis. Identified literature terms (Section 3.1.3) are founded on theories (Section 3.1.1).

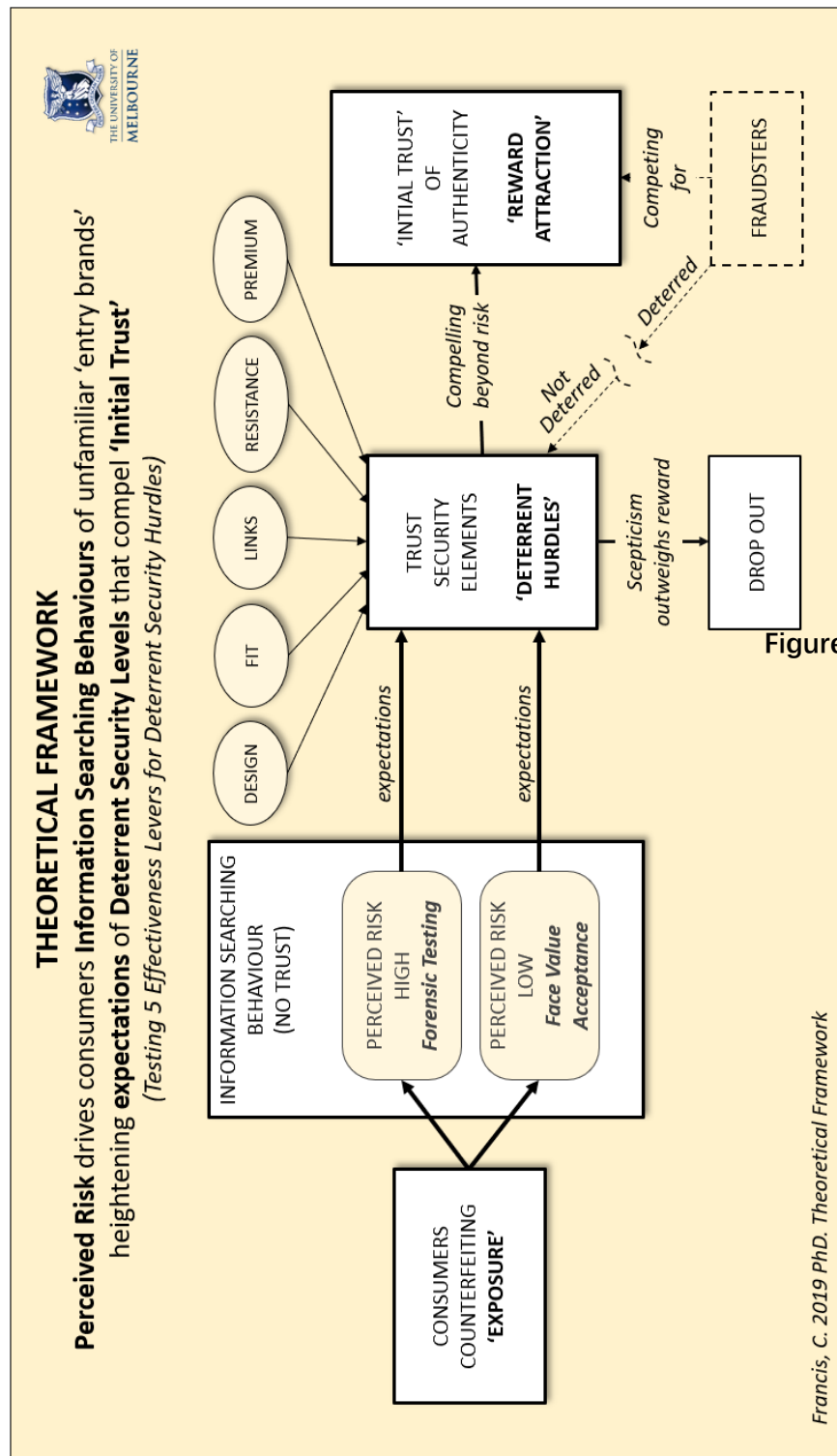


Figure 52. Theoretical Framework.

The counterfeiting risk exposure of consumers is believed to influence their information searching behaviours when presented with a new brand or product which has little to no familiarity resulting in no trust. Thus, consumers expectations of security information and presentation is assumed to increase to a forensic testing state. To overcome perceived risk, five control variables have been identified in literature that theorised the influence on trust. These consist of Design, Fit, Links, Resistance and Premium value. If these aspects are completed with satisfactory sophistication, then consumers are hypothesised to respond positively to a new product or brand. This, therefore, confirms authenticity and the SME brand, competing with counterfeiters, wins Initial Trust through perceived reward attraction. If the reward attraction of presented information and promised benefits does not meet consumers expectations, then the brand or product will be considered dubious and consumers will drop out of the trust cycle damaged consumer trust and according to literature, WoM will further damage indirect customers.

Chapter 3:

Research Design

The purpose of this chapter is to outline the planned research design and methods adopted to achieve the aims and objectives stated in Chapter 1, Section 1.3 to address the three research questions as highlighted below. These research questions correspond to the three research studies respectively that are individually outlined in this section.

Question 1: *Does design impact consumer's acceptance and perceived value of anti-counterfeiting securities applied to food packaging?*

Question 2: *Would an anti-counterfeiting workshop, facilitating multiple stakeholders through co-creative strategies that use design-driven deterrents and anti-counterfeiting technologies, positively impact on exporting SME decision making and planning?*

Question 3: *Do cultures of varying trust propensities comparatively expect different levels of security to trust unbranded products authenticity across food categories, packaging formats, demographics profiles and product status levels?*

Chapter 3 is outlined as follows: Section 3.1 presents the methodologies used in the three studies of enquiry based on established literature research and theories, the stages of implementation, and the overall research design; Section 3.2 defines the participants details; Section 3.3 details all instruments used and their justification; Section 3.4 presents the procedures and timelines of each study; Section 3.5 discusses how the data was analysed; finally, Section 3.6 outlines the attention to ethics considering research problems and limitations.

3.1 Methodology and Research Design

3.1.1 Methodology

The methodology chosen for the research study is a Mixed Methods approach that employs two major stages defined by qualitative and quantitative methodologies. The first stage included two qualitative sub-studies that informed the second stage that incorporates a quantitative online survey design. In line with the Mixed Methods approach, complimentary methodologies and confirming research designs are used to address the research questions.

Section 3.1.1. outlines the methodology framework of the two Stages and their respective studies. It presents methodologies on Mixed Methods (applied to all studies), Participatory Action Research (PAR) (study 1 and 2), Co-Creation Continuum (study 1 and 2), Design Thinking Model (study 2), Problem-Oriented Case Study Method (study 2), and Online Survey Design for Quantitative Comparative Statistical Analysis (study 3).

Stage 1 - Qualitative Insights Investigation

Stage 1 researched security trust perceptions and addressed question 1 (consumers) and question 2 (SME stakeholders) using the *Participatory Action Research (PAR)* method which is detailed below. The two sub-studies of stage 1 consisted of (a) *a Pilot Study* and (b) *a Workshop Case Study*. The Pilot Study objectively reviewed consumers perceptions of anti-counterfeiting technologies varied by design. The Case Study tested the newly developed Anti-Counterfeiting Workshop with an industry partner using the Design Thinking model and the Co-Creation approach.

Stage 2 - Quantitative Conjoint Analysis

Stage 2 examined both question 3 and question 4 using a cross-cultural comparison Online Survey. The justification of selecting this type of research method was to ensure a true population cross-section was sampled from the various districts throughout China

and Australia beyond the major cities and into regional settings. National-wide representation could be only achieved through an online survey capturing normally distributed demographic profiles for statistical analyses. Thus, the insights from Section 1 informed the research design of Section 2 which compared consumers from the two cultures investigating both question 3 (security expectations across food categories) and question 4 (security products trust transfer).

Thus, complimentary mixed-methodologies were supported to address the three levels of enquiry. The following methods are detailed: (1) Mixed Methods, (2) Participatory Action Research (PAR), (3) Co-Creation Continuum, (4) Design Thinking Model, and (5) Comparative Statistical Analysis.

Mixed Methods (All three studies)

Mixed methods, also known as Multimethodology or multimethod research, includes the combination of methods for data collection and research. The term ‘multimethodology’ was first introduced by Brewer and Hunter (1980) but is now well established in many disciplines which make use of the cross-examination and deeper understandings that are obtained through overlaying qualitative and quantitative approaches. While this research will focus on the equal status of both strategies, the qualitative studies were conducted first to guide and inform the quantitative studies.

The Mixed Methods approach used a triangulation assessment (Figure 53), considering consumer and business insights at qualitative and quantitative levels. This enabled a cross-sectional view of the insights and additional validation of findings.

Three studies are presented over two stages:

Stage 1 Qualitative (PAR)	Study 1	Qualitative Multivariate Analysis
	Study 2	Industry Workshop Case Study
Stage 2 Quantitative (2 Population Comparison)	Study 3	Online Cross-Cultural Survey

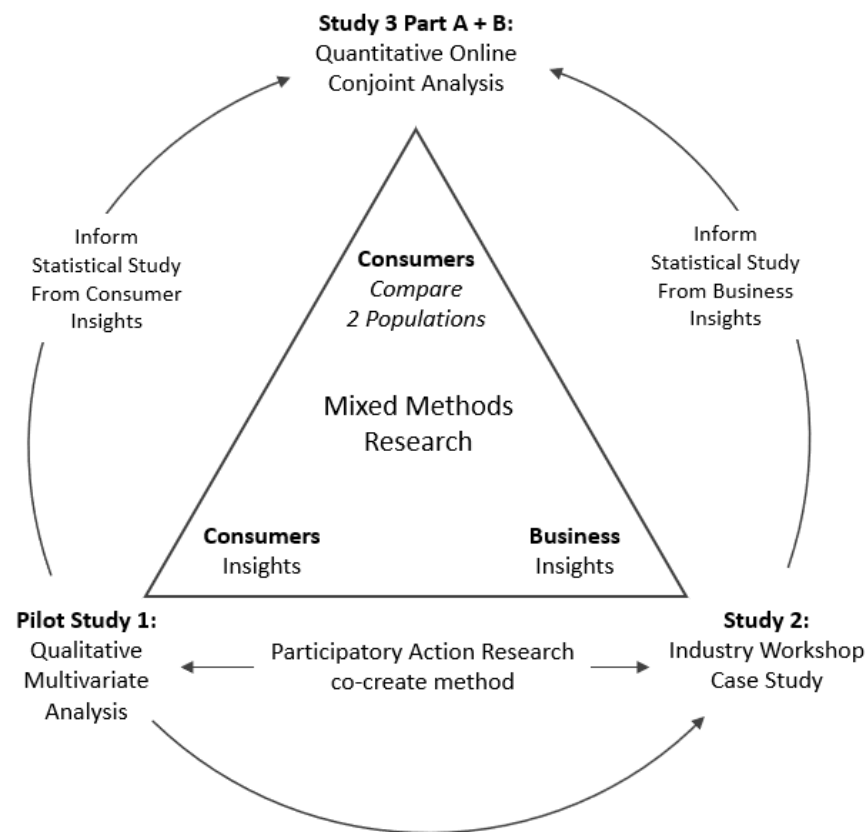


Figure 53. The Mixed Methods Research Conceptual Model using Triangulation

Participatory Action Research (PAR) (Studies 1 and 2)

As referred to the Research Conceptual Model (Figure 53), Qualitative Studies 1 and 2 utilise the methodology of Participatory Action Research (PAR). PAR instigates the researcher beyond facilitation and enables participation within the studies to evolve questions and contribute to the decision making through the co-creation processes (Reason and Bradbury, 2001). PAR researchers ensure study designs integrate the three key focus points: (1) Participation: Life in Society and Public Relations, (2) Action: Interactions with experience and past learnings, (3) Research: Replication of study, levelled thought and expansion of knowledge (Figure 54). The purpose of the qualitative-orientated PAR Studies 1 and 2 was to investigate consumer and business perceptions when considering their unique needs, expectations and perceived risks of food packaging security. The insights were obtained through a co-Creation process to later guide the Design of Experiment (DOM) for Study 3.

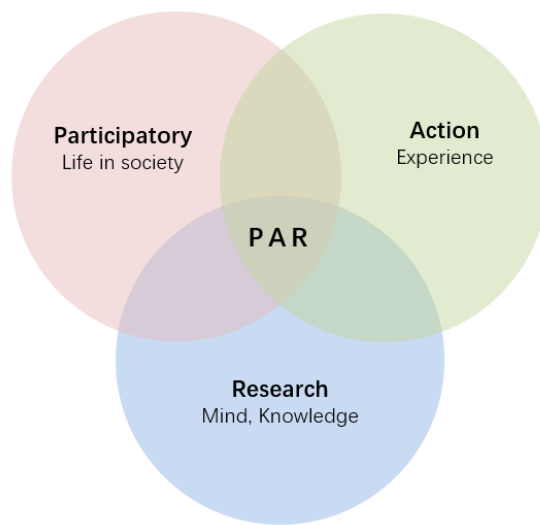


Figure 54. Participatory Action Research Model (Reason and Bradbury, 2001, Francis, 2019b)

Co-Creation Continuum (Studies 1 and 2)

Co-Creation is the method that enables a collaborative approach to innovation by gathering insights and solutions from multiple stakeholders. The co-creation continuum as depicted in Figure 55, theorises that the extremes of underutilising co-creation compared to the adoption of co-creation methodology is comparatively opposing. It is viewed that co-creation exposes new competitive insights unforeseen by tactical market research tools and revealed by adopting a strategic collaborative innovation method (Ind et al., 2017).

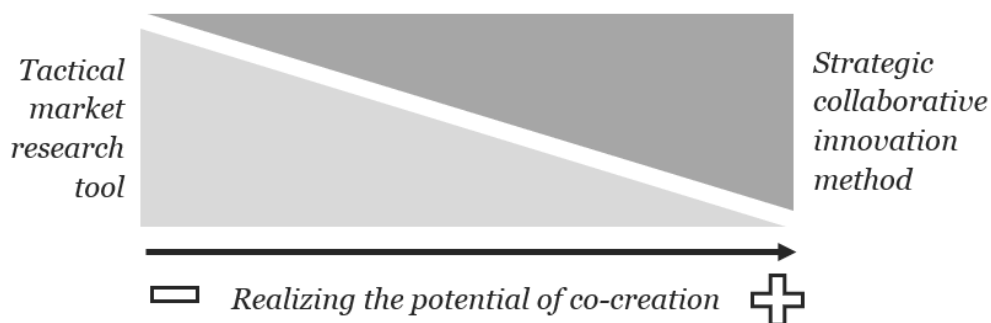


Figure 55. The Co-Creation Continuum (Ind et al., 2017)

Stakeholders are becoming more willing to collaborate on sharing information and ideas in pursuit of empowerment over problems and innovation leaps (Kazadi et al., 2016). In

the context of counterfeiting, SME stakeholders are seeking more information to validate best value and effectiveness when considering investments into anti-counterfeiting. Thus, co-creation methods engaging both multiple SME stakeholders and the employment of anti-counterfeiting experts, was explored in this research.

Design Thinking Model (Study 2)

Design Thinking was utilised to drive the solution-orientated research and the development of the workshop model. The 5 stages of Design Thinking methodology comprises of *Empathy*, *Define*, *Ideate*, *Prototype* and *Test* as defined by the Stanford d.school (2016) are the key steps to shaping an ‘ill-defined problem’ in which a user standpoint will drive the design research process. This 5-stage process is represented in Figure 56 where each stage is detailed. Design thinking is cyclic and iterative, encouraging quick progression through the 5 stages to initiate ideas and rapidly prototype co-created concepts only to revisit the early stages again for confirmation and adjustment.

Definitions of the 5-Stages are summarised in Figure 56 and outlined below:

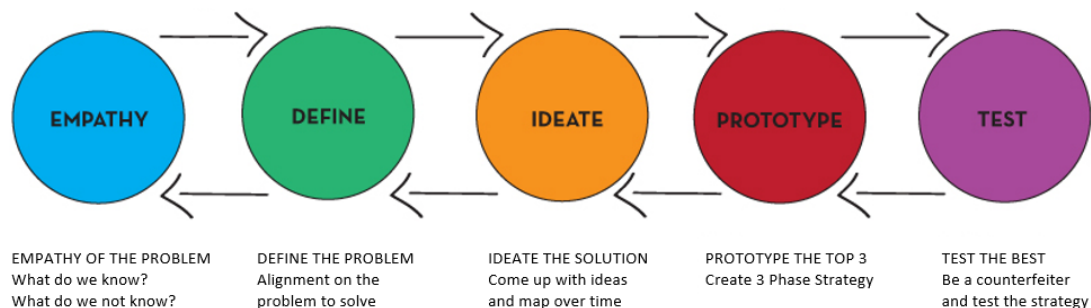


Figure 56. Design Thinking Stages adopted for the Anti-Counterfeiting Workshop.

The Empathy Stage is to gather all available information on the user’s/stakeholder’s needs and overall problem by identifying: consumer/market trends, unmet needs or problems; current and future limitations and criteria; stakeholder expectations and overall ideal outcomes/successes. Overall, two key questions posed at this stage are:

- (1) *What do we know?*
- (2) *What do we not know?*

The Define Stage is to clearly *specify* the identified problem statement. Clarification must be made on all definitions and terms to ensure all stakeholders are *aligned*. Definitions are made at this point on what is in the realm of control and what is outside, the uncontrollable factors. Only the controllable variables can be manipulated, and the uncontrollable variables observed.

The Ideate Stage is the creative episode where constructive and unlimited problem solving occurs. The generation of new ideas, innovations and conceptual visualisations should not be hindered by the 'how-to' but focused on the 'what-if'. These can take the form of rough hand sketched concepts, brainstormed maps, rapid craft constructions or even acted out scenarios. In the context of the anti-counterfeiting workshop, security elements in the form of printed out cards representing options of design-deterrents and anti-counterfeiting technologies were offered as a resource to ideate with. The purpose is to build multiple concepts for later refinement or comparisons.

The Prototype Stage is the process of selecting a concept from the ideate stage to 'mock-up' as a rough prototype to aid in communication to the other stakeholders. The purpose of a prototype is to capture an idea in a physical form or sketch to then test against a defined set of success criteria. The success criteria were previously defined as counterfeiter's capabilities taken from the literature review findings further described in Section 3.1.2. Study 2 Workshop Research Design.

The Test Stage is the final stage of the Design Thinking process yet, is often revisited through the iterative nature of refinement. This stage takes the prototype/s to test against the success criteria to prove if the concept/s have validity. If the prototype/s fail to meet all the requirements, the 5 stages will be reiterated quickly to build on the learnings of the first round, to achieve a refined solution. Testing should consider the problem actors for example, thinking like a counterfeiter.

Problem-Oriented Case Study (Study 2)

The case study methodology researches a bounded system, defined by the researcher, in intimate detail over time (Range, 2018). In addition, the Problem-Oriented Case Study (POCS) methodology, approaches the case with a problem in mind to seek solutions and offer recommendations (Irweb, 2019). In the context of Study 2, the bounded system is the detailed investigation of an exporting Australian SME business with a pre-defined

problem of counterfeiting threats. Irweb (2019) defines the stages of a POCS study (Figure 57). The POCS method closely aligns to the Design Thinking method, therefore, the two qualitative experimental approaches are utilised for guiding the design and analysis of Study 2 found in this Chapter 3.

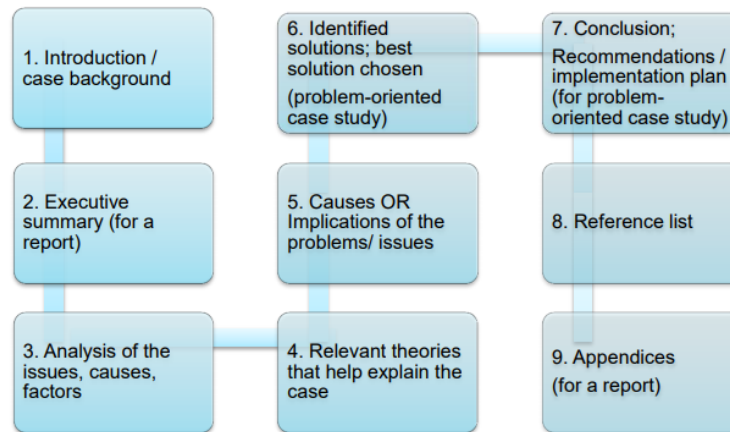


Figure 57. Problem-Oriented Case Study Stages (Irweb, 2019).

Statistical Analysis (Study 3)

Study 3 is a quantitative, Check-All-That-Apply (CATA) online survey, designed to test the defined *hypotheses* (see Section 2.4.3 and Section 3.1.2) for statistical analyses. The Comparison of Two-Populations methodology used random, independent samples taken from multivariate responses considering the *Different Worlds Theory* (see Chapter 2, Section 2.2.5.). Gathered online survey data from online participants is an appropriate research method when the study assesses multi-variables across more than one population (Churchill and Iacobucci, 2005).

The CATA method, developed for rapid multivariate statistical analyses and to reduce the response burden of participants (Rasinski et al., 1994), was applied to enable multi-responses; capturing detailed participant perceptions on product and security attributes. Quality expectations were met with the University of Melbourne’s outsourced research service provider ResearchNow (currently renamed Dynata), being an adequate supplier of quantitative online survey data that followed the outlined policies provided to them for scholarly outputs. More detail is outlined on the raw data files provided and their handling under Section 3.1.2 Research Design.

3.1.2 Research Design

The Research Design is staged in two parts combining 2 Qualitative studies followed by a detailed Quantitative study (Figure 58). Section 3.1.2. addresses in detail the three study designs: Study 1 - Qualitative Multivariate Analysis; Study 2 - Workshop Case Study; and Study 3 - Online Cross-Cultural Survey which are detailed in the following sub-sections.

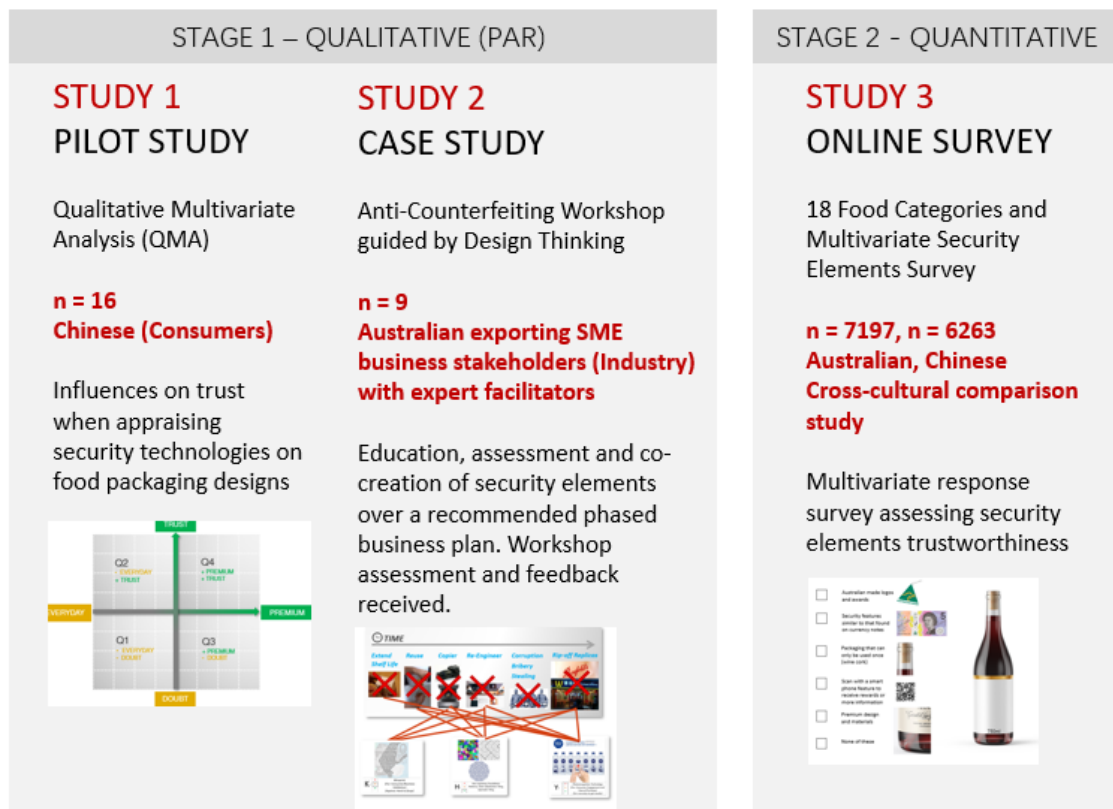


Figure 58. Research Design using Mixed Methods over 3 Studies.

Study 1 - Qualitative Multivariate Analysis (QMA) Design

Study 1 was designed to test influencers on consumers' perspectives based on their perceived trust and value of anti-counterfeiting technologies and food packaging designs. The guiding research question revisited was: *Does design impact consumer's acceptance and perceived value of anti-counterfeiting securities applied to food packaging?*

To measure consumers' value of a product's perceived benefits (rewards) or risks, one must identify benefits to compare and therefore, scale their importance from one another (Lopetcharat, 2012). Therefore, a Qualitative Multivariate Analysis (QMA) (Beckley et al., 2012), developed for rapid consumer research trials to test triggers and barriers towards product features, was selected to capture appraisal insights from grouped participants.

QMA Session Design

Two sessions were conducted of eight participants per session as outlined in the methodology of the QMA, a total of sixteen participants were randomly recruited enabling a cross-comparison of the two groups. Participants were asked to attend a conference style room and to stand around the table which presented a *Preference Matrix* masked onto the table top. *Descriptor Anchors* were labelled from Trust to Doubt and Everyday to Premium on opposing ends of the axes. Consumers (participants) were asked to appraise the images referred here, in this report as *Visual Stimulus* variants (example provided in Section 3.3) and plot each visual on the 2-dimensional preference matrix (Figure 59) in response to the research question:

"You are in China and want to buy some Australian red-meat sold either online or in-store. You start to look for a product that appears 'high quality' and 'trustworthy'. You find a product with this [image] of a....scene/logo/packaging/technology..... on the packaging. Would you think that:

- (1) the product is more premium or more everyday, and*
- (2) I can trust that it is from Australia?"*

The value scale was pointed out to the group ranging from Everyday to Premium and the trusting from Australia scale indicated by Doubt to Trust. Each visual was presented to the group consecutively for appraisal and plotting. Consumers were not asked to taste

or sample any stimulus. Each product and/or technology was assessed on visual judgement only and thus the study was considered low risk.



Figure 59. Qualitative Multivariate Analysis, Preference Matrix with Participants.

Preference Matrix Design

The four quadrants of the Preference Matrix were identified as (Q1) Everyday – Doubt, (Q2) Everyday – Trust, (Q3) Premium – Doubt, (Q4) Premium – Trust (Figure 60). The visuals represented two categories for assessment: (1) anti-counterfeiting applications and (2) meat product packaging designs.

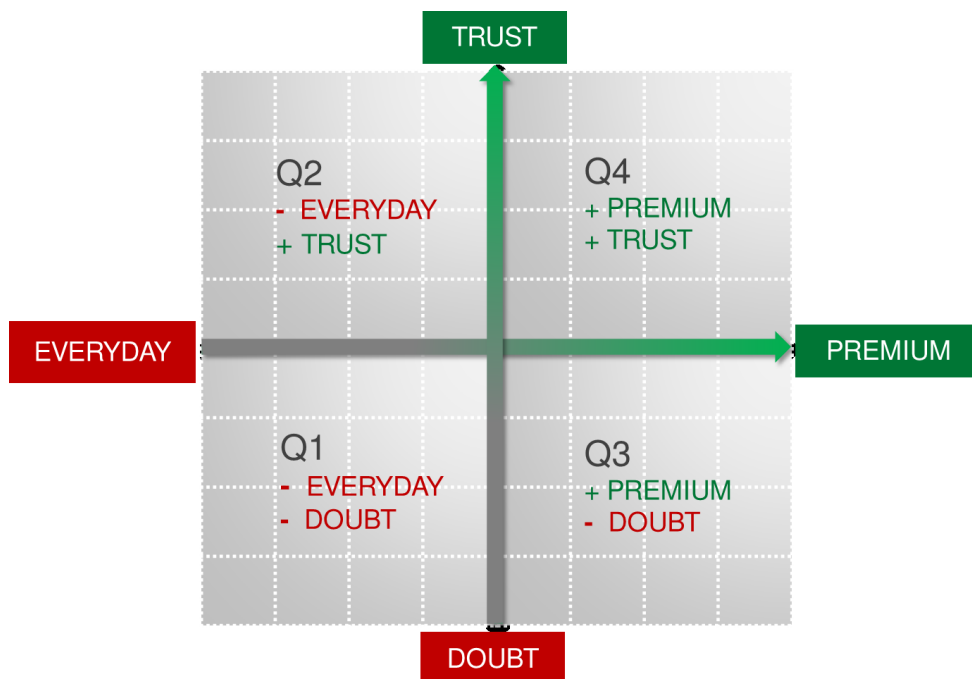


Figure 60. Preference Matrix and the Four Quadrants Identified.

Visual Plotting and Data Capture Design

Each participant had a chance to hold and consider the various visuals successively and communicate any thoughts or concerns they may have had with the stimulus's characteristics. All responses were captured through notetaking. Any questions or confusion of the stimulus were directed to the research facilitator who would explain as briefly as possible the context of the visual using the Participatory Action Research guidelines of engagement. Moreover, participants were asked to plot the visuals based on their perceived trust and acceptance of both product design and technology. Once the group had examined the complete stimulus set for each category (e.g. Anti-counterfeiting technology) a digital photograph was taken for analysis purposes (Figure 61).



Figure 61. QMA Post-Session Plot Record.

Study 2 –Workshop Case Study Design

As exporting businesses face new unknown risks with counterfeiting and are presented with a vast array of anti-counterfeiting options, SME businesses are unclear which attributes meet their specific needs and are effective against counterfeiters.

The research design of Study 2 was to test the developed anti-counterfeiting workshop model with an industry partner exporting to China through a qualitative pilot case study using the Participatory Action Research (PAR) methodology. This was to evaluate whether the new model, founded on the Design Thinking process, successfully educated and equipped multiple stakeholders in aligning on, and progressing with, the co-created anti-counterfeiting strategies developed for their unique SME business needs. Thus, the research question for this case study was:

Question 2: *Would an anti-counterfeiting workshop, facilitating multiple stakeholders through co-creative strategies that use design-driven deterrents and anti-counterfeiting technologies, positively impact on exporting SME decision making and planning?*

The framework of the workshop was structured in four parts which are summarised below:

1. Pre-session Work Design
2. Workshop Session
3. Post-session Work Report
4. Workshop Evaluation Feedback

Pre-Session Work Case Study Design

The purpose of the pre-session work was to prepare the Industry stakeholders (participants) on questions to be anticipated and evaluations of their business structure and operations. Priming stakeholders to pre-establish a position of empathy for the counterfeiting problem is necessary to achieve a view of their perceived current risk position based on thoughtful considerations.

Pre-session work required stakeholders to pre-consider certain questions, bring select items and invite key stakeholders for input into the Workshop session. These included:

- A. Bring authentic product samples
- B. Bring discovered counterfeited samples
- C. Bring a list of Online Channels they currently engage
- D. Bring any pending design patents, registrations or trademarks specific for China
- E. A stakeholder who has knowledge in the packaging operations
- F. A stakeholder who has knowledge in online sales (e.g. Marketing Manager)
- G. A stakeholder who has knowledge of their supply chain (e.g. Supply Chain Manager)
- H. A stakeholder who manages the overall decision making and budget allocation (e.g. CEO)
- I. Questions to consider prior to the workshop – current control and future changes
 - a. Early Product Phase – product/packaging
 - b. Supply Channel – supply chain
 - c. Tracking – monitoring or release
 - d. Channel – marketing and sales
 - e. Awareness – counterfeit risk level

Workshop Session Design

The workshop design was modelled using the 5-stages defined by the Design Thinking approach as defined in this Chapter 3, Section 3.1.1 Methodology. The PAR methodology was used to facilitate a pre-designed program over a 1-day session using an Industry Partner who was actively combating counterfeiting issues on real products in the China market. The study's research questions evolved as an informal conversation with the SME stakeholders as they revealed unique and unexpected business needs.

The co-creation process was selected for use within the study to facilitate multiple stakeholders in the collaboratively process of generating concepts together suitable for their unique needs. Stakeholder education on the provided resources, that summarised key design-driven deterrents and anti-counterfeiting technologies, was conducted. The stakeholders were then asked to combine these resources to create bundled solutions that successfully disabled counterfeiters capabilities. These co-created bundles were then discussed and justified by the stakeholders to the entire group to evaluate their overall group rating. The workshop session was summarised and next steps of a Work Report submission was discussed and feedback request scheduled.

Post-Session Work Report Design

The research facilitators collated the outputs from the Anti-Counterfeiting Workshop session and reported on the overall findings in a post-session summary work report. This detailed the Workshop and the stages outputs, the co-created bundles ranked and finally recommendations for business next steps. This was submitted to the Industry Partner within 2 weeks of the workshop.

Workshop Evaluation Feedback

The Industry Partner was requested to provide feedback using an email survey rating the Workshop's overall effectiveness measured on a 7-point Likert scale. The 7-points were rated as follows:

- 1 – it was a waste of our time, we would not recommend it to other businesses,
- 2 – not as good as expected, it could have been much better,
- 3 – not too bad, a bit confusing,
- 4 = neutral,
- 5 = good, we learnt a few things and it was helpful,
- 6 = great, we learnt a lot of things and got much out of it that we can apply into the future,
- 7 = excellent, we learnt a lot of valuable things and are implementing the learnings, I would recommend it to other businesses.

The workshop feedback used a six-question survey, asking:

- (1) Did the Workshop help you in learning about Counterfeiting Capabilities?
- (2) Did the Workshop help you in learning about Anti-Counterfeiting Options?
- (3) Did the Workshop help you in learning how to think differently about bundling securities to disarm counterfeiters?
- (4) Was the Workshop Security Cards helpful?
- (5) Has your business acted on any of the discovered security options?
- (6) Overall, was the Workshop and Report valuable to your business?

In addition, a short comment was requested, welcoming both positive and/or negative feedback. The feedback was then used to assess the effectiveness of the workshop as rated by the Industry Partner.

Study 3 – Online Cross-Cultural Survey Design

Comparative studies often employ a cross-cultural framework as it reveals “differences among systems taken into account as they are encountered in the process of explaining social phenomena observed within these systems” (Przeworski and Teune, 1970). The quantitative online survey was designed to compare two populations with varied trust propensities against their expectations of security. This was to identify if significant differences were evident in expectations when considering trust of an un-branded product’s authenticity. The test accommodated a review across food categories, packaging formats and status levels. Therefore, the research question revisited to guide Study 3 was:

Question 3: *Do cultures of varying trust propensities comparatively expect different levels of security to trust an unknown products authenticity across food categories, packaging formats, demographic profiles and product status levels?*

Comparison Survey of Two Populations Design

An online quantitative, comparative survey was selected to achieve a national sample of two populations covering each countries provinces or states. Therefore, the online survey design enabled the required reach across the populations to collect data on dichotomised multivariates representing six security elements. Multi-response options were enabled to investigate consumers expectations of bundling options and overall ranked security elements compared culturally. Two packaging formats representing status of everyday and premium were also compared.

As the two countries had notable different cultures and social behaviours the research design considered methods to maximise the level of intersystemic similarities (Przeworski and Teune, 1970) rather than differences (Refer to Chapter 2, Section 2.2.5. Different Worlds Theory). As the survey was to clearly communicate across both English and Chinese contexts, one method to reduce differences in the survey was through reduced text to the minimum amount permissible without diminishing the context of the research questions. The text was also translated into Chinese and piloted with mainland Chinese for iterative corrections and overall refinement before activating the full survey test throughout Australia and China. In addition to these textual methods, visual elements were used to reinforce context meaning and further reduce misunderstandings in the survey questions. The context of food packaging and security

elements were visually presented using unbranded, realistic images with plain backgrounds to simplify options presented to participants.

Security Domains and Elements Selection

Literature reviewed on consumer trust (Section 2.2.) and anti-counterfeiting (Section 2.3.) identified five overarching fields that encompass authenticity checks for consumers defined as *Security Domains*. The five Security Domains align to the effectiveness levers defined in the theoretical framework and are termed as: (1) Identity Badges (or Links to further information), (2) Security Printing (currency securities), (3) Destructive Packaging (one use, layering or tamper evident), (4) Digital Technology (anti-counterfeiting connective applications) and (5) Design Sophistication (presentation and quality).

Security element visuals were selected to represent these five Security Domains as shown in Table 8 as (1) Australian made logo and awards, (2) Security features, (3) Packaging that can only be used once, (4) Scan with a smart phone feature, (5) Premium design and materials. Thumbnail images were provided for each and two thumbnails presented if an element changed over the Everyday or Premium contexts.

Table 11. The Five Security Domains with Representative Elements across ‘Everyday’ and ‘Premium’ Status showing Repeat or Change Alerts.

Security Domains	Elements #	Descriptions	Everyday Elements	Premium Elements	Repeats or changes for each category
Identity Badges	1	Australian made logos and awards			Repeat
Security Printing	2	Security features (e.g. similar to that found on currency banknotes)			Repeat
Destructive Packaging	3	Packaging that can only be used once (e.g. tear open spout)			Change
Digital Technology	4	Scan with a smart phone feature (e.g. to receive rewards or more information)			Repeat
Design Sophistication	5	Premium design and materials			Change

Conceptual Framework Design

The survey's Conceptual Framework (Figure 62) demonstrates the two-populations and the defined Independent, Dependent, Moderator and Control Variables. It shows the planned groupings of data for identified Statistical Tests on both Individual and Comparative assessments. The 'Comparative Populations' consisted of Australian and Chinese participants. The participants were allocated to the 18 food groups selected for testing (approximately 400 participants per food group, per country) based on their familiarity and frequency of use. The 18 food groups were later recoded into 10 higher-level food groups as identified as the 'Control Variable' in the Conceptual Framework. The 'Independent Variables' included the 5-demographic outputs consisting of: Life Stage, Gender, Living Arrangements, Income, and Place of Residence (Section 3.2. Study 3 Participants).

The 'Moderator Variable' was derived from an averaged score of participants trust rankings of food producers, suppliers and regulators and categorised as their overall Trust Propensity, which was detailed in a statistical interaction study. The 'Dependent Variables' consisted of binary responses of (selected and non-selected) to the presented 5 security elements, as well as the seventh option available classified as 'None of these'. The sixth option defined as 'Other' allowed for textual input for further clarification. The survey design allowed multi-response answers over the multivariates enabling complex statistical analyses to be made on consumer expectations for three major tests: (1) individual compared elements, (2) total probability securities and (3) hierarchical ranking between elements.

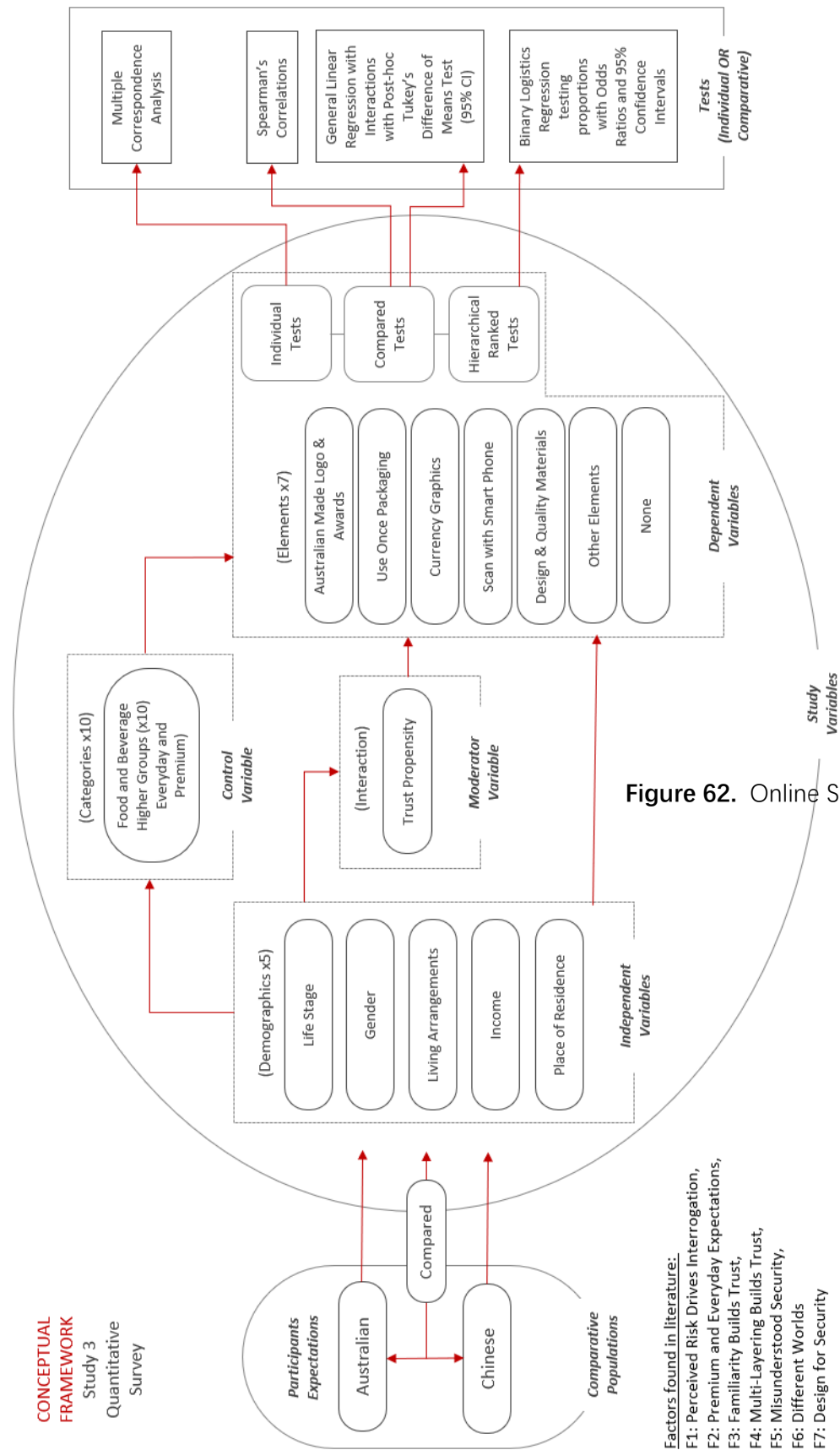


Figure 62. Online Survey Conceptual Framework

Status Comparison of ‘Everyday’ and ‘Premium’ Design

The assessment of status was assessed on two levels of ‘everyday’ and ‘premium’. Visuals representing a food category (18 categories) were presented in two versions, for example (Table 12) Coffee was shown in an everyday glass jar format compared to the premium version of a refrigerated aluminium can. Beef was presented on a white Styrofoam tray whilst the premium version was depicted on a shrink-wrapped cut on a reusable cutting board. Another example shown is the Tomato category showing cherry tomatoes in transparent structural packaging compared to a glass jar of sundried tomatoes.

Table 12. Online Survey Example of ‘Everyday’ and ‘Premium’ Comparisons.

Food Category	Everyday	Premium
Coffee	 Instant Coffee	 Barista Cold Espresso
Beef	 Loin Cut on Styrofoam Tray	 Loin Cut on VacSealed Board
Tomato	 Cherry Tomatoes in Container	 Sundried Tomatoes in Oil

Final Security Survey Design

The final design layout, as presented to the participants, demonstrates the two screens assessing the Wine category using the ‘everyday’ packaging format (Figure 63) compared to the ‘premium’ packaging version (Figure 64). The research question is posed at the top of the screen: How do you know if this product is Australian-made? What features would you expect to see on this style of packaging that builds your trust? Please select from the list below all that apply. The seven options shown were available for choice.

How do you know if this product is Australian-made? What features would you expect to see on this style of packaging that builds your trust?

Please select from the list below all that apply.

- ☐ Australian made logos and awards 
- ☐ Security features similar to that found on currency notes 
- ☐ Packaging that can only be used once (tear open spout) 
- ☐ Scan with a smart phone feature to receive rewards or more information 
- ☐ Premium design and materials 
- ☐ Other (please specify)
- ☐ None of these



Figure 63. Online Wine Survey Showing the Everyday Pack Format.

How do you know if this product is Australian-made? What features would you expect to see on this style of packaging that builds your trust?

Please select from the list below all that apply.

- ☐ Australian made logos and awards 
- ☐ Security features similar to that found on currency notes 
- ☐ Packaging that can only be used once (tear open spout) 
- ☐ Scan with a smart phone feature to receive rewards or more information 
- ☐ Premium design and materials 
- ☐ Other (please specify)
- ☐ None of these



Figure 64. Online Wine Survey Showing the Premium Pack Format.

Trust Propensity Survey Design

The Trust Propensity survey design tested consumers trust of suppliers and regulators of food products. A 7-point Likert scale was used to rate trust in response to the research question posed to participants as, “Please indicate the extent to which you agree or disagree that you trust each of the following...” with the scale of 1 being ‘strongly disagree’ to the statement and 7 being ‘strongly agree’ to the statement. The question was repeated to assess consumers trust of the Food Industry stakeholders which included:

- (a) People I buy products from,
- (b) Online retailers,
- (c) Local producers,
- (d) Foreign producers,
- (e) Officials in my country who regulate the production of goods, and
- (f) Officials in foreign countries who regulate the production of goods.

The full set of online survey questions were presented in English to the Australian participants and in simplified Mandarin to the Chinese participants.

3.2 Participants

Study 1 – QMA Participants

Participants were randomly recruited Chinese international students, aged between 20-35 years, new-to-Australia within 1 year of attending the University of Melbourne, Australia. Sixteen subjects distributed across two-cohorts with online shopping experience participated. Male (38%) and females (62%) were represented and required a basic level of spoken English for communication purposes. Table 13 summarises the participant profiles and proportions reported as of 2016. No cases were omitted. The two sessions of eight participants each assessed two sets of visuals, summarised as: (1) the Design set, and (2) the Technology set. This was to observe commonalities between group responses and distil subjective comments that were not reviewed by the larger group.

Table 13. QMA Participant Frequencies and Proportions recorded over 2016-2017.

Variables	Participants n= 16	
	<i>f</i>	%
Life Stages		
20	1	6.3
21	7	43.8
22	4	25.0
23	3	18.8
24	1	6.3
Gender		
Male	6	37.5
Female	10	62.5
Experience Online Shopping		
Yes	16	100.0
No	0	0.0
Chinese mainland resident		
Yes	16	100.0
No	0	0.0
Able to speak English		
Yes	16	100.0
No	0	0.0

Note: Participants were randomly recruited from the University of Melbourne and were from mainland China, living within Australia within less than 1 year.

Study 2 – Workshop Case Study Participants

The purpose of the research was to pilot the Anti-Counterfeiting Workshop model with an Industry Partner whose IP was threatened by counterfeiting at the time of study. An Australian exporting Small-to-Medium (SME) Industry Partner was identified and recruited for participation. The Industry Partner employed between 20-199 staff placing them as a medium sized business. At the time of study, they were exporting to multiple countries including various e-Commerce channels servicing China mainland and had discovered counterfeits of their product throughout. The participants were invited to attend the University of Melbourne, Parkville for a scheduled 1-day Workshop session from 10:00am to 3:00pm with a short working lunch.

A total of nine participants attended the Workshop with the experts considered participants under the Participatory Action Research methodology. These included, six stakeholders representing key managerial positions from the same exporting Australian SME business (Stakeholders), and three research facilitators from the University of Melbourne (Researchers).

The research proposal requested for representatives of the company's key stakeholders to be present at the workshop session. Six Stakeholders representing key positions included (1) the Director/CEO, (2) the Marketing and e-Commerce Operations manager, (3) the Packaging Technologist manager, (4) Supply Chain and Logistics manager, (5) International Relations Manager and (6) the Chinese Human-Relations coordinator.

Three Researchers were identified for participation based on their combined expert knowledge in consumer research, industry experience, counterfeiting research and anti-counterfeiting design and knowledge of technological responses. The Researchers were part of the facilitators and contributors to the workshop.

Participants were pre-asked to comment or provide evidence from their field of responsibility on details relating to counterfeiting issues and how it has impacted their team directly. The proposal also prepared them to expect the planned co-creation activity and to come willing to creatively collaborate with their team colleagues.

Study 3 – Online Survey Participants

Study 3 was a study that compared citizens perceptions represented of two populations thus, large sample sizes were required to assure normality of the data. This was achieved by using an online survey to recruit participants through the Industry Transformation Research Hub quantitative research service provider ResearchNow. Participants were taken from two distinct cultures based on the identified exposure to counterfeiting risk: (1) Australia (a low-risk culture) and (2) China (a high-risk culture). The size and breath of the study enabled the research to assess a cross section of life stages, living arrangements, demographics and economic and social standings.

Participants recruited (raw) Australia (N=7239) and China (N=7255).

Participants who preferred not to answer on specific details were considered incomplete cases and therefore were omitted from the study as shown in Table 14. The final descriptives for the final analysis were reported as:

Participants included in analysis Australia N=6263 and Chinese N=7195.

Table 14. Online Survey Recruitment and Analysis Frequencies for Australian and Chinese Participants.

Participants	Australia	China
Recruitment	7239	7255
Prefer not to answer (Income)*	969	58
Prefer not to answer (Living Arrangement)*	15	2
Prefer not to answer (Both)	8	0
Omitted (Income+LivArr-Both)	976	60
Final Analysis (Recruitment-Omitted)	6263	7195

** Studied as an individual group and then omitted from Final Analysis*

All participants stipulated their age and the discrete data was recoded into 6 life stage groups ranging from young adults to retirees. All life stage groups represented a decade, except for group 1 which defines the young adults aged 18 to 24 years. The cross-section

of participants represented a gender balance with males (Aust: 45%; China: 51%), and females (Aust: 56%; China: 49%) participating.

The descriptives of the participants demographics showing frequencies and percentages are portrayed in Table 15 defining demographics of Life Stage, Gender, Living Arrangements and Income Quintiles. The Living Arrangement segments and profiles are provided showing the criteria for inclusion into the recoded six groups in Table 16.

Table 15. Online Survey Participant Demographics showing Frequencies and Proportions compared across Countries recorded over 2017-2018.

Variables	Australia n= 6263		China n= 7197	
	<i>f</i>	%	<i>f</i>	%
Life Stages				
18-24	43	0.7	60	0.8
25-34	1151	18.4	2845	39.5
35-44	1340	21.4	2289	31.8
45-54	1555	24.8	1403	19.5
55-64	1597	25.5	548	7.6
65+	577	9.2	50	0.7
Gender				
Male	2786	44.5	3649	50.7
Female	3477	55.5	3546	49.3
Living Arrangements				
Adult no kids	3708	59.2	1522	21.1
Adult w Preteen	1302	20.8	3206	44.5
Adult w Teen	691	11.0	1353	18.8
Adult w Postteen	278	4.4	63	0.9
Adult w Parent	284	4.5	1051	14.6
Income Quintiles				
Most disadvantaged	1508	24.1	1251	17.4
Quintile 2	1471	23.5	1429	19.9
Quintile 3	1042	16.6	1872	26.0
Quintile 4	1322	21.1	1292	18.0
Most affluent	920	14.7	1351	18.8

Recoded Age into 6 groups defining Life Stages

Recoded Living Arrangements into 5 groups defining Adults living with or without children or with parents.

Recoded Income groups into Quintiles ranging from Most disadvantaged to Most affluent.

Table 16. Living Arrangements Recorded Groups and Criteria for Inclusion.

Recoded Variable	Criteria
(1) Adult no kids	Adult/s not living with child/ren (incl. single/s, friend/s, partner/s, empty nester/s and retiree/s).
(2) Adult with a Preteen*	Adult/s living with dependent/s, (0 – 13 years) (incl. grandparent/s who care for grandchild/ren part-time).
(3) Adult with a Teen*	Adult/s living with dependent/s, (between 13 – 17 years) (incl. multi-generational families and guardian/s).
(4) Adult with a Post Teen*	Adult/s living with adult child/ren, (18 years or over) (incl. independent children).
(5) Adult living with Parents	Adult participant, 18 years or over, living with parent/s or guardian/s (incl. carers of parents and all adult household).
(6) Omit (unknown status)	unknown living arrangement status.

* Families with dependent children

The Australian and Chinese participant descriptives respective of Place of Residence Regions are seperatively shown in Table 17, as they do not allow for comparison between Australian States and Chinese Wider Regions.

Table 17. Online Survey Participants Residential Region Frequencies and Proportions compared across Countries recorded over 2017-2018.

Residential Regions	Australia n= 6263		Residential Regions	China n= 7197	
	f	%		f	%
Australian Capital Territory (ACT)	117	1.9	Eastern China	2087	29.0
New South Wales (NSW)	1748	27.9	North-Eastern China	571	7.9
Northern Territory (NT)	38	0.6	Northern China	865	12.0
Queensland (QLD)	1356	21.7	South Central China	2080	28.9
South Australia (SA)	506	8.1	Western China	1592	22.1
Tasmania (TAS)	160	2.6			
Victoria (VIC)	1703	27.2			
Western Australia (WA)	635	10.1			

Participants were recruited with a target of 400+ participants per 18 food category studies (original-level) identified as: (1) Wine, (2) Coffee, (3) Chocolate, (4) Yogurt, (5) Milk Drinks, (6) Ice Cream, (7) Cheese, (8) Baby Formula, (9) Capsicum, (10) Pumpkin, (11) Tomato, (12) Banana, (13) Melon, (14) Tea, (15) Grains, (16) Beef, (17) Pork, and (18) Olive Oil. To reduce variables and report on insights of higher categories, certain groups were recoded, for example, Yogurt, Milk Drinks, Ice Cream, and Cheese were combined to create a new (high-level) category titled Dairy. The participants were selected for each food group based on the criteria they had some experience with the food group. Therefore, final descriptives for the ten higher-level food groups are shown in Table 18.

Table 18. Online Survey Food Categories (Higher-Level) showing Participant Frequencies and Proportions compared across Countries as of 2017-2018.

Variables	Australia		China	
	n= 6263		n= 7197	
	<i>f</i>	%	<i>f</i>	%
Food Categories (higher level)				
Wine	337	5.4	400	5.6
CoffeeTea	673	10.7	802	11.1
Chocolate	345	5.5	398	5.5
Dairy	1328	21.2	1600	22.2
BabyForm	344	5.5	399	5.5
Vegetables	1005	16.0	1198	16.6
Fruit	865	13.8	799	11.1
Grains	334	5.3	402	5.6
Meat	694	11.1	797	11.1
OliveOil	338	5.4	400	5.6

Recoded 18 Food Categories into 10 groups (higher level)

3.3 Instruments

Study 1 – QMA Instruments

Visual Elements

Participants were presented with 2-dimensional paper-based Visual Elements as stimulus to the groups for group-assessment of the two categories: (1) meat packaging ‘Design’ represented by 13 visual elements (Figure 65), and (2) Security ‘Technology’ portrayed as 9 visual elements (Figure 66).

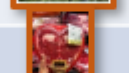
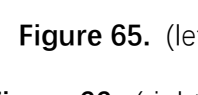
REF	DESIGN	NAME	REF	TECHNOLOGY	NAME
D1		Tray with Organic Label	T1		QR Code Post-Pack Sticker
D2		Professional Photo w Aust Logo	T2		QR Code Self-Stand Display
D3		Tray with fun colourful design	T3		QR Code WeChat Payment
D4		Tray with designer label	T4		QR Code Designed Label
D5		Tray with livestock image	T5		LCD Temperature Monitor
D6		B&W minimalist design label	T6		NFC Track and Trace Chip and Beef App
D7		Sleeve Pack with Chinese Text	T7		Augmented Reality Origin
D8		Card Box with Info Booklet	T8		Live Cow Cam
D9		MLA Promotional Event	T9		Augmented Reality How To
D10		Australian farmer family Photo			
D11		Structural pack Heart Smart			
D12		Imagery of cooked meat			
D13		Imagery of premium design			

Figure 65. (left) QMA Stimulus for assessing Design (13 visuals).

Figure 66. (right) QMA Stimulus for assessing Technology (9 visuals).

Visuals – Packaging Design

Design packaging visuals, 13 in total, were full colour printed images on paper, cut out for participants to view and appraise. The visuals were selected for assessment based on their cross-sectional representation of trustworthy elements which were identified in the literature review. Elements were selected to test consumers perceptions of packaging designs and technologies rating on a scale between trust or scepticism. Elements tested were founded on familiarisation (such as recognisable country of origin logos), transparency (level of information presented), demonstration of ability (design sophistication), and engagement (layers of detail).

Table 19 presents the criteria used to select the visuals. The table outlines the 13 Design Visuals (represented as D_n) with n ranging from 1 to 13. Each visual could represent multiple features listed under Criteria (e.g. Familiarisation and Transparency etc.) and several visuals did not represent any selection criteria at all to test if they rated less positive than the other visuals that aligned to the criteria. Various elements represented recognisable and unfamiliar attributes such as Country of origin, Organic claims, and English or Chinese terminology presented on pack designs. Design of packaging was represented at various levels to identify if design played an essential role in influencing positive rating.

QMA Selection Criteria across Trust Attributes: Familiarisation, Transparency, Ability, Engagement and Capability per Visual

Criteria					Cross References																						
Familiarisation	Transparency	Ability	Engagement	Capability	Packaging Design and Technology Attributes	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	D13	T1	T2	T3	T4	T5	T6	T7	T8	T9
/	/				Badge - Country of Origin (recognisable)	/	/	/	/	/	/	/	/	/	/	/	/	/	/								
/	/			/	Badge - Organic Claim (recognisable)	/			/			/															
					Badge - Organic Claim (unrecognisable)	/						/															
/					Language Text - Chinese							/															
/					Language Text - English	/	/	/	/	/	/	/	/	/	/	/	/	/	/								
					Design - Simple	/						/															
		/		/	Design - Premium				/		/	/	/	/	/	/	/	/	/								
	/				Information - Detailed				/				/														
					Information - Basic	/						/		/	/	/	/	/	/								
/					Imagery - Indorsement										/	/	/	/	/								
/					Imagery - Australian References		/		/		/				/	/	/	/	/								
					Product View - no		/								/	/	/	/	/					/			
	/	/	/	/	Product View - yes	/		/	/	/	/	/	/	/	/	/	/	/	/								
		/	/	/	Unique Packaging			/					/			/				/							
					Technology retrofitted															/			/				
					Technology at point of display															/			/				
/	/	/	/	/	Technology using digital Pay																/		/				
	/	/	/	/	Technology multiple layers																	/		/			
	/	/	/	/	Technology monitoring																		/		/		
/	/	/	/	/	Technology further information															/				/		/	/

Visuals – Technology

The Anti-Counterfeiting technology visuals, nine in total, covered technologies including QR codes, LCD temperature monitors, NFC Track and Trace technologies, Authentication Apps, Augmented Reality content and a Live Cow Cam. Technologies were presented more than once to test if design impacted consumer choice in security trust, for example the QR codes were represented on four design levels; increasing in sophistication: Retrofitted (post pack design), a Point-Of-Sale display (separated from product), a digital pay enabler callout (added-purpose attribute), a design embedded point in the packaging label as well as multiple points of reference displayed by a lady who shows how to use (layered detailed information). The purpose of adding more detail over the four technologies was to observe what influences consumers trust. Similar technologies were randomly presented to the participants throughout the study.

Preference Matrix

The QMA preference matrix (Figure 67) was masked onto a table with the descriptor anchors (1) everyday, (2) premium, (3) doubt, (4) trust, adhered to the extreme points of each marker. The descriptor anchors were measured approximately 800 millimetres from the centre 0,0. This was so the participants could surround the table and access within arm's reach each quadrant for plotting visuals.



Figure 67. QMA Preference Matrix with Descriptor Anchors and Plotted Visuals.

Study 2 – Workshop Case Study Instruments

The instruments used for the Anti-Counterfeiting Workshop included a PowerPoint presentation delivered by a laptop and projector on a white wall. Participants were asked to rapidly brainstorm thoughts on their current risk perception captured on sticky notes of various colours and a marker for rapid generation and flexible positioning on the wall (Figure 68). Participants and workshop staged outputs were photographed using a smart phone. Other instruments used for ideation and data capture are outlined below.

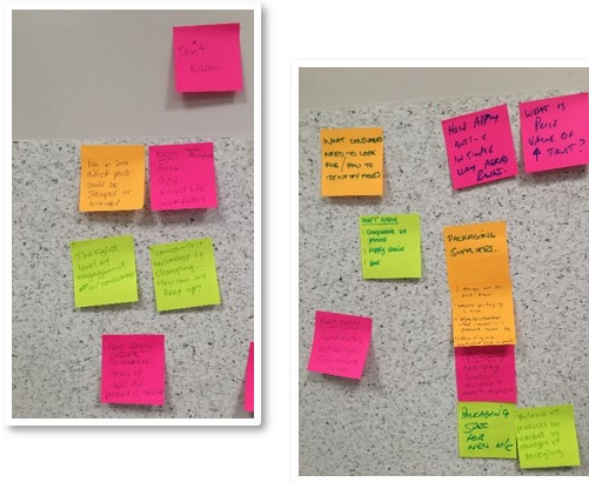


Figure 68. Rapid Knowledge Mapping of Current Risk Perceptions.

Security Elements Summary Posters

Security Elements Summary Posters were wall mounted, A3 paper print outs of each security element that outlined key descriptor features and a summary impact effect on counterfeiter capabilities. Each A3 poster introduced an element's: (1) functionality, (2) complimentary elements for further enhancement, (3) application by others, and (4) deterrence against counterfeiter's capabilities. Key features presented on the Security Element Summary Posters as shown in Figure 69: (1) An Element Hero Image, (2) an Element Reference number (e.g. B1), (3) an Element Rank (Green/low, Orange/medium, Red/high – based on its overall comparative cost and difficulty to implement), (4) Element Description, (5) Counterfeiters Capabilities (for targeting), (6) an Element's Impact (shown as a 'X' on the effected counterfeiters capabilities).

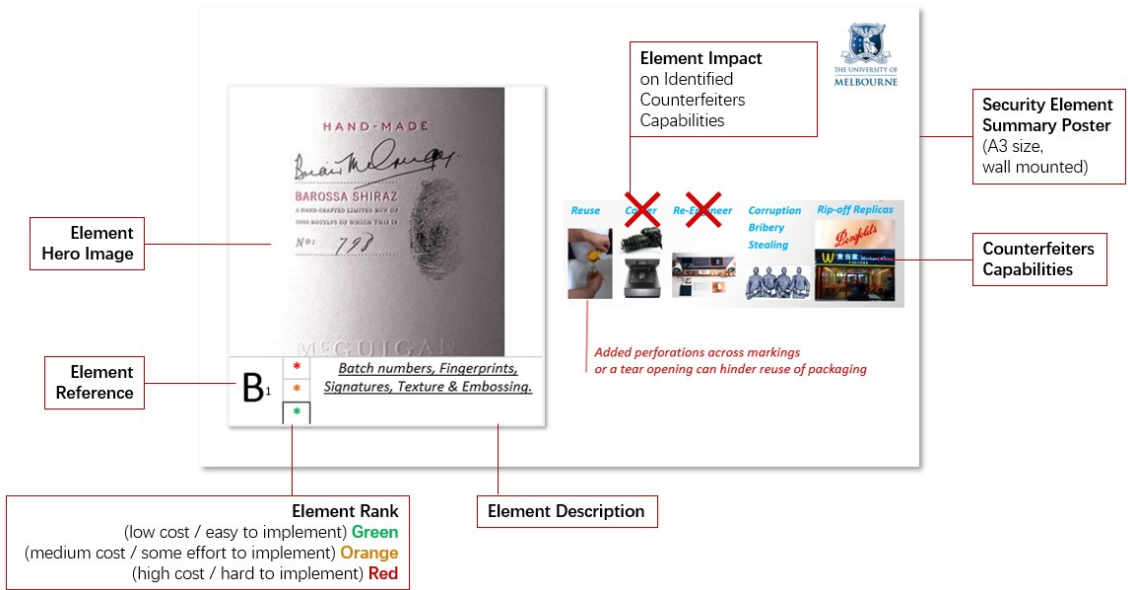


Figure 69. An Example of a Security Element Summary Poster Reference B1.

Security Element Cards

In addition to the Summary Sheets, Security Element Cards, 50 x 70mm in size, were printed out paper cards as shown in Figure 70. These were made available as co-creation resources for stakeholders to bundle together to produce a set for prototyping. The details were similar to the Summary Sheets with attributes consisting of: (1) Element Hero Image, (2) Element Reference, (3) Element Rank, and (4) Element Description. The bundles were grouped by blue tack and applied to a white board.



Figure 70. Workshop Security Element Card (Ref D1 Destructive Packaging).

Success Criteria Sheet

The Counterfeiter's Capabilities (Figure 71 top strip), identified through literature and industry examples, was printed out on an A3 sheet of paper to act as a Success Criteria sheet. This was to test the bundled elements (prototypes) against the tools used by counterfeiters (test) to validate the effectiveness of the combined elements.

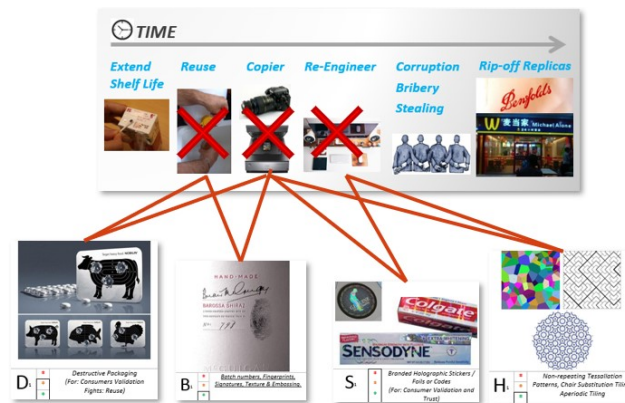


Figure 71. Workshop Success Criteria Sheet to Disarm Counterfeiter's Capabilities.

Workshop Proposal

A *Workshop Proposal* (Appendix A) stipulated the workshop details to the unidentified Industry Partner for their consideration and agreement of participation.

Workshop Report

A 35-paged 16:9 Widescreen full colour Workshop Report was documented in Microsoft Powerpoint. It outlined the Design Thinking workshop overview, the resulting bundled prototypes and their rankings against the Success Criteria. Additional captured outputs and recommendations were reported or visualised as a summary. The report contained an executive summary as well as identified solutions and recommendations over a phased business rollout plan as per the problem-oriented case study methodology.

Feedback Survey

The Microsoft Word Feedback Survey was emailed to encourage easy reply. A 7-point Likert scale was used to rate the participants perception on the workshop and report on their fulfillment on the projects aims and objectives and overall effectiveness (refer to Section 3.1.2 Research Design for Study 2 Workshop Evaluation Feedback Survey).

Study 3 – Online Survey Instruments

The Instruments used included the ResearchNow Screener-In Survey to recruit respondents from Australian and China. The ResearchNow DECIPHER software was used to run the web-based survey enabling multivariants to be tested with multi-response options. The participants response data was collected through DECIPHER's interactive links and staged pages. The Online Survey used a CATA style questionnaire with photo-realistic visuals to enhance context comprehension across cultures (see Section 3.1.2. Research Design for Study 3 Final Security Survey Design). The raw data was received in both Microsoft Excel and SPSS file formats. The statistical analysis was conducted using Minitab® Statistical Software (Version 18.1).

The full *Online Survey Questionnaire* (Appendix B) consisted of questions inquiring on participants profiles including: Demographics (Life Stage, Living Arrangements, Gender, Income and Place of Residence); Trust Propensities of the Food Industry; and Expectations of Security Elements across Everyday and Premium food categories.

Reference to MiniTab® Statistical Software requires the following clause to be mentioned:

"MINITAB® and all other trademarks and logos for the Company's products and services are the exclusive property of Minitab, LLC. All other marks referenced remain the property of their respective owners. See minitab.com for more information."

3.4 Procedures and Timelines

Study 1 – QMA Procedures and Timelines

The QMA studies were conducted in January 2017 with two groups, each group lasting 1-hour sessions that consisted of two sections: Session 1A testing Design visuals and Session 1B testing Technology visuals (Table 20). A period of 12 minutes approximately was allocated to welcome participants, sit them down to read through the Plain Language Statement and then sign the Consent Form. Once the 8 participants had all completed this, they were then asked to stand around the prepared table with the QMA preference matrix. The procedure was explained to the participants for them to verbally respond to the research question outlined in Section 3.1.2 by group appraising each visual from the shuffled pack, by communicating individual thoughts of the visual, whether positively or negatively, and then pass it on to the next participant so that each person would have time to review the stimulus. Once the entire group had an opportunity to appraise the visual, the visual was then placed on the preference matrix based on the groups agreed position. Each visual took approximately 1 minute for the group to assess. Once all 13 Design visuals were assessed, the facilitator took a photo of the plotted visuals and then cleared the preference matrix of visuals. The participants took a short break between Session 1A and 1B however, remained in the room. Session 1B repeated the same procedure as Session 1A for assessing the Technology visuals. All comments were captured through notetaking with reference to the visual reference number being assessed. The group was photographed and the plotted visual positions. The participants remained anonymous. One session took 1 hour to complete which was repeated for both sessions, thus, the study in action took 2 hours approximately with 2 hours break in between sessions.

Table 20. QMA Sessions and Time Allocations.

QMA SESSION 1: 10:00 am - 11:00 am (1 hour duration) n=8 participants																									Total Time (mins) 59	
Welcome	Session 1A													Final	Break	Session 1B										Final
Prep	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	D13	Confirm	Record	T1	T2	T3	T4	T5	T6	T7	T8	T9		Confirm
12	1	1	1	1	1	1	1	1	1	1	1	1	1	10	5	1	1	1	1	1	1	1	1	1		10

QMA SESSION 2: 13:00 pm - 14:00 pm (1 hour duration) n=8 participants																									Total Time (mins) 59	
Welcome	Session 1A													Final	Break	Session 1B										Final
Prep	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	D13	Confirm	Record	T1	T2	T3	T4	T5	T6	T7	T8	T9		Confirm
12	1	1	1	1	1	1	1	1	1	1	1	1	1	10	5	1	1	1	1	1	1	1	1	1		10

Study 2 – Workshop Case Study Procedures and Timelines

Once the Industry Partner was aligned on the *Workshop Proposal* (refer to Section 3.3 Study 2 Instruments or Appendix A) that outlined the required Pre-work, Session details and Post-workshop deliverables, the Workshop was then scheduled for Tuesday, the 31st of October 2017 for a 1-day event running from 10am to 4:30pm with a working lunch. The event was held at the University of Melbourne, School of Agriculture and Food, state-of-the-art sensory facility in Parkville, Melbourne Victoria. The Workshop Agenda executed on the day is shown below with the Design Thinking stages highlighted in red.

10am	start / welcome
10:15	empathise / knowledge map
11:00	define
12:00	<i>lunch review concept boards</i>
1:00	ideation / map benefits / time vs value chart
3:00	<i>break</i>
3:20	prototype / test / break the counterfeiting teams
4:30	wrap up

The session was commenced by all facilitators (researchers) and participants (Industry stakeholders) greeting each other, with administration details addressed. The Design Thinking structure of the workshop was presented outlining the aims and objectives and overall purposes of the 5-stages of Empathy, Define, Ideate, Prototype and Test. The workshop's forecasted outcomes were discussed concerning the bundled solutions and a Research Report. Once, all were aligned, the workshop commenced the first stage.

The Empathy Stage ran over 45-minutes in total and was segmented into two sub-sections: Firstly, a 15-minute background presentation on counterfeiting. Secondly, a rapid 30-minute Knowledge Map session on what the business knew and what they didn't know on the current risk position.

The background presentation utilised current research statistics and specific cases reported in China to help the business understand the threat they were facing. To provide context of a food category impacted by counterfeiting, a brief Olive Oil case study was presented demonstrating the damage counterfeiting has on consumer's perceptions on specific brands involved and how Word-of-Mouth (WoM) further exasperates the problem. Fraudster's motivations and capabilities, identified in literature, were highlighted (later to act as the *Success Criteria* in the Test Stage).

Following the presentation, the Industry Partner was asked to Knowledge Map using sticky notes under KNOW and DON'T KNOW their combined knowledge and understanding of what they currently knew and what they did not know on the situation they were in; they were asked to individually respond to where they lost control of the supply chain with details on where they would like to claim control again. After the participants completed their responses on notes (anonymously), they compared them to see where they needed to align.

The Define Stage was run over 1-hour broken into two 30-minute sub-sections: (1) the Problem Define Stage and (2) the Resource Define stage.

Firstly, the *Problem Define stage* was to enable all the stakeholders to discuss and align on the scope of the overall problem; taking the learnings from the Empathy Stage and distil them into a specific Problem Statement they wanted to solve. This problem statement would then act as the project brief for the anti-counterfeiting co-creation Ideate Stage.

Secondly, the *Resource Define stage* verbally presented *30 Security Element Summary Posters* (see Section 3.3. Instruments, Study 2) presented by an anti-counterfeiting research expert using A3 paper printouts which were mounted on walls around the room. Each security element took approximately, 1-minute or less to review the details. The elements were provided for stakeholders to appraise against their business needs.

The Ideate Stage was the a 2-hour stage that utilised the co-creation methodology: Firstly, to *co-Nominate process* to distil relevant elements. Secondly, the *multi-stakeholder co-Create process* to bundle award-winning, effective elements.

The *co-Nomination process* ran over 1-hour of the Ideate stage. The participants were paired and asked to vote on their preferred elements using their stakeholder expertise to award or nominate an element using sticky notes. Each participant had five sticky notes each to vote with as shown in Figure 72. The winning security elements consisted of the posters with 2 or more votes. Elements with more votes indicated a greater stakeholder alignment on the elements relevance to their business plan needs. Elements were later ranked by votes in the Workshop report for future referral.



Figure 72. Worksheet Summary Sheets for Stakeholder Appraisals.

From this session, the non-winning elements were then extracted from the pack of 30 *Security Element Cards*. The remaining winning elements were available for cluster ideation.

The *co-Create process* required all the stakeholders and facilitators to return to the main table and start discussing ways on combining the winning Security Element Cards through a co-creational process. The aim was to combine elements into a group or bundle that together would defeat the listed counterfeiter capabilities. The objective was to create as many bundles that suited the business needs within the provided time of 1-hour.

The Prototype Stage took approximately 10 minutes. The participants were asked to review their bundled options and select the top 5 best bundles as the Prototypes to plot on a graph that the 'y-axis' is Brand Enhancing (BH) and the 'x-axis' is Insurance Value (IV). Brand Enhancing is the value in marketing terms that improves the IP perceived value from a consumer point of view (Design Deterrence). Insurance Value was weighted towards technological security applications. The prototypes were to be group-plotted on the graph based on their perception of the amount of technological applications in the bundle or the design-oriented nature of the elements. Therefore, more design-oriented bundles were placed higher on the graph towards the Brand Enhancing axis whereas, the bundles with a higher inclusion of technological-based elements were pulled closer towards the Insurance Value axis. Figure 73 demonstrates the co-created prototype bundles placed on the BE x IV graph allowing each prototype to be viewed comparatively on their orientation.

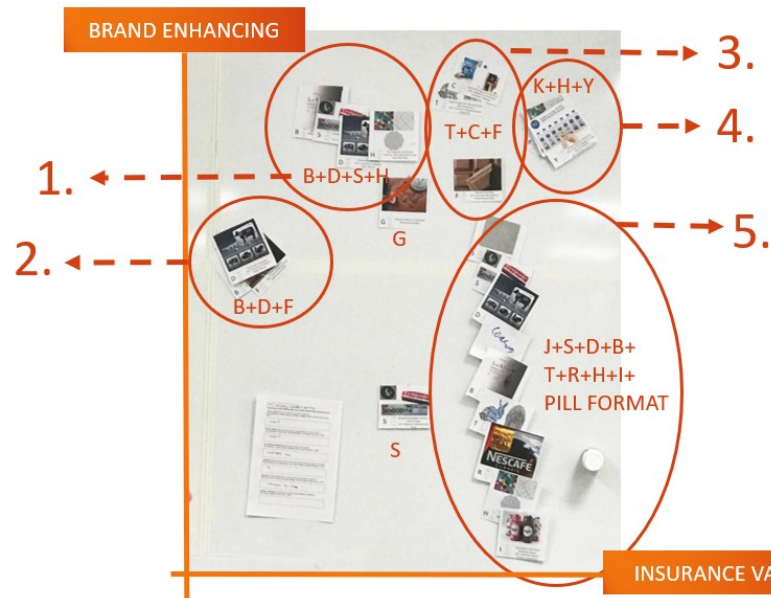


Figure 73. Brand Enhancing x Insurance Value Graph showing Five Plotted Prototypes of Co-Created Security Elements.

The Test Stage took 20 minutes. The participants were asked to again review the Prototypes plotted on the BE x IV graph and test the prototypes against the counterfeiting capabilities to see if they stood up against the Success Criteria Sheet (see Section 3.3. Instruments Study 2 Success Criteria Sheet). If the tested prototype succeeded in disarming the counterfeiter's capabilities, then the prototype could be considered for action.

The remaining time was used to debrief and review the final prototypes that succeeded in the test stage. The Workshop report was planned, and any final questions discussed.

Study 3 – Online Survey Procedures and Timelines

Panellists were first verified by ‘ResearchNow’ (now known as ‘Dynata’ and their corresponding legal name ‘Survey Sampling International’) who are ISO accredited (ISO 26362 and 20252) through a screener-in survey and respondents were Quality Checked for any speeders, flatliners and gibberish open ended verbatim according to the Dynata (2017) guidelines. The participants were selected “By-Invitation-Only” from the pre-validated pool of respondents to partake in the online survey. Data is protected by Dynata security and governed by strict Privacy Law. The panels were localised with “native language panel support” and were “incentivised using country-specific reward choices” (Dynata, 2017).

The same design was applied for all participants with English version for Australian’s and a simplified Mandarin Chinese translated version for the Chinese participants. A sample size of N=400 respondents per food category was targeted. Participants were allocated to one of the 18 food categories based on the criteria that they had a degree of familiarisation of the food product. The conditions of the experiment included an untimed, online CATA survey which the participants were provided seven options and asked to endorse the trustworthy attributes that characterised Australian origin. trialled at approximately 16 to 20 minutes average duration. The participants were asked to choose a quiet location for carrying out the survey and to dedicate 30 minutes duration. The survey could not be stopped, and participants could not return to previously filled questions. Participants were asked to read and agree to the University of Melbourne plain language statement prior to commencement. The study size was achieved by combining the research questions in with a larger Conjoint study similar in context and assessing the same cross-section of cultures. The data shared among studies was the demographic variable data and the trust propensity data. No other data was shared. The details of the other studies are not outlined in this research as they do not impact the research analysis or results.

Overall, the survey from design to first trial took approximately half a year to develop. The online trial was conducted with accessible links for final amendments in November to December 2017. Final amendments were completed, and the first live online survey was completed in China, then Australia over a 2-month period with the final raw data files received by the University of Melbourne in March 2018.

3.5 Analysis

Study 1 – QMA Analysis

The completed preference matrix with plotted visuals was photographed with a digital smartphone from a top down view. From these photographs, comparisons were made of the two groups appraisals on both Design and Technology Visuals. An example is provided of the two groups assessment of the Technology visuals which were grouped into clusters as seen in Figure 74. The clusters provide a quick estimation of differences between the two compared groups. It is evident that Group 1 had three distinct clusters, while Group 2 had two main clusters.

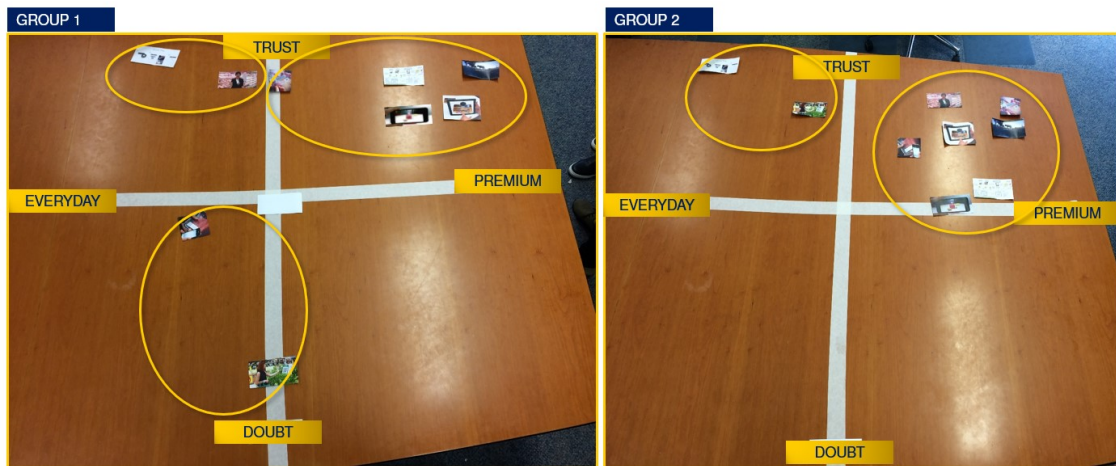


Figure 74. QMA comparison of the two groups assessing the technology visuals.

The captured visuals were then located using coordinates as shown in Figure 75. Each quadrant used a grid format that scaled from the central point labelled neutral 0,0 outwards to 4 points each way. Negative integers plotted entries towards the everyday or doubt sectors. Positive integers indicated entries were placed towards premium.

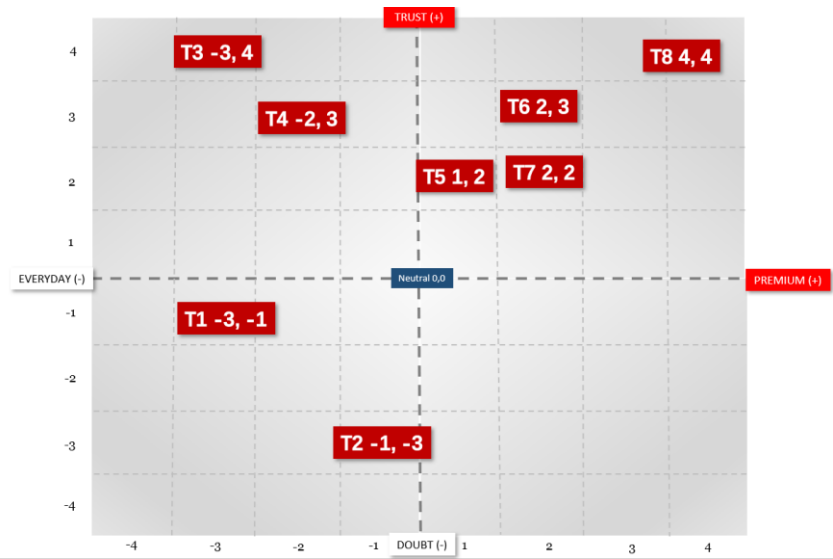


Figure 75. QMA Technology plots using a 4-point coordinates grid format.

Each visual stimulus was then provided coordinates and summarised in Microsoft Excel as portrayed in Figure 76 which demonstrates x,y co-ordinates against each visual.

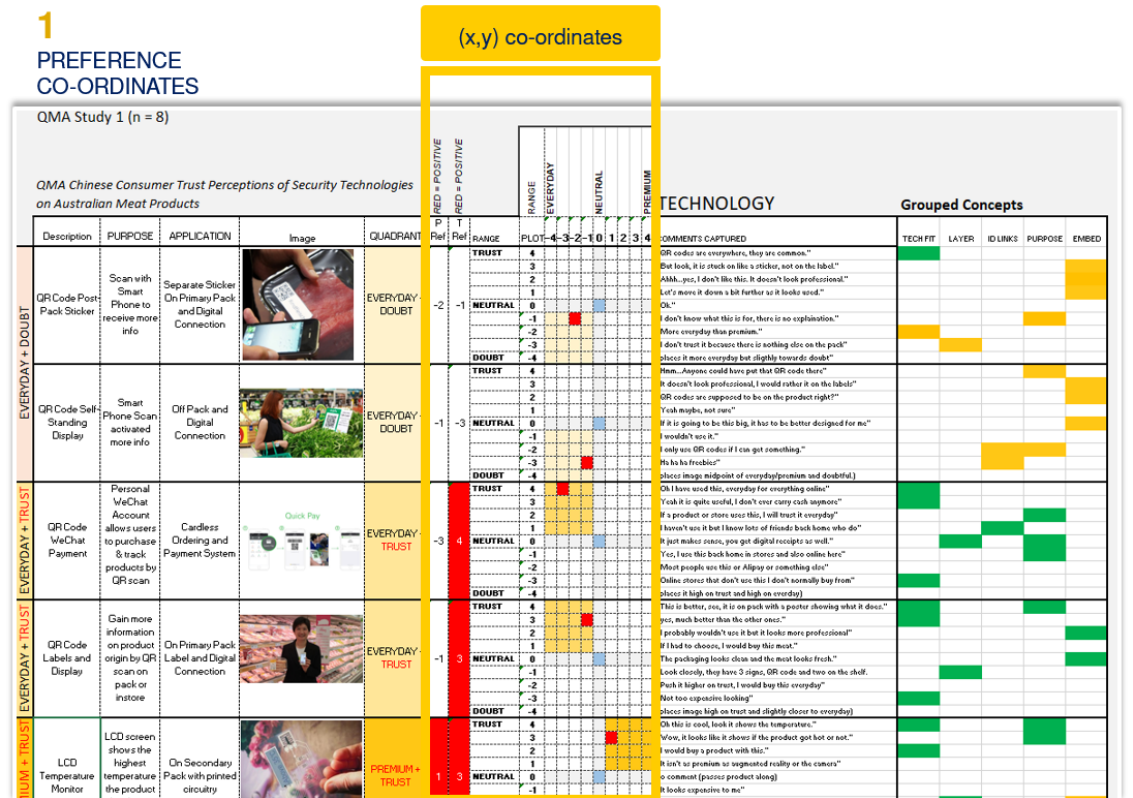


Figure 76. QMA Preference Co-Ordinates Summarised for Analysis.

Captured notes associated with each visual appraisal was transcribed (Figure 77). Emerging common concepts from the transcriptions were grouped as clustered insights (refer to the green or yellow coloured cells). Five Clustered Insights were identified which will be later detailed in the Chapter 4 Results and Chapter 5 Analysis of this thesis.

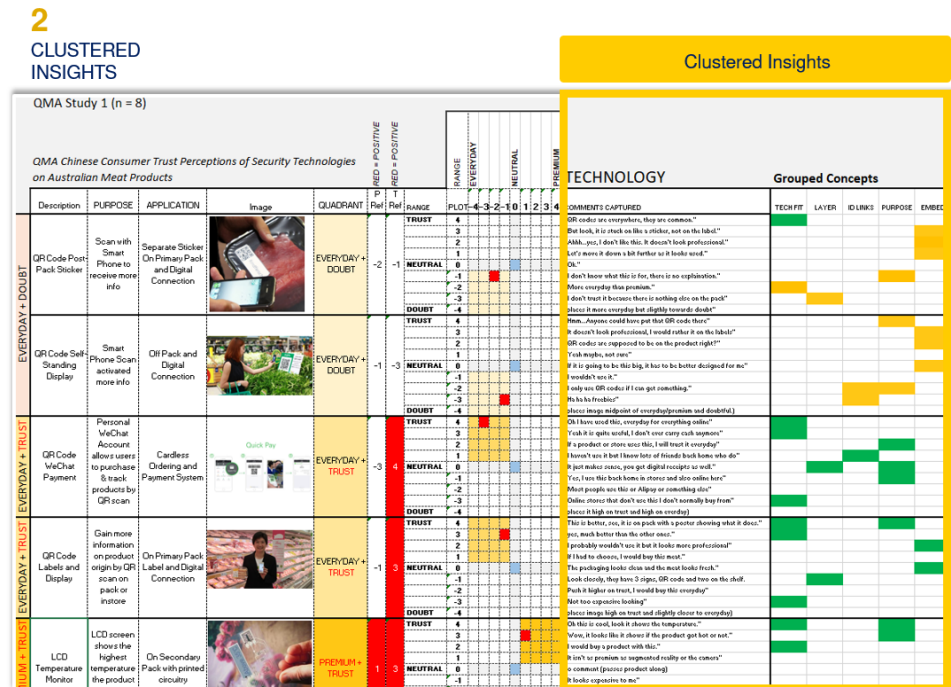


Figure 77. QMA Transcriptions Summarised for Analysis with Clustered Insights.

The coordinate outputs of 'X, Y' were compared across the rankings of (1) Premium 'X', and (2) Trust 'Y' as shown in Figure 78 to identify which technologies rated high on premium and trust. Transcriptions were used to cross-examine visual coordinates.

TECHNOLOGY SCALING ON PREMIUM AND TRUST

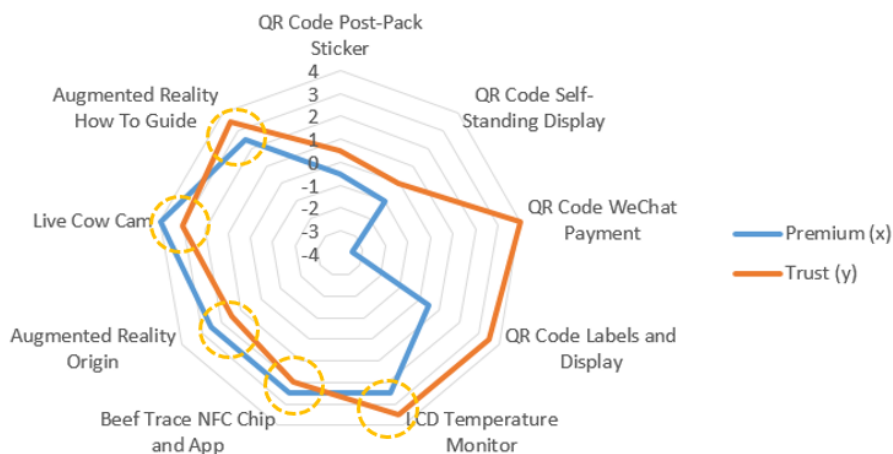


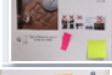
Figure 78. QMA Analysis comparing Technology Premium and Trust Rankings.

Study 2 – Workshop Case Study Analysis

The Workshop was analysed by using the 9-stage problem-orientated case study methodology (Irweb, 2019) (see Section 3.1.1. Methodology for Problem-Orientated Case Study). Stage 6 defines the process of generating multiple solutions to the Causes or Implications of the problem and then distilling them down to the best-chosen solutions. The workshop used Security Element Cards that were voted on in the session and the analysis of the votes summarised in the Workshop Report. Firstly, in line with the Participatory Action Research, questions and processes can evolve within the study session as new insights are discovered. Therefore, a new Counterfeiting Capability was discovered through the Industry Partner's experiences of being counterfeited and was added as an 'Extension of Shelf Life' capability and defined as the process of a fraudster modifying the expiry date to extend the life of the product. Although this process was considered as a Reuse sub-technique, the Industry Partner expressed that this capability was significant for their situation and was requested to become a new category.

Table 21 depicts attributes for assessment which consist of: (1) Image: A photograph of the Security Element Summary Sheet with sticky note votes; (2) Ref: The Reference Identifier; (3) Description; (4) Vote: The number of stakeholder votes combined; and (5) 6 Counterfeiters Capabilities: with marks that indicate deterrents against the capability. Two or more votes are highlighted in red to indicate a greater alignment of stakeholders.

Table 21. Workshop Analysis Table of Ranked Security Elements against Counterfeiting Capabilities.

IMAGE	REF	DESCRIPTION	VOTE	Extend Shelf Life	Reuse	Copier	Re-Engineer	Corruption Bribery Stealing	Rip-off Replicas
	A ¹	VOID PANTOGRAPH, SECURITY PAPER	1	x	x	x	x		
	B ¹	BATCH No. FINGERPRINTS, TEXTURE & EMBOSING	5		x	x	x		
	C ¹	RECOGNISABLE UNIQUE PACKAGING	1			x	x		
	E ¹	UNIQUE SHAPED PRODUCT	1			x		x	x
	F ¹	MOULD-IN BRANDING	6			x	x	x	x
	G ¹	STAMPED PATTERNS & BRANDING	2		x	x	x		x
	H ¹	NON-REPEATING TASSALLATION PATTERNS ETC.	4		x	x	x		x

The next stage of analysis was to consider the bundled Security Element Cards classified as Prototypes to again compare their deterrence against the identified Counterfeiters Capabilities which represented the Success Criteria. Figure 79 demonstrates a Prototype consisting of the Security Element Cards K1+H1+Y1 with the combined deterrence factors disarming all six counterfeiters' capabilities. Thus, resulting in a Strong 6 out of 6 rated security level.

The ratings of Prototypes were based on (1) Strong, (2) Medium, (3) Ok and (4) Weak. The Strong rating indicated that the Prototype could disarm all six capabilities however, it may require some time planning and therefore was suited for the long-term rollout. The Medium rating disarmed between 4 and 5 capabilities and again required some planning. The Ok rating disarmed 3 capabilities and could be considered for the near future. The Weak rating was between 1 to 2 capabilities and although considered a weak security attribute, it still acted to disarm the common counterfeiters attempts and would be a best fit for immediate rollout for the Industry Partners business plans.



Figure 79. Workshop Prototype (K1+H1+Y1) against the Success Criteria.

A Workshop Report was produced for the Industry Partner outlining the sessions analysis and findings presented in an executive summary. This also clearly defined the problem statement, possible created solutions and summarised the recommendations for Prototype rollout over a 2-year phased business plan as per the case study methodology followed.

This Workshop Report was presented to the Industry Partner for their records and potential execution of recommendations.

The Workshop Session and the Workshop Report was assessed on the Industry Partner's perceived effectiveness for their business needs. The feedback survey was the final assessment made on the workshop model from the Industry Partners perception of the methods, delivery and outputs of the workshop (see Section 3.1.2. Research Design for Study 2 – Workshop Evaluation Feedback Survey).

Study 3 – Online Survey Analysis

Omitted Incomplete Cases

The raw data of the two-population comparative Online Survey was investigated for incomplete cases that would impact on the overall results. Thus, 976 Australian cases and 60 Chinese cases were identified as incomplete cases for Income and Living Arrangement variables. These were initially analysed as a separate group to see if there was anything of interest to the study, later to be omitted for final reporting. This did not impact the study analysis.

Recoding for Higher-Level Analysis

A select number of variables were recoded for higher-level assessment. Recoded variables included the 18 food category variables recoded into 10 higher-level categories such as Dairy (Milk Drinks, Ice Cream, Yogurt, Cheese) and Meat (Pork and Beef). The Age variable was recoded into 6 groups defining LifeStages. The Living Arrangements variable recoded into 5 groups defining Adults living with or without children or with parents. The Income variable recoded into 5 Quintiles; with Quintile 1 being the Most disadvantaged through to Quintile 5 being the Most affluent.

Measurements of Analysis

Numerical variables were measured formats of: binary, nominal and ordinal formats. Textural formats did not have a word limit and allowed for additional comments that explained further a respondent's perceptions and demographic details.

Statistical Analyses

Multiple statistical analyses were selected to identify key factors and confirm significant findings through cross-assessment as outlined in the MAST90007 Statistics for Research Workers Book (Gordon, 2018). Initially, descriptive statistics were used to examine the normality and spread of the data across the two populations to identify any necessary adjustments needed to correct the distributions to satisfy assumptions for the Analysis of Variance (ANOVA) statistical assessment. A Multiple Correspondence Analysis was selected to examine the binomial (selected, not-selected) responses to identify security elements contribution to the overall variance of data. Identified factors were then further analysed using the (ANOVA) General Linear Model which enabled multiple independent variables (demographics and economical-demographics) to be assessed together and

compared statistically across the respondent's dependent variable of expected Total Security. An interaction study was included to extrapolate the influence of a cultures Trust Propensity on their expected Total Security across the independent variables. A Tukey's Difference of Means (DOM) test was conducted to compare the evident shifts between, and within, the means of the two-populations using a Fishers Least Significant Difference (LSD) approach. A Binary Logistic Regression was adopted to obtain the Odds Ratio's (ORs) with 95% confidence intervals between the compared individual Security Elements to identify a hierarchy ranking per country. Significant and non-significant findings were reported in Chapter 4 Results.

3.6 *Ethics and Limitations*

Ethics Application ID: 1646413.4

Ethics Title: Sensory Analysis of Meat Products and Packaging

Application Type: Minimal Risk

All three studies conducted for the purposes of this research comply with all ethical considerations outlined in the *Ethics Application* (Appendix C) submitted to the University of Melbourne Ethics Committee and for the strategic ARC Industry Transformation Research Hub. All products were assessed either visually online or on printed out 2-dimensional visuals of food packaging designs and anti-counterfeiting technologies. Participants were not required to sample any products presented therefore, the research was classified as low-risk ethical studies. All participants remained anonymous and had agreed to a *Plain Language Statement* (Appendix D) by signing the provided *Participant Consent Form* (Appendix E). Candidates enrolled in participation were able to opt-out of the studies at any time without question and all details omitted from the study.

Limitations

Study 1 relied on participants that were new-to-Australia within 1 year and assumed the participants had little influence by the Australian culture, society and environment with little impact on the study results. The findings were based on less than 100% targeted results due to the participants residing in a foreign culture and were only indicative of consumers living in China of their same counterparts. The qualitative pilot study was taken from a small sample size of 16 participants and therefore, further research is recommended to validate the learnings reported from this study. In response, the purpose of the pilot study was to quickly test for influencing unknown insights that may inform the larger quantitative studies that followed.

Study 2 was a pilot of the newly developed Anti-Counterfeiting Workshop and therefore, refinement and further trialling for best practice is called for to validate the model. The Workshop was well received by the Industry Partner who stated that they were rolling out the recommended 2-year phased anti-counterfeiting business plan however, a

second follow up interview with the SME business would enable a greater understanding if this has eventuated which has not been planned.

Study 3 was a large scale quantitative online survey over two-populations which could not be achieved through common survey methods and therefore, the outsourcing of the data capture through ResearchNow allowed for unforeseen discrepancies to impact the study however, assumptions were made on the validity and quality processes stipulated by the research service provider who had previously been utilised by the leading researcher on earlier research projects justifying the employment of their quality services.

Chapter 4:

Results & Analysis

Chapter 4 combines the reported results and discussed analyses pertaining to the three research studies undertaken. The studies are founded on the methodologies, designs and data collection processes outlined in Chapter 3. Each study is presented in sequential order with results that provide positive or negative evidence for answering the research questions defined in Chapter 1 Introduction followed by the evaluation and interpretation of the results. The specific analyses for each study reference the literature, concepts and driving theories found in Chapter 2. The first two pilot studies are qualitative based and provide deep insights of consumer and industry expectations to advise the third major study at a quantitative level. The overall findings are judged on significance to academic research and impact for SME management and design education.

Chapter 4 is structured as follows:

Section 4.1 presents the results for Study 1 Qualitative Consumer Appraisals, with sub-sections providing the X,Y Coordinate Results for Design and Technology studies (Section 4.1.2) and the Clustered Insights Results for Design and Technology studies (Section 4.1.3).

Section 4.2 detailed the analysis for Study 1, identifying the overall key findings described as Design-Driven Influencing Factors (Section 4.2.2), followed by the individual analyses of the Design Elements (Section 4.2.3), and the Technology Elements (Section 4.2.4).

Section 4.3 reports the results for Study 2 Qualitative Industry Appraisals, with sub-sections presenting the Workshop Report (Section 4.3.2) and finally the Industry Partners Feedback on the events effectiveness (Section 4.3.3).

Section 4.4 continues with the analysis for Study 2, depicting the SME Appraisals of the elements (Section 4.4.2), the Design Impact on SME Acceptance of the elements (Section 4.4.3), and the overall Design Impact on SME Protection perceptions (Section 4.4.4).

Section 4.5 reports the results for Study 3 Qualitative Consumer Survey with sub-sections detailing the tabled Descriptive Statistics of the two population demographics (Section 4.5.2). The results for Test 1 – Multiple Correspondence Analysis is defined (Section 4.5.3), the results for Test 2 ANOVA GLM is split into Test 2A examining differences *between* the populations (Section 4.5.4), and Test 2B investigating differences *within* the two populations (Section 4.5.5). Finally, Test 3 – Binary Logistics Regression exploring the likelihood ratios of element selection per country is reported (Section 4.5.6).

Section 4.6 interprets the analysis of Study 3 with sub-sections discussing consumer's compared Trust Propensities (Section 4.6.2), the comparative analysis findings between cultures (Section 4.6.3), and within cultures (Section 4.6.4), and finally reporting the individual weighting value of each element over each food category (Section 4.6.5).

The collated significant findings and key recommendations are concluded in Chapter 5.

4.1 Results (Study 1) - Qualitative Consumer Appraisals

4.1.1 Overview for Results

The QMA study was used to investigate the research question: *Does design impact consumer's acceptance and perceived value of anti-counterfeiting securities applied to food packaging?* The expected alternative and null hypotheses defined to test the results against is restated as follows:

If security elements are presented to consumers representing both non-design-driven and design-driven, then consumers will positively rank higher the design-driven elements as 'trustworthy' and 'valuable' compared to the non-design-driven elements (H1).

Thus, the null hypothesis states that there is no difference between presented elements (H₀).

Study 1 is presented in two parts: Section 4.1 Results (Study 1) Qualitative Consumer Appraisals is partnered with Section 4.2 Analysis (Study 1) Qualitative Consumer Appraisals. Both the Results and Analysis sections are defined firstly by the reporting of the Design Elements, followed by the Technology Elements. The term 'Elements' is defined as the visual images and information presented to the participants as research stimulus as further defined in Chapter 3.0 Research Design, Section 3.3 Instruments.

4.1.2 *X, Y Coordinate Results*

Firstly, the captured results of each session's preference maps were photographed and are provided for reference in *Study 1 QMA Plotted Elements* (Appendix F). Each element was allocated a reference number (e.g. 1, 2, 3.... n) for identification purposes and ease of graphing. The results are listed in the Results Tables and Scatterplot Graphs reported below. The X, Y Coordinates report the plotted *Design Elements* and *Technology Elements* positions captured in the two QMA studies, each with two sessions as defined in Chapter 3.0 Research Design. The Design and Technology results were averaged to achieve a *Combined Total Means* for Premium (X_M) and Trust (Y_M). Scatterplots visualise the Combined Means using the identifying reference numbers listed in the respective tables.

It is important to note that the X, Y Coordinates can only identify with one of the four quadrants of the preference map, these are:

(1) Everyday, Doubt (-ve, -ve)	The least desired quadrant
(2) Premium, Doubt (+ve, -ve)	
(3) Everyday, Trust (-ve, +ve)	
(4) Premium, Trust (+ve, +ve)	The most desired quadrant

Design X, Y Coordinate Results

The Design QMA results are reported as X, Y Coordinates in Table 22. The x-axis scale captured the Everyday (-ve value) to Premium (+ve value) and are reported in the Premium (P) columns: P1 (x) and P2 (x) respective of the two sessions. The y-axis reports the scale from Doubt (-ve values) to Trust (+ve values) and reports the elements in the Trust (T) columns: T1 (y) and T2 (y). The negative (-ve) values are shown in **Red**, and the positive (+ve) values, in **Black**.

The group results shown in the table report x,y coordinates of the plotted elements by participants of Session 1, Session 2 and with a Total Combined Sessions column averaging the overall results across the two sessions.

Session 1 participants positively appraised elements on Premium (+ve) status included 1 through to 8, 11 and 13. In comparison, the same group positioned elements on positive

Trust (+ve) including 1, 4, 5, 6 and 13. Thus, the elements perceived as Premium (+ve) but not Trustworthy (-ve) were 2, 3, 7, 8 and 11. Session 2 participants ranked elements 4 and 6 positively on Premium (+ve) status with both element's coordinates located at point 1 indicating a low level of status. The same group positively ranked on Trust (+ve) the elements 1, 4, 5, 6 and 13 suggesting an evident difference between the elements perceived trust and perceived premium status.

Table 22. Design QMA Results of Session 1 (n=8) and Session 2 (n=8) Group Coordinates (x, y) and Combined Session Results (n=16) summarised as Total Means (X_M , Y_M) (as of Sept 2016).

Ref	QMA Design Variables	Session 1 Group Coordinates (x,y) (n=8)		Session 2 Group Coordinates (x,y) (n=8)		Combined Sessions 1 and 2 Total Means (M) (x_M , y_M) (n=16)	
		P1 (x)	T1 (y)	P2 (x)	T2 (y)	Premium (x_M)	Trust (y_M)
1	Tray with Organic Label (1)	2	3	-1	1	0.5	2.0
2	Professional Photo w Aust Logo (2)	3	-4	-2	-2	0.5	-3.0
3	Tray with fun colourful design (3)	1	-2	-2	-3	-0.5	-2.5
4	Tray with designer label (4)	4	4	1	3	2.5	3.5
5	Tray with livestock image (5)	2	2	-2	2	0.0	2.0
6	B&W minimalist design label (6)	4	3	1	2	2.5	2.5
7	Sleeve Pack with Chinese Text (7)	3	-3	-4	-3	-0.5	-3.0
8	Card Box with Info Booklet (8)	4	-2	-1	-1	1.5	-1.5
9	MLA Promotional Event (9)	-1	-2	-3	-3	-2.0	-2.5
10	Australian farmer family photo (10)	-4	-3	-3	-4	-3.5	-3.5
11	Structural pack heartsmart (11)	3	-1	-4	-2	-0.5	-1.5
12	Imagery of cooked meat (12)	-1	-1	-3	-2	-2.0	-1.5
13	Imagery of premium design (13)	3	3	-1	2	1.0	2.5

Note: P = Premium values including -ve values of Doubt, T = Trust Values including -ve values of Everyday. Negative values are highlighted in RED. P1 = Premium Session 1 Group Coordinates.

When considering the tabled Combined Total Means (averaged sessions results), it shows elements 1, 4, 5, 6 and 13 as positively scored both on Premium and Trust. Elements 2 and 8 reported Premium (+ve) and Trust (-ve) whilst the remaining elements 3, 7, 9 through to 12 all reported Premium (-ve) and Trust (-ve) results were neither perceived as high quality or trustworthy. The elements results were then ranked and ordered for interpretation and discussed in Section 4.2 Analysis (Study 1).

The Design Scatterplot (Figure 80) highlights the Total Combined Means (averaged x,y coordinates). The labelled numbers point to the reference number given to each Design element which ranges from 1 to 13. The results visually report the Design elements 3, 7, 9, 10, 11, and 12 all plotted within the Everyday (-ve) and Doubt (-ve) quadrant (Q4). Elements 2 and 8 were positioned in the Premium (+ve) and Doubt (-ve) quadrant (Q3). No elements were found in the Everyday (-ve) and Premium (+ve) quadrant (Q2). The remaining elements 1, 4, 5, 6 and 13 were plotted in the Premium (+ve) and Trust (+ve) quadrant (Q1) indicating these design elements were perceived as high quality and trustworthy. Element 4, titled ‘Tray with Designer Label’, was plotted the highest in Premium (+ve) and Trust (+ve) quadrant (Q1) with extreme opposition to Element 10, titled ‘Australian Farmer Family Photo’, which was plotted the lowest score on Everyday (-ve) and Doubt (-ve) quadrant (Q4).

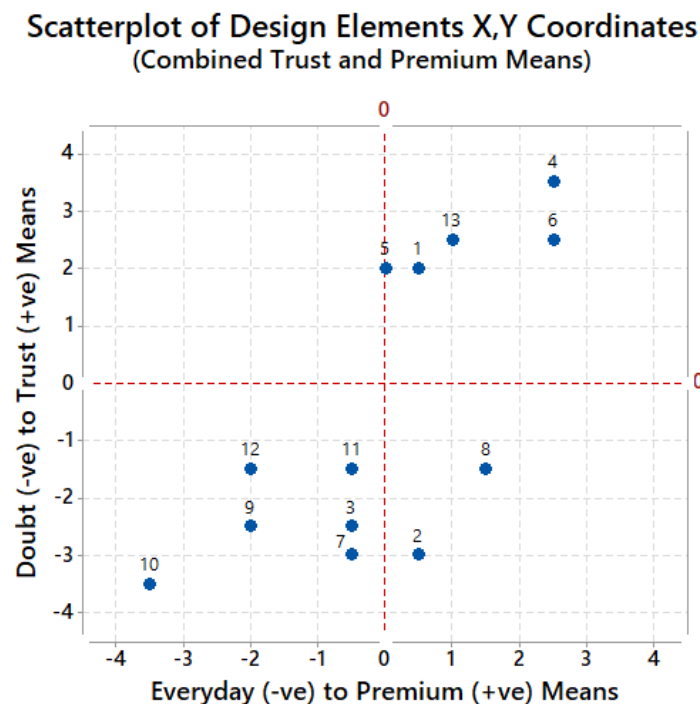


Figure 80. Scatterplot of Design Elements Total X_M , Y_M Coordinates with Reference Numbers.

The Radar Plot (Figure 81) shows the Design QMA individual averaged results for the Premium X_M , Y_M Coordinates and the Trust X_M , Y_M Coordinates overlayed. The graph enables the individual technologies to be scaled on both the X and Y axis to identify the technologies that are deemed premium and trustworthy from Australia.

Design QMA Combined X,Y Coordinates showing Rankings of Premium and Trust Means

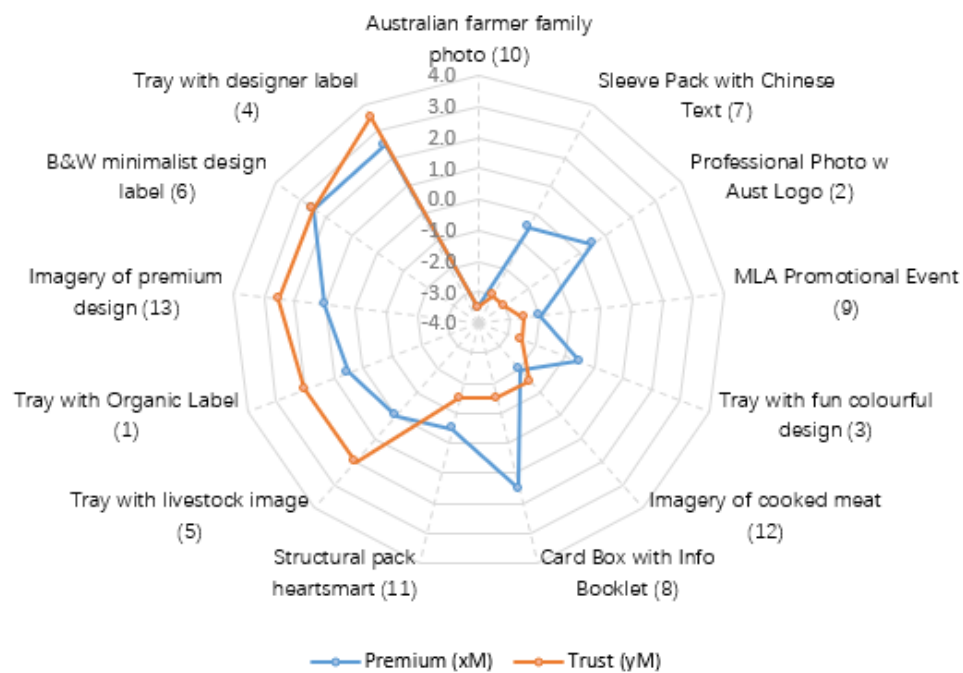


Figure 81. Radar Plot of Design QMA Combined X_M , Y_M Coordinates.

Technology X, Y Coordinate Results

The subsequent results are taken from the Technology QMA Study and are reported as X, Y Coordinates in Table 23. The scales of Doubt (-ve values) to Trust (+ve values) are ranked on the y-axis and reported in the Trust (T) columns T1 (y) and T2 (y). The x-axis scale captured the Everyday (-ve value) to Premium (+ve value) and are reported in the Premium (P) columns P1 (x) and P2 (x). The negative (-ve) values are shown in **Red**, and the positive (+ve) values, in **Black**.

Regarding similar technologies, four QR code related elements referenced as 1, 2, 3, and 4, Session 1 participants negatively plotted all four elements on the Doubt (-ve) scale whilst Session 2 participants negatively plotted only elements 1 and 2 on the Doubt (-ve) scale with elements 3 and 4 comparatively ranked positive on Trust (+ve).

The Combined Total Means for the three QR code elements 1, 2 and 3 resulted in negative plotting on the Doubt (-ve) scale. However, the remaining QR code element 4 was averaged into the positive Premium (+ve) status. The remaining elements 5, 6, 7, 8, and 9 represented varied technologies and all were rated positively on both Premium (+ve) and Trust (+ve).

Table 23. Technology QMA Results of Session 1 (n=8) and Session 2 (n=8) Group Coordinates (x, y) and Combined Session Results (n=16) summarised as Total Means (X_M , Y_M) (as of Sept 2016).

Ref	QMA Technology Variables	Session 1 Group Coordinates (x,y) (n=8)		Session 2 Group Coordinates (x,y) (n=8)		Combined Sessions 1 and 2 Total Means (M) (X_M , Y_M) (n=16)	
		P1 (x)	T1 (y)	P2 (x)	T2 (y)	Premium (x_M)	Trust (y_M)
1	QR Code Post-Pack Sticker	-2	-1	1	2	-0.5	0.5
2	QR Code Self-Standing Display	-1	-3	-1	3	-1	0
3	QR Code WeChat Payment	-3	4	-4	4	-3.5	4
4	QR Code Labels and Display	-1	3	2	4	0.5	3.5
5	LCD Temperature Monitor	1	3	4	4	2.5	3.5
6	Beef Trace NFC Chip and App	2	3	3	1	2.5	2
7	Augmented Reality Origin	3	2	2	1	2.5	1.5
8	Live Cow Cam	4	3	4	3	4	3
9	Augmented Reality How To Guide	3	4	2	3	2.5	3.5

Note: P = Premium values including -ve values of Doubt, T = Trust Values including -ve values of Everyday. Negative values are highlighted in **RED**. P1 = Premium Session 1 Group Coordinates.

The Combined Total Means results for the two AR elements are reported as: Element 7 positively rated for both Premium (+2.5) and Trust (+1.5), whereas Element 9 rated

positively on Premium (+2.5) and Trust (+3.5). Although, a difference in Trust means is evident, the Premium means are equal.

The Technology Scatterplot (Figure 82) visualises the Total Combined X, Y coordinates as Means. The reference numbers refer to the number of Technology elements ranging from 1 – 9. The results show that the Technology elements referenced 1, 2, and 3 were ranked in the Everyday (-ve), Trust (+ve) quadrant (Q2). Whilst elements 4, 5, 6, 7, 8 and 9 were all positioned in the Premium (+ve), Trust (+ve) quadrant (Q4).

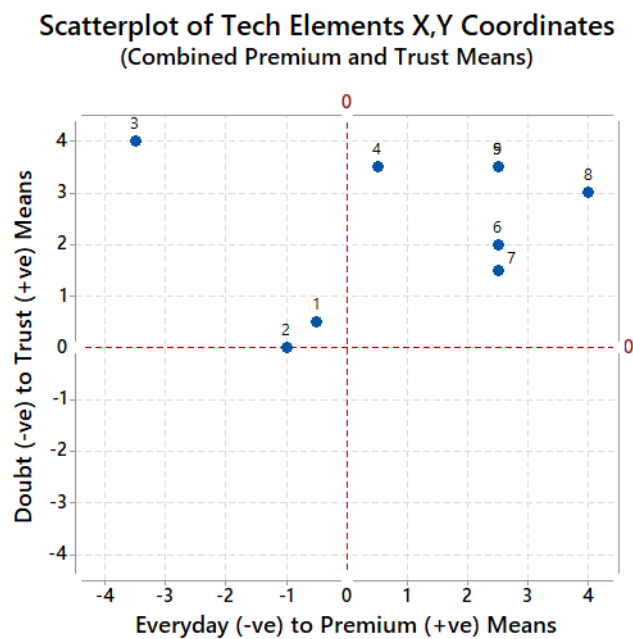


Figure 82. Scatterplot of Technology Elements Total X_M , Y_M Coordinates.

The overlayed individual results are shown in Figure 83 of the Premium and the Trust Mean Coordinates. This enables the individual technologies to be ranked on both the X and Y axis to identify the technologies that are deemed separately premium and trustworthy from Australia. It is noteworthy that Trust and Premium scores are similarly found for technology elements 1, 2, 5, 6, 7, 8 and 9 with both scores approximately 1 score distance from each other. In comparison, technology elements 3 and 4, both representing versions of QR codes, have significant differences between their Premium and Trust scores. Element 3 has an average combined score that is Everyday (-3.5 rating) and Trust (+4 rating). Element 4 is rated slightly positive on Premium (+0.5 rating) and strongly positive on Trust (+3.5 rating). These results clearly show that Trust and Premium can individually be influenced.

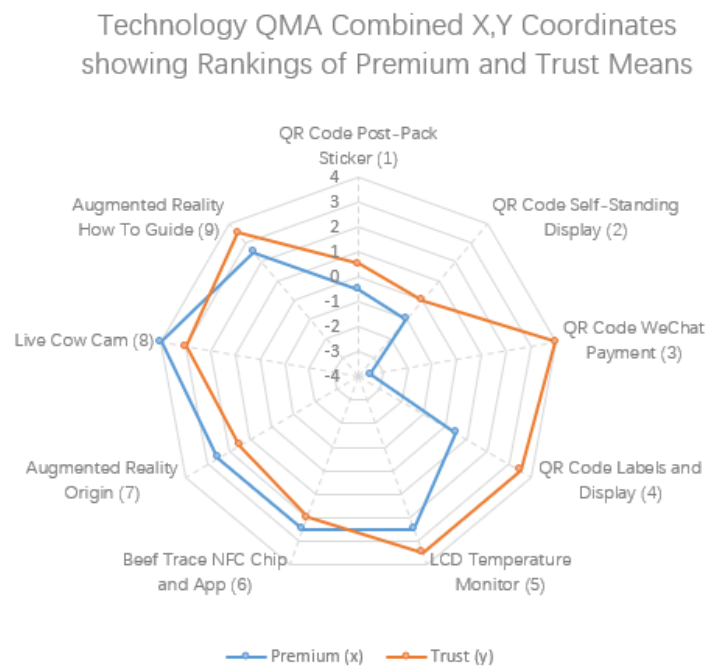


Figure 83. Radar Plot of Technology QMA Combined X_M , Y_M Coordinates.

4.1.3 Clustered Insights Results

The following outputs report on the results from the Design and Technology Clustered Insights. Firstly, the summary tables are structured to show the list of elements and the two group sessions comments transcribed within the QMA study. From the participant appraisals, common concepts were identified and clustered. Five emerging concepts or factors were seen to influence the group-appraisal rankings of either accepting or rejecting an element.

The five *Design-Driven Influencing Factors* (DDIFs) commonly discussed by participants throughout the study are briefly described below as:

- Factor 1: *Fitted* is the design and/or security attribute's 'appropriateness' to the applied product category or type.
- Factor 2: *Layered* uses various quantities of complimentary design and/or security elements to reinforce authenticity and reassure consumers through multiple channels.
- Factor 3: *Identity Linked* are connections to authentic references and are an important factor for origin reference.
- Factor 4: *User-Purposed* represents the idea of a design and/or technology's usefulness to the consumer.
- Factor 5: *Embedded* is the term describing the completeness of a product's design and applied technologies.

These factors are detailed in full and further discussed in Chapter 5.0 Analysis, Section 5.2.1 Design-Driven Influencing Factors. To confirm the presence of the identified factors, each transcription was re-analysed, and colour coded using three options of yellow, green or white. *Yellow* indicated a participant's negative response to an element that correlated to a specific factor. *Green* represented a participant's positive response to an element relating to a certain factor. A *White* cell indicates the response had no relationship to the aligned factors and was not identified as a group influencer and offered little insights.

The following results show the Design Clustered Insights (Table 24) and the Technology Clustered Insights (Table 25) which will be further discussed in Section 4.2 Analysis.

Clustered Insights for Design Results (sessions 1 and 2)

ELEMENT DESCRIPTION	PREMIUM	TRUST	REF
Tray with Organic Label	+ve	+ve	1
Professional Photo w Aust Logo	+ve	-ve	2
Tray with fun colourful design	-ve	-ve	3
Tray with designer label	+ve	+ve	4

SESSION 1: DESIGN COMMENTS CAPTURED	FITTED	LAYERED	IDENTITY LINKED	USER - PURPOSED	EMBEDDED
This one looks like it is from an Australian store					
It is certified organic who says so though?					
ohhh, the meat looks good to eat!					
Ok I would also try this. It looks like it is from a store.					
It looks like it is from Australia. I would buy it.					
Ok, trust and premium?					
Yep					
(places image in trust and in premium)					
This one has the grading award logo so it seems premium					
The logos are good but I cannot see the meat so I don't trust it					
Yeah, they are hiding something, the picture looks good but inside?					
Ok, so if this was on a box packaging it would be premium					
But if we can't see inside, the meat could be off or fake					
Ok, let's put it as low as we can on doubt and into premium					
Ok					
nodding					
(places image in doubt and in premium)					
Oh, this looks a bit more designed with all the products the same					
A bit more premium but anyone could have done this					
It doesn't say it is from Australia					
The pictures are animals, see!					
Oh that funny but I don't want to see the animals cut up					
So low on trust but over the line for premium yeah?					
Ok					
Sure					
(places image in doubt and in just into premium)					
This one is good, you can see the meat insight the packaging.					
I really like this one, the packaging has a brand and logos					
I like the meat photo and seeing inside the packaging					
The meat looks good quality, I would buy this one.					
This looks like you would find it in Australia. On the shelf.					
Nodding, all agree					
Nodding					
"Ok"					
(places image in high level of trust and in premium)					

SESSION 2: DESIGN COMMENTS CAPTURED	FITTED	LAYERED	IDENTITY LINKED	USER - PURPOSED	EMBEDDED
Well this one looks like something I would find here.					
Yeah but what does the label say? Certified Organic- hmm not sure					
Yeah, the organic label is just a sticker, it should be on the label					
I can't see what is on the main label, it is unclear					
It looks ok but not really great hey?					
Nodding...passes it					
Sure. I agree					
Put it near the centre, just up a little.					
(places image in trust and everyday)					
Ok, this looks nice but it is just a photograph?					
Anyone could take a picture, I want to see into the meat					
Sure, it has the AustLogo but who knows if it is really from there?					
At least I can check online the grade mark, but it could be copied					
Nahhh, not sure, what do you think?					
It looks like something copied from online					
Ok, so low on trust, here...					
I think higher than the last one.					
(places image in doubt and in everyday)					
Ah ha ha, look the packaging has silly animals shapes cut out					
weird, that's different but I don't know where it is from.					
I don't want to see the meat through animal shapes					
Oh yeah, now that you say that (looks closer and frowns)					
There is no more information.					
Someone could have put this together in China.					
It doesn't say where it is from or anything I could check.					
Ok, here?					
(places image in doubt and in everyday)					
Hey, this one looks professional and you can see the meat					
Yeah, it also has information on the label I could check out					
It just looks better, I think I would trust this one definitely					
It has logos and I can see the meat, it looks like it is from Aust.					
Yeah, it looks fresh and clean. I like it					
High on trust, oh just a little down and in premium					
Doesn't look too expensive so not too premium, yep					
"Ok"					
(places image in trust and premium)					

Clustered Insights for Design
(continued over page).

ELEMENT DESCRIPTION	PREMIUM	TRUST	REF
Tray with livestock image	+ve	+ve	5
B&W minimalist design label	+ve	+ve	6
Sleeve Pack with Chinese Text	-ve	-ve	7
Card Box with Info Booklet	+ve	-ve	8

SESSION 1: DESIGN COMMENTS CAPTURED	FITTED	LAYERED	IDENTITY LINKED	USER-PURPOSED	EMBEDDED
Ok, this is clean and neat, I can read the information, it is good Yes, it has the Australia symbol and other information Ok, but I don't want to see the animals and cut up meat behind it Yeah, but the name is Eversfield organic diced lamb, sounds good Sure, I would like to try this. I trust it is from Australia Me too Nodding Here. Good (places image in trust and in premium)					
I like this design, I can see the information clearly The design is simple but clean It is also from Australia, see the logo down the bottom The meat is sealed which would keep it fresh yes, this one looks great It looks a bit expensive though Sure, but I want to have high quality if buying from Australia Me too. Here? (places image in trust and in premium)					
Ok, this one looks good, it looks clean and there is some info I don't really like the picture but the sheep look happy I can see some more logos that I could look into Not really premium though, is it? Sure, put it here. Yeah, I would buy it. Maybe, the label is simple So here? Ok. (places image in trust and everyday)					
Ok, I can see what the packaging looks like and it is a nice design Not really premium but just a little maybe The meat looks a little dull but I think I would try this product. Hey look, it has an Australian logo and the QR code with ingredients Good one, I would put this one in trust and premium Yeah, I guess I would eat this. I can see clearly the information here Put it here maybe A little less premium, ok. (places image in trust and premium)					
This image doesn't look right, the sticker looks cut off Yeah, and the meat looks too dark I have never seen this brand before, there is no real brand logo It uses premium colours though, black and gold Ok, well we could put it in premium but doubt, where though? Same place as the cut meat photo but just slightly higher on trust Really, ok, I guess you can see the meat, they aren't hiding it Ok (places image in doubt and in premium)					
Not sure if I like meat in a brown box but here we go It has much more information, look they give you a booklet What would the booklet say, information about the meat cut? It has a window so you can see the product Yeah but I still don't see that it is from Australia Ok, I can see that, that is missing So we don't trust it but it still looks premium? Yes (places image in doubt and in premium)					

SESSION 2: DESIGN COMMENTS CAPTURED	FITTED	LAYERED	IDENTITY LINKED	USER-PURPOSED	EMBEDDED
Wow, this looks not too good! The meat looks too dark. Look, the sticker is just stuck on and looks crooked, I don't trust this Definitely not from Australia and pretending to be premium Chinese text is ok but the design looks cheap to me Yeah the sticker doesn't look right, where did you find this? The meat looks like it is in a bag, it doesn't look fresh It doesn't look like a 1kg pack anyway Put it as far away from trust and premium as possible. (places image in doubt and in everyday)					
Alright, this one has more information and a booklet Ummm meat in a cardboard box, not sure But at least it looks like a product you could find more info Yeah but the packaging looks too plain. Not sure if I would buy it I like how you can see into the pack but I still am not sure Well we trust it more than the picture with the photograph, yeah? I think we can put it close to the middle, this ok? Ok, a little down because I can't see where it was made. (places image in doubt and in everyday)					

ELEMENT DESCRIPTION	PREMIUM	TRUST	REF
MLA Promotional Event	-ve	-ve	9
Australian farmer family photo	-ve	-ve	10
Structural pack heartsmart	-ve	-ve	11
Imagery of cooked meat	-ve	-ve	12
Imagery of premium design	+ve	+ve	13

SESSION 1: DESIGN COMMENTS CAPTURED	FITTED	LAYERED	IDENTITY LINKED	USER-PURPOSED	EMBEDDED
Does anyone know who is MLA? I do, I think it is a meat group here, looks like they are promoting Oh, ok, well I can't see what they are doing I wouldn't want this on my meat packaging, Anyone could get it Sure, let's put really low on trust and premium How about we push it up a little as this person knows MLA Yeah but it could be copied from online right Sure, ok, let's put it here. (places image in doubt and in everyday)					
Nice photo of the farmer's family but it means nothing They look healthy, maybe the product is good for buyers too? Umm, maybe, not sure It makes me want to visit that place. But it says nothing about the product, this is to be on the product oh ok, well then, we should put it down here as we can't trust it yes, further down. ok (everyone agrees to place it low in doubt and low in everyday)					
Ha ha, this is interesting, a heart shaped packaging, cool Is the meat a heart, I wouldn't buy a heart! No I think it is saying it is healthier for you. This is kinda good Yeah but the label is just stuck on, I can't read the information So we don't think it is from Australia? Naa, it could be from anywhere It looks like it cost a lot to make, right Ok, let's put it here. (places image in doubt and in premium)					
I guess we can see the product this time but it is still a photograph The meat looks fake - too raw and also overcooked. If this was all that was on the pack I wouldn't buy it It looks ok to me but I need more info. Put it here, maybe ok nodding ok (places image in doubt and in everyday)					
Can you see the information in this picture? A bit, the packaging looks nicely designed, I would like to try it You can see the meat and how to cook it, I think. I like it too Ok well should we put it here. I think it looks more premium than the organic one. Move it over to the right OK "Ok" (places image in trust and in premium)					

SESSION 2: DESIGN COMMENTS CAPTURED	FITTED	LAYERED	IDENTITY LINKED	USER-PURPOSED	EMBEDDED
MLA, who is that? It looks like some chefs in China. I think it is a celebrity chef demonstrating products. I don't trust this as I don't know who MLA is or the chefs Those people look interested, the good could be good. I would have to see more information and the packaging to trust it I don't trust this at all. The photo could be from MLA website. Yeah (passes it on) I guess if I wanted to know more, I could look up MLA (places image low in doubt and everyday)					
"I don't want to see an Australian family on my packaging!" This doesn't tell me anything about the product Cute kids but not mine I guess the environment looks clean Their the farmers that produce the meat products. Maybe this could be on pack but I would need to see it to trust it I don't trust it at all, someone could have copied it from online It doesn't say anything, I don't trust it (everyone agrees to place it low in doubt and low in everyday)					
Oh wow, that's weird, a heart shaped pack, hmmm, no. Cook pack but I wouldn't buy it, the label looks stuck on. The design is pretty cool but the label is not on right... I wouldn't expect this from Australia and there is little information It doesn't look complete, nice packaging but no proper label Have you seen this in Australia? This is not Australian Ok, so don't trust and not premium but higher than the Chinese one Make it not premium because it looks silly and has no proper label (places image in doubt and in everyday)					
Oh, The meat looks cooked on the outside but raw on the inside! I am not sure if I like the look of this meat, it looks fake Yeah, the meat looks to square, see and the inside looks too red I don't know anything about the packaging or the brand, not sure I have no other information to look up to see if it is authentic I don't think it is from Australia do you? Naa, let's put it here Lower, move it lower, yeah there (places it low into doubt and everyday)					
This one looks a bit better designed, what do you guys think? hmm, yeah but I can't see if it is from Australia or any other info Is this English on the packaging? The meat looks ok, the packaging looks ok... Let's place it close to the edge then? It needs more information that I can read Yes! Here then. (places image in trust and everyday)					

Clustered Insights for Technology Results

ELEMENT DESCRIPTION	PREMIUM	TRUST	REF	SESSION 1: TECHNOLOGY COMMENTS CAPTURED	FITTED	LAYERED	IDENTITY LINKED	USER-PURPOSED	EMBEDDED	SESSION 2: TECHNOLOGY COMMENTS CAPTURED	FITTED	LAYERED	IDENTITY LINKED	USER-PURPOSED	EMBEDDED
QR Code Post-Pack Sticker	-ve	+ve	1	"QR codes are everywhere, they are common."						This QR code is stuck on with a word next to it. It looks not real.					
				"But look, it is stuck on like a sticker, not on the label."						Yeah, the film over the meat also looks like it has been poked too.					
QR Code Self-Standing Display	-ve	+ve	2	"Ahhh...yes, I don't like this. It doesn't look professional."						This product does not look real. I would not trust it.					
				"Let's move it down a bit further as it looks used."						But if the QR code told you more information then this could help					
QR Code WeChat Payment	-ve	+ve	3	"Ok."						Maybe, but I would expect a better label					
				"I don't know what this is for, there is no explanation."						The meat looks good though. It looks high quality.					
QR Code Labels and Display	+ve	+ve	4	"More everyday than premium."						I don't like the QR code, it should be on the label but the meat looks good					
				"I don't trust it because there is nothing else on the pack"						Should we put it just into trust and premium because of the meat?					
				(places it more everyday but slightly towards doubt)						(places it just inside everyday and premium)					
				"Hm--Anyone could have put that QR code there"						"I would prefer visual image rather than a big QR, not cool"					
				"It doesn't look professional. I would rather it on the labels"						"Still it looks official, I trust it"					
				"QR codes are supposed to be on the product right?"						"Normally, if it is imported into China, it is wrapped up in plastic"					
				"Yeah maybe, not sure"						"What does it link too? I have no idea what this is for?"					
				"If it is going to be this big, it has to be better designed for me"						"I wouldn't use this"					
				"I wouldn't use it"						"Me either"					
				"I only use QR codes if I can get something, I can't see what"						"If I scan this, I would like to get something back. They get my ID!"					
				"Ha ha freebies"						no comment					
				(places image midpoint of everyday/premium and doubtful)						(places image slightly everyday and midway to trust)					
QR Code WeChat Payment	-ve	+ve	3	"Oh I have used this, everyday for everything online"						"Ah WeChat, I have used this a lot, good with tracking payments"					
				"Yeah it is quite useful, I don't ever carry cash anymore"						"A simple system, easy to use, I trust it"					
				"If a product or store uses this, I will trust it everyday"						"To purchase meat, I would trust this more so than other sites"					
				"I haven't use it but I know lots of friends back home who do"						"It's a nice layout too, step by step"					
				"It just makes sense, you get digital receipts as well."						"I haven't use it, I don't buy many things online"					
				"Yes, I use this back home in stores and also online here"						"Really? Normally it is cheaper online, you should try it"					
				"Most people use this or Alipay or something else"						"Yeah and if the product isn't good, you can send it back refunded"					
				"Online stores that don't use this I don't normally buy from"						"cool"					
				(places it high on trust and high on everyday)						(places it high on trust and high on everyday)					
				"This is better, it is on pack with a poster showing what it does."						It looks like a lady scanned a QR code with her phone in a store					
				"yes, much better than the other ones."						Ok, it would be good if you could find out more information					
				"I probably wouldn't use it but it looks more professional"						It looks like the sign at the back explains how it works, that's good					
				"If I had to choose, I would buy this meat"						The QR code is on everypack behind her. I would scan it once.					
				"The packaging looks clean and the meat looks fresh"						It depends on what the information says, I would use it too					
				"Look closely, they have 3 signs, QR code and two on the shelf."						It looks good, I think I would trust this. It looks premium too yeah?					
				"Push it higher on trust, I would buy this everyday"						Packaging looks clean					
				"Not too expensive looking"						Ok, should we put it higher, ok here.					
				(places image high on trust and slightly closer to everyday)						(places it high on trust and high on premium)					

Table 25. Clustered Insights for Technology Results (continued over page).

ELEMENT DESCRIPTION	PREMIUM	TRUST	REF	SESSION 1: TECHNOLOGY COMMENTS CAPTURED	FITTED	LAYERED	IDENTITY LINKED	USER-PURPOSED	EMBEDDED
LCD Temperature Monitor	+ve	+ve	5	"Oh this is cool, look it shows the temperature of the meat."					
				"Wow, it looks like it shows if the product got hot or not."					
				"I would buy a product with this."					
				"It isn't as premium as augmented reality or the camera"					
				no comment (passes product along)					
Beef Trace NFC Chip and App	-ve	+ve	6	"It looks expensive to me"					
				"It would be better if put into the packaging so you see only the LCD."					
				"I like it, I like this idea."					
				(places it near trust anchor.)					
				"What is this? Oh it is the journey from the farm."					
Augmented Reality Origin	+ve	+ve	7	"It isn't very easy to understand though, is it?"					
				"A bit too much information or not well presented"					
				"I wouldn't use this, a bit too premium for me"					
				"It isn't clear but I think it is good if it was better designed."					
				"It would be good if it showed where it was processed and packed"					
Live Cow Cam	-ve	+ve	8	"I think if the information updated, this would be better"					
				"I think I would use it only once but then I might trust it after that"					
				(places it high on trust and premium)					
				"Why would you used Augmented Reality on a meat burger?"					
				"This is a new way to communicate the ingredients and information"					
Augmented Reality How To Guide	+ve	+ve	9	"Sure but I would only use it once"					
				"But all that effort to create the animations makes me trust it"					
				"I wonder if it tells you where the potato is from?"					
				"I think it would be expensive though, more premium"					
				"I would show my friends, it probably takes you to their website"					

4.2 Analysis (Study 1) - Qualitative Consumer Appraisals

4.2.1 Overview for Analysis

The purpose of the first assessment appraising Design elements was to initially test if design impacted perceptions of premium and trust? This was achieved by consumers assessing visuals of packaging attributes selected on varying degrees of design-contributions to test the driving assumption that design-driven elements would be ranked higher than those without.

The first hypothesis of design positively impacting trust and quality perceptions was supported and is discussed in this section, which then allowed the second and primary research question concerning design-driven technologies to be assessed. It was assumed that design-driven technologies would be ranked higher on trust and premium status compared to those with less design-embedding.

Therefore, the structure of Section 4.2 firstly introduces the five identified Design-Driven Influencing Factors termed throughout the analysis as DDIFs (Section 4.2.2), followed by the individual assessment of the Design Elements (Section 4.2.3) and the design impact on the Technology Elements (4.2.4), with a summary of the proposed theory of the impact of DDIFs (Section 4.2.5).

4.2.2 Design-Driven Influencing Factors

The collated results, taken from the ranked coordinates and the transcriptions captured across each appraised element, were further analysed into clustered groups of reoccurring concepts. These clustered concepts are called Influencing Factors. It was evident that five factors acted as drivers of positive perceptions on Premium and Trust rankings. These factors are design oriented in nature and therefore are classified as *Design-Driven Influencing Factors* (DDIFs). They are listed in Table 26 which shows in each listed column: The Factor Reference Number, the DDIF Title, the DDIF Definition, and the driving Parameters of Trust; previously used as Selection Criteria for designing the experiment and elements (defined further in Chapter 3, Section 3.3). The expanded definitions (below) for each DDIF is provided to clarify terminology meaning with terms used throughout the remaining analysis sections for Design (Section 4.2.3) and Technology (Section 4.2.4).

Table 26. Design-Driven Influence Factors (DDIFs)

Factor Ref.	Design-Driven Influence Factors	Definitions	Parameters of Trust (Criteria)
1	Fitted	Appropriateness of the Design/Technology (<i>perceived usefulness to product category or type</i>)	Capability
2	Layered	Married levels of detailed authenticity checks (<i>multiple layers that reveal quality and detail</i>)	Transparency
3	Identity Linked	Connections to country of origin (<i>supported by third party testimonials and awards</i>)	Familiarisation
4	User-Purposed	Invitation to engage through perceived attraction (<i>ensuring the expected reward is greater than the cost</i>)	Reward
5	Embedded	Professional product using holistic design (<i>demonstration of sophisticated integration</i>)	Ability

Factor 1: *Fitted* is the perceived ‘appropriateness’ of the design and/or security to the applied product category or type. For example, does the design or security suit the type of product when comparing across categories such as an RFID tag on a premium meat packaging compared to a premium wine bottle? The analysis showed that not all elements were naturally fitted to all product categories. However, perceived fitness could be improved by overlapping Design-Driven Influence Factors. An example of this is provided over the comparison of two elements both representing the same AR technology (Figure 84). The same group appraised both elements with Element 7 (top) initially rejected as not being appropriate for food packaging and rated 1 on Trust,

whereas element 9 (bottom) was accepted and praised for its usefulness and rated 4 on Trust. Whilst this example shows a certain technology may be initially perceived as unfit for the food industry, pairing it with User-Purposed information (Factor 4) can positively increase its acceptance and trust. This is seen for Element 9 which represents an option of AR Technology, previously perceived as inappropriate for meat packaging. As Element 9 portrays relevant and valuable content to the consumer, the overall trust rating is significantly increased comparative to Element 7. The perceived reward of purchasing this product has positively impacted the perception of the technology. Thus, the usefulness of the technology becomes evident and consumers acceptance strengthened.

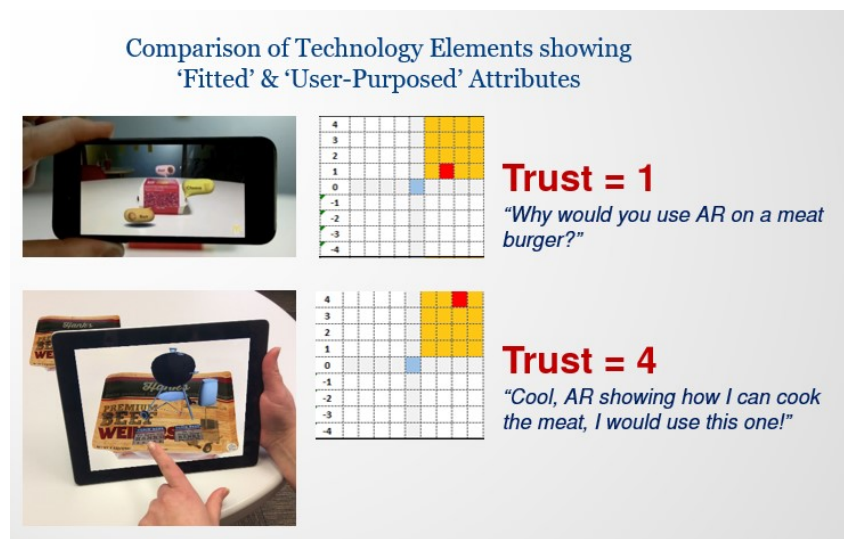


Figure 84. QMA Technology Element 7 (top) and Element 9 (bottom) compared on Fitted and User-Purposed DDIFs with Transcriptions.

Factor 2: Layered uses various quantities of complimentary design and/or security elements to reinforce authenticity and reassure consumers through multiple channels. These channels can be visual, tactile, digital, transparent or even hidden with a discoverable attribute. For example, technologies can be either Overt (seen by the naked eye) or Covert (hidden). Layering allows for the use of both such as, a Covert hidden security technology that is revealed through an Overt security seal which together produce a two-fold effect: (1) deterring potential fraudsters and (2) protecting consumers trust. In addition, Layering can be the multiple levels of cross-examination of quality such as the imagery used on pack (first level) compared to the real product through transparent packaging (second level) and a scan code to seek more information (third level). An example of this is shown in Figure 85 which compares element 2 (left) with element 4 (right) on Identity Linked and Layered design-driven attributes. Although

both elements showed clear use of Identity Linked logos and badges, element 4 was rated 8+ points higher than element 2, as element 4 applied Layered design-driven attributes. Element 4 depicts a packaging design that demonstrates multiple levels of information that in turn reduce perceived risk. These include the transparency of the packaging to enable consumers to judge the meat quality against the professional imagery and labelled quality claims significantly impact on participants perceived trust.

Factor 3: Identity Linked factors are important to origin reference. Elements that made use of imagery, storytelling and badges that linked to authentic references were positively perceived. The Australian made logo, local awards or association badges were essential as they acted as integrity checkpoints. Identity links were like testimonials from a third party or an image that referenced a geographical location that could be later researched. Identity links enabled consumers the option of investigating additional reputable websites that offered independent reviews of the sort out product, providing evidence for authenticity. Referencing Figure 85, the two elements both demonstrate Identity Linked attributes. However, they significantly differ in Trust ratings with Element 2 (left) negatively rated Trust at -4 compared to Element 4 (right) positively rated at +4. This example shows that Identity Linked are not enough in themselves to justify consumer trust although they are necessary. This suggests that consumers acceptance of a new product can be influenced by bundling design-driven factors, to be tested in Study 3.

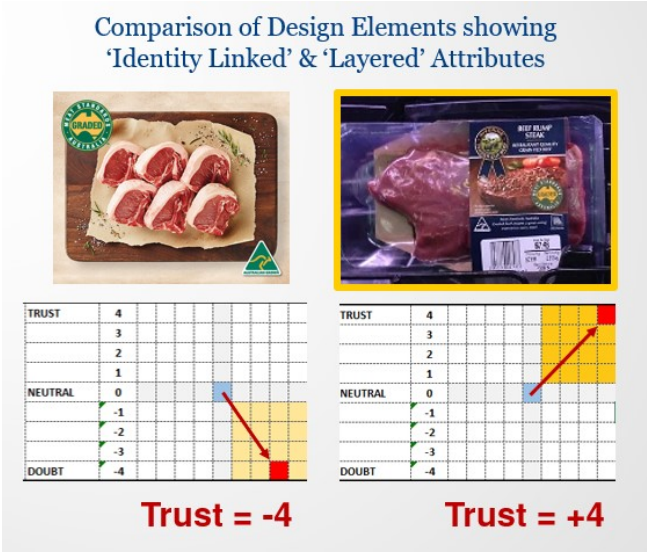


Figure 85. QMA Design Element 2 (left) and Element 4 (right) compared on Identity Linked and Layered DDIFs.

Factor 4: User-Purposed represents the idea of a design and/or technology’s usefulness or perceived reward for the consumer. For example, if the designed digital content

presented by a technology is perceived to be useless, then this negative perception was seen to be passed onto the technology itself. The perception of Premium and Trust of a technology's purpose was connected to the usefulness of the overall outcome for the consumer. An example of User-Purposed is provided earlier in Figure 84. Overall, Chinese consumers are tech-savvy and willing to participate in authenticity check measures. Participants preferred technology to be openly purposeful for them. Inviting investigation or connection which would lead to offering a 'reward attraction' (Siau and Shen, 2003) beyond the immediate information.

Factor 5: *Embedded* is the term describing the completeness of a product's design and applied technologies. All attributes presented as one holistic design with respective technologies decisively planned into the overall packaging. For example, if a technology element was presented with an incomplete design or was not professionally placed within the branded label (Figure 86), it was deemed dubious. Although, embedding a technology with design into the overall label takes time and planning, the results indicate a strengthened perception of trust for the technology application.

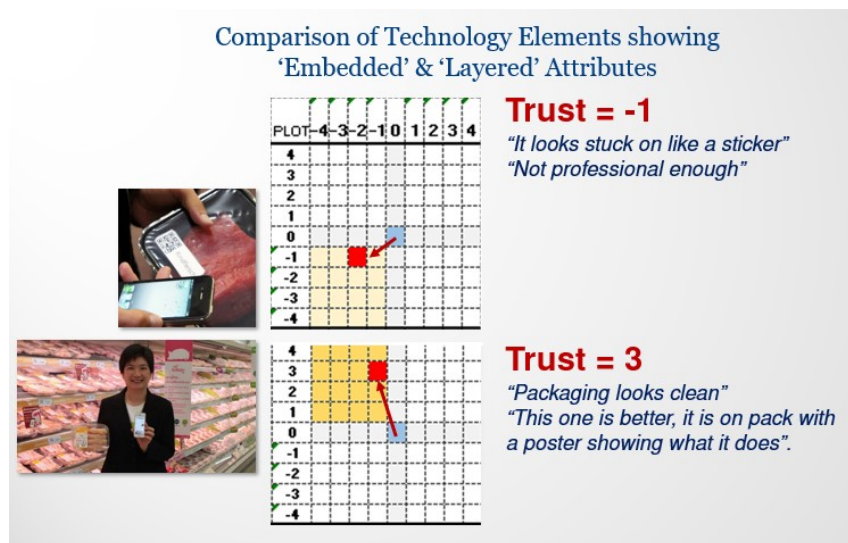


Figure 86. QMA Technology Element 1 (top) and Element 4 (bottom) compared on Embedded and Layered DDIFs with Transcriptions.

The analysis will now present the findings and discussion dedicated to the results of the Design elements and Technology elements separately.

4.2.3 *Design Elements Analysis*

From the collated Design Elements Results (Chapter 4.0, Section 4.1.2 X, Y Coordinate Results, and Section 4.1.3 Clustered Insights Results), insights were interpreted from the analysis and are discussed in full in this section. To further compare the results on commonalities and differences, the Design elements were ranked and hierarchically ordered on their averaged scores (Table 27). The table's first two columns list the individual rankings for both Premium and Trust scores, followed by a column dedicated to the Total Average Ranks and their respective quadrants (Q1 through to Q4) with 1 being the most desirable (+ve, +ve) and 4 being the least desirable (-ve, -ve). The Total Average Ranked scores average together the Premium and Trust scores.

Top 5 Ranked Elements (Quadrant 1)

Reporting the Total Average ($\bar{x}$) Ranked top 5 scoring elements plotted in quadrant 1 (Q1) are as follows: (Rank 1) Element 4: Tray with designer label, (Rank 2) Element 6: B&W minimalist design label, (Rank 3) Element 13: Imagery of premium design, (Rank 4) Element 1: Tray with Organic Label, and (Rank 5) Element 5: Tray with livestock Image. All top 5 elements were plotted positively for Premium (+ve) and Trust (+ve).

The top 5 ranked elements represented packaging with designer inputs or significant health/quality claims such as Organic. It was noted that although element 1 was rated strong on Premium and Trust due to the benefits of organic claims applied as a sticker, the element was moved further down from the top ranked position as the packaging label did not have any additional information other than the organic sticker. This suggests that although the organic claim acted as an Identity Link and a strong influencer on trust, it was weakened by the lack of design embedding into a complete label, nor provided Layering of complimentary information. The top 5 ranked elements, apart from element 1, presented additional information and recognisable elements which resulted in higher positive scores.

Table 27. Design QMA Ranked Results showing Individual Premium and Trust Rank Scores and a Total Average Rank Score (as of Sept 2016).

Ref	QMA Design Elements	Premium	Trust	Total Average $= \sum (P1+T1+P2+T2)/4$	
		(P) Rank	(T) Rank	($\bar{x}$) Rank	Quadrant
4	Tray with designer label	1	1	1	1
6	B&W minimalist design label	2	2	2	1
13	Imagery of premium design	4	3	3	1
1	Tray with Organic Label	5	4	4	1
5	Tray with livestock image	7	5	5	1
8	Card Box with Info Booklet	3	6	6	3
11	Structural pack heartsmart	10	7	7	3
2	Professional Photo w Aust Logo	6	8	8	4
3	Tray with fun colourful design	8	9	9	4
12	Imagery of cooked meat	12	8	10	4
7	Sleeve Pack with Chinese Text	9	12	11	4
9	MLA Promotional Event	11	10	12	4
10	Australian farmer family photo	13	13	13	4

Total Average Rank Score is calculated by summing the four sessions x,y values of P1, P2, T1, T2 and then averaging the score. The four Quadrants are ranked from most desirable outcome (Q1) to least desirable outcome (Q4). Premium (P) Rank reports X-axis and Trust (T) Rank reports Y-axis.

Top 1 Ranked Element

When considering the transcriptions relating to element 4 (the number 1 ranked element), positive comments were made by participants on the product and what influenced their group perceptions of Premium status and overall Trust. These summarised comments show the association with the DDIFs defined in Section 4.2.2.

1. *the packaging used visible branding, logos and awards (Identity Links)*
2. *the label design used meat imagery that presented high quality that could be confirmed through the transparent packaging (Layered and Embedded)*
3. *the real meat product was visible enabling the consumers to judge texture and quality to their expectations (User-Purposed)*
4. *the product looked like products already purchased in-store (Identity Links)*
5. *the packaging looked professional (Embedded and Fitted)*
6. *the packaging had additional information that could be researched (Layered)*

Overall, these summarised comments suggest that the professional designed product influenced the overall appeal strengthening the rating that indicated perceived premium status and trust.

Bottom Ranked Elements

Elements depicting independent images that were not presented on a full packaging design including positive attributes of Australian scenery or endorsements of celebrity chefs were ranked negatively lower in the Doubt quadrants. These elements indicated attributes that were questionable, unclear and were perceived without a holistic design. For example, Element 2 Professional Photo of red-meat cuts with Australian Made Logo was ranked 6th (Session 1), and 8th (Session 2) suggesting that although the visual presented a professional photograph and included Identity Links such as the AustMade Logo, the image was not Embedded into an overall packaging design and therefore, was negatively impacted causing doubt. Although, this suggests that the Australian Made Logo contributes to trust, it is not a stand-alone trustworthy element for Chinese consumers and additional trust elements need to be present to overcome perceived risk.

Negative Impact on Design-Driven Elements

The overlapped individual rankings of Premium and Trust scores presented in the Radar Plots (Chapter 4 Results, Section 4.1.2) show that Element 7: Card Box with Info Booklet was a design-driven product. It was perceived as Premium because of its layering and additional information delivered through a pull-out booklet. However, this element was ranked lower in trust compared to other elements with multiple information levels as it did not confirm country of origin or show a brand logo, according to the analysed transcriptions. Although, this indicates that the Australian Made Logo and other badges such as awards play a substantial role in confirming a products authenticity, as previously pointed out in the example of Element 2 and Element 4 (Figure 85), they require additional trust guarantees using multiple DDIFs. These collected findings suggest that together, identity icons and packaging that are design-driven are essential in authenticity and quality checks. This pilot study is to inform the large-scale quantitative Study 3 to confirm insights, designed to test Chinese expected trust elements on various food packaging designs, compared to Australians.

Interesting, another finding on the impact of design-driven elements was the negative perception of associating real animals on the packaging labels next to the view of cut meat. For example, two elements depicted photographs or representations of live animals and were impacted as a result. Element 3 = 'Tray with fun colourful designs', rated on combined average (-0.5, -2.5), showed stylised but recognisable animal shapes as windows into the product with a participant comment stating, "I don't want to see the

animals cut up”. Element 5 = ‘Tray with livestock image’, rated on combined average (0.0, 2.0), presented a label showing sheep and lambs in a farm with green grass, with a respondent saying, “I don’t really like the picture, but the sheep look happy” and another stating, “I don’t want to see the animals and cut up meat behind it”. Both elements were considered less attractive to the Chinese consumers as they did not consider the User-Purposed DDIF, although both packs were professionally designed. This shows that cultural perceptions can cause negative ratings on Premium and Trust of a product and there is a need to study cultural differences on the perceptions of anti-counterfeiting and design trust which is examined further in Study 3 (Section 4.5 and Section 4.6).

4.2.4 Technology Elements Analysis

The results from the Technology Elements (Chapter 4.0 Results; Section 4.1.2 X, Y Coordinate Results, and Section 4.1.3 Clustered Insights Results), presented insights that were translated and are discussed in this section in full. Following the same process of the design elements analysis (Section 4.2.3) the results were ranked and ordered for comparison (Table 28). The table's first two columns list the individual rankings for both Premium and Trust scores, followed by a column dedicated to the Total Average Ranks and their respective quadrants (Q1 through to Q4) with 1 being the most desirable (+ve, +ve) and 4 being the least desirable (-ve, -ve). The Total Average Ranked scores average together the Premium and Trust scores.

Top 6 Ranked Elements (Quadrant 1)

The results reported 6 scoring elements plotted in Quadrant 1 and the Total Average ($\bar{x}$) Ranks are as follows: (Rank 1) Element 8: Live Cow Cam, (2 placements drew for Rank 2) Element 5: LCD Temp Monitor, and Element 9: Aug Reality How to Guide, (Rank 3) Element 6: Beef Trace NFC Chip, (2 placements drew for Rank 4) Element 4: QR Code Labels and Display, and Element 7: Aug Reality Origin. All top 6 elements were plotted positively for Premium (+ve) and Trust (+ve).

Table 28. Technology QMA Ranked Results showing Individual Premium and Trust Rank Scores and a Total Average Rank Score (as of Sept 2016).

Ref	QMA Technology Elements	Premium	Trust	Total Average $= \sum(P1+T1+P2+T2)/4$	
		(P) Rank	(T) Rank	($\bar{x}$) Rank	Quadrant
8	Live Cow Cam	1	3	1	1
5	LCD Temperature Monitor	2	2	2	1
9	Augmented Reality How To Guide	2	2	2	1
6	Beef Trace NFC Chip and App	2	4	3	1
4	QR Code Labels and Display	3	2	4	1
7	Augmented Reality Origin	2	5	4	1
3	QR Code WeChat Payment	6	1	5	2
1	QR Code Post-Pack Sticker	4	6	6	2
2	QR Code Self-Standing Display	5	7	7	2

Total Average Rank Score is calculated by summing the four sessions x,y values of P1, P2, T1, T2 and then averaging the score. The four Quadrants are ranked from most desirable outcome (Q1) to least desirable outcome (Q4). Premium (P) Rank reports X-axis and Trust (T) Rank reports Y-axis.

Design Impact on Individual Technologies

Similar Technology (QR Code) Elements Compared

- Premium (X_M)

Elements 1, 2, 3, and 4 all represented various forms of QR code technology and the two groups of participants comparatively had similar responses to the QR code elements. In comparing against Premium status (Section 4.1.2, Table 23), the Session 1 results (P1) negatively ranked all four QR code elements in the Everyday (-ve) quadrant. Session 2 results (P2) again negatively appraised elements 2 and 3 as Everyday. However, they differed on elements 1 and 4 being slightly positively plotted within the Premium (+ve) quadrant. The Combined Total Means in the Premium (X_M) column indicated that only three technology elements were negatively ranked as Everyday being the first three QR code elements 1, 2, and 3. In contrast, Element 4 was slightly positive with a ranking of +0.5.

This analysis indicates that QR codes are a familiar, common element to Chinese participants and are expected to be seen everyday on food packaging. This leads to the question, does QR codes and other scan type technology reduce a products perceived status? This question is addressed in Study 3. The findings also suggest that all other presented technologies that were less familiar, other than common QR codes, were perceived as a premium element to packaging and were rated significantly higher compared to the QR code elements.

- Trust (Y_M)

When considering the Trust rating of the four QR code elements, Session 1 results (T1) show negative ranking of the first two QR code elements 1 and 2 in the Doubt (-ve) quadrant. The same group ranked the QR code elements 3 and 4 positively on Trust (+ve) quadrant. As for Session 2 (T2), participants perceived all four QR code elements 1, 2, 3, and 4 as trustworthy. However, when comparing the Combined Total Means (Y_M) scores, the results indicate a clear differentiation between the varied QR code elements perceived trust rankings ranging from 0 to 4 points. This clearly indicates that the same technology assessed on varying degrees of applied design can be positively impacted.

Transcriptions captured from the assessment of the low ranking QR code element 2: QR Code Self-Standing Display, supported these findings with comments entailing: “Anyone

could have put that QR code there,” and “it doesn’t look professional, I would rather it on the label”. These comments indicate a lack of design-driven Embedding with the QR code freestanding within the loose green vegetables being sold. There was a lack of integration that caused doubt. Whereas, element 3: QR Code Labels and Display was positively rated (+3.5) indicating a significant increase in trust with comments stating, “This is better, it is on pack with a poster showing what it does” and “look closely, they have 3 signs, QR code and two on the shelf”. These comments again indicate that by adopting multiple DDIFs such as Embedding and Layering, consumers trust perceptions will be positively impacted.

Similar Technology (Augmented Reality (AR)) Elements Compared

Two elements representing the AR technology were presented by Element 7: AR Origin, and Element 9: AR How-to Guide. The Combined Total Means (X_M) results show equal Premium (+ve) ratings (+2.5). However, when comparing the Combined Total Means (Y_M) results for Trust, they differ by 2 points distance (Element 7 rated +1.5 and Element 9 rated +3.5). This indicates that the same technology’s trust ranking was influenced by the presented designed content. For example, element 7 presented content showing a McDonald’s burger ingredients and their origins which wasn’t as trustworthy as the same AR technology presented through element 9 which showed ‘how-to-cook your meat like an Aussie’. Element 9’s designed content was more valuable to the participants and therefore, used User-Purposed content with supporting comments such as “This one is better because I have never cooked a steak”. Element 9 also indicated a strong use of Identity Links to the authentic country of origin compared to Element 7. Comments were made on the need to connect to Australian identity such as, “It is a very Australian thing isn’t it, it makes me trust it a bit more”.

Design Impact on Grouped Technologies

All Technologies Compared

Overall, considering the Scatterplot graphs for the Technology Elements, all elements from 1 to 9 were positively ranked on Trust (+ve) and were found either in the two positive quadrants (Q1 and Q2), with no elements falling into the Doubt (-ve) related quadrants (Q3 and Q4). These results indicate that all the technologies were perceived as trustworthy and accepted as authentic. All technology elements were considered a strong indication of product protection. Interestingly, participants expressed scepticism

when presented with the idea of a packaging design with 6 or more technologies applied to it which was concluded as a group that the product was a counterfeit.

The results also show that the technologies trust rankings ranged from 0 to 4 indicating that technology type and DDIFs contribute to consumer acceptance. For example, Element 8: Live Cow Cam, was the highest ranked element (+4,+3) on combined Premium and Trust scores respectively and the lowest ranked element was Element 2: QR Code Self-Standing Display (-1, 0) ranked on Premium and Trust respectively. This suggests that individual technologies differ in trust and premium values and these perceptions of technologies can be increased with DDIFs. It also suggests that certain technologies may be perceived by consumers as Premium and Trustworthy yet, they also may be viewed as too expensive, thus, it is important to note that although Trust is a positive rating, Premium can be perceived negatively if it incurs an unwanted expense or is so unfamiliar that it is plotted as premium. Two comments supporting both claims are expressed on the assessment of Element 8: Live Cow Cam, “It would be really expensive, right?” and “Really?, do people use this for real?”. Thus, further investigation to justify expectations on security elements will be tested and examined through Study 3.

DDIF Weighted Technologies Compared

All technology elements were compared across the number of adopted Design-Driven Influence Factors (DDIFs) shown as coloured cells of Green (+ve perception), Yellow (-ve perception) and White (no relationship) (refer to Section 4.1.3). The analysis of the results show that the elements weighted with the most DDIFs were positively rated higher than elements with less adopted DDIFs. For example, the highest ranked elements for the Design group and the Technology group had the most positive comments reflecting the presence of DDIFs.

Thus, a theory is proposed that the identified five DDIFs multiply their impact by mutually strengthening each other. Thus, the more DDIFs present, the more trusting and valuable a product is perceived. It is noted, cultural differences exist and can influence DDIFs which need to be readjusted to target the desired culture. Study 3 addresses the comparison of China and Australia to see if DDIFs alter between cultures.

4.2.5 Summary

Overall, it was evident that elements that adopted the full set of DDIFs increased their positive ratings on Trust and Premium suggesting that design-driven attributes positively impact on consumers perceptions.

Noteworthy, characteristics of DDIFs include firstly, they are user-centred and target consumer's needs. The trust relationship is strengthened through consumers partnership (Deutsch, 1960). Secondly, consumers perceptions have impact (Slovic, 2000) and perceptions can drive the success or failure of a design and/or technology, thus, if demonstration of trust parameters is not evident through the use of DDIFs, confidence is negatively impacted (refer to Chapter 2.0, Section 2.2.2 Trust Parameters). Thirdly, there is a multiplying power in adopting the five DDIFs that mutually strengthen each other. Culturally however, DDIF rules need to be researched and updated according to the rapid advancement of a Risk Theory (Beck, 1992) and the comparative system variations found in Different Worlds (Przeworski and Teune, 1970).

Overall, from the literature review and investigation from Study 1, a theory is initially proposed, that the increase of Design-Driven Influence Factors, equates to the multiple power of consumer acceptance of a new brand or product. Whereas in contrast, the less DDIFs present, the minimal support is offered for 'Initial Trust' formation to occur, and consumers perceived risk, heightened.

4.3 Results (Study 2) - Qualitative Industry Appraisals

4.3.1 Overview for Results

The Participatory Action Research Workshop was utilised in the Workshop Case Study to investigate the research question: *Would an anti-counterfeiting workshop, facilitating multiple stakeholders through co-creative strategies that use design-driven deterrents and anti-counterfeiting technologies, positively impact on exporting SME decision making and planning?*

To test the research question, the alternative and null hypotheses are stated below:

The anti-counterfeiting workshop model positively impacts on the exporting SME business decision making and planning (H_1).

The anti-counterfeiting workshop model will not have any impact (H_0).

Two main outputs from the study was a Workshop Report (Section 4.3.2) and the Workshop Feedback Survey (4.3.3). Firstly, the Workshop Report summarised the workshop session, the co-created developed prototypes and their ranking against the success criteria that was defined as identified counterfeiter's capabilities. These prototypes were later recommended in the report based on their ranked success rating and complexity to implement. Secondly, the Industry Partner was requested to complete a brief workshop Feedback Survey to assess the effectiveness and value of the workshop design and delivery to the individual business needs.

Thus, the two forms of results, reported for Study 2, are presented in this Section 4.3 and discussed in detail in the following Section 4.4 Analysis.

4.3.2 Workshop Report

Prototypes and Testing

The Workshop used multiple stakeholders with a common goal to co-create solutions to disarm counterfeiting capabilities. From the thirty presented Anti-counterfeiting elements and a voting system to identify potential elements fit for the SME business needs, prototypes were developed. Five Prototypes, (one as shown in Figure 87) were reported to the Industry Partner that were established as potential bundled options to explore. They are presented individually within the Figures 88 through to 92.

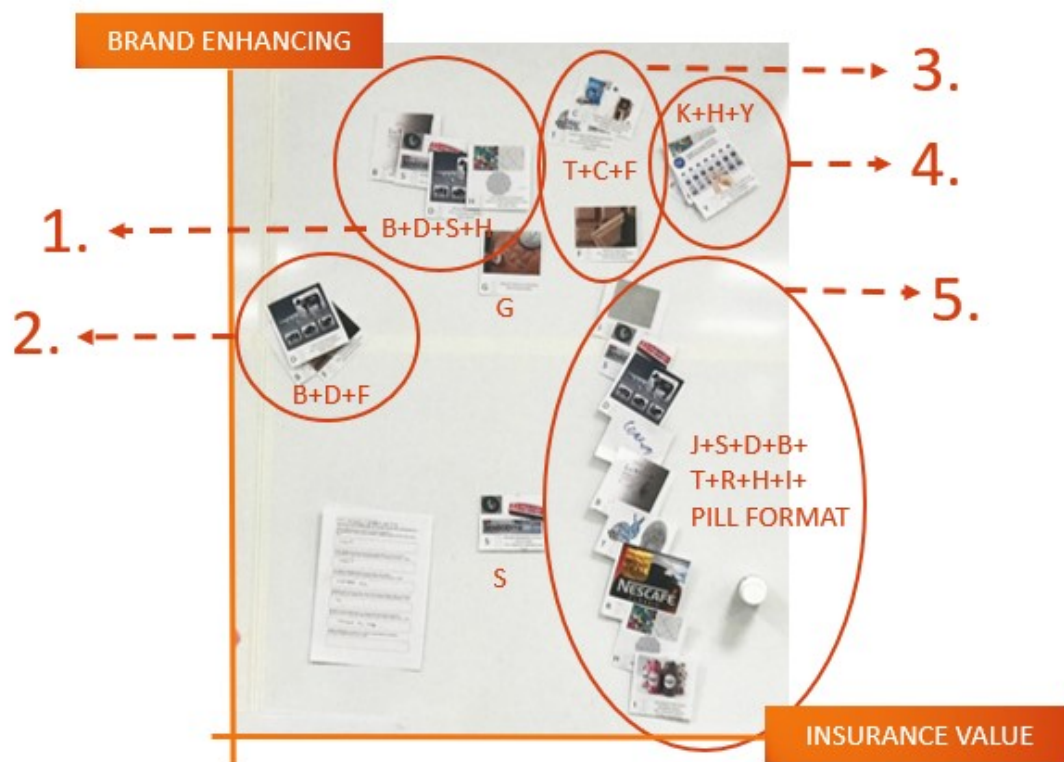


Figure 87. The Five Bundled Prototypes Using Anti-Counterfeiting Elements.

Once the co-created prototypes were aligned with all stakeholders, they were tested against the Success Criteria to disarm counterfeiter's capabilities. Each prototype is individually reported in this section as found in the Workshop Report: Prototype 1 (Figure 88); Prototype 2 (Figure 89); Prototype 3 (Figure 90); Prototype 4 (Figure 91); and Prototype 5 (Figure 92). These are further discussed in Chapter 5.0 Analysis.

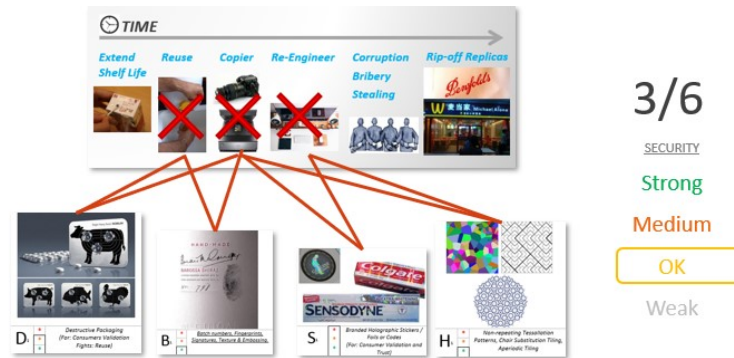
Prototype 1

Figure 88. Prototype 1 tested against the Success Criteria (rating 3 out of 6).

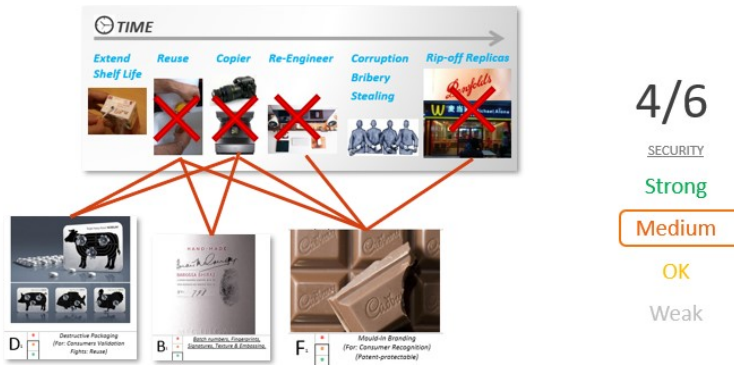
Prototype 2

Figure 89. Prototype 2 tested against the Success Criteria (rating 4 out of 6).

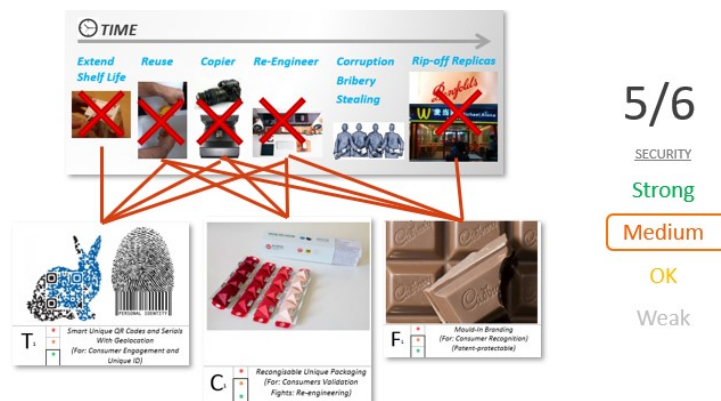
Prototype 3

Figure 90. Prototype 3 tested against the Success Criteria (rating 5 out of 6).

Prototype 4

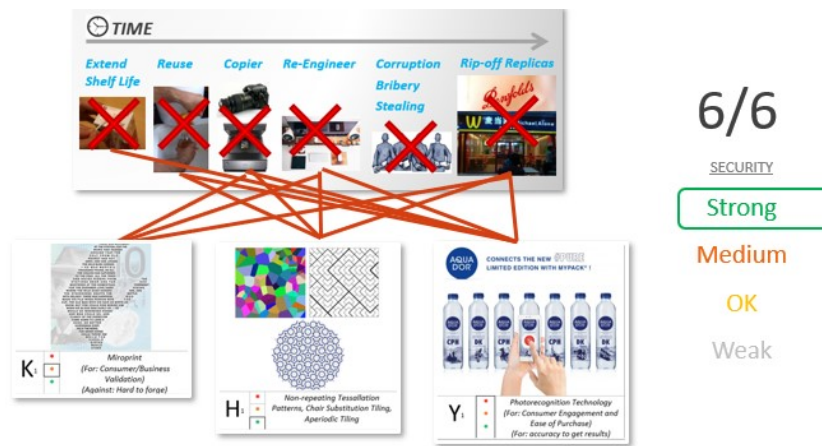


Figure 91. Prototype 4 tested against the Success Criteria (rating 6 out of 6).

Prototype 5

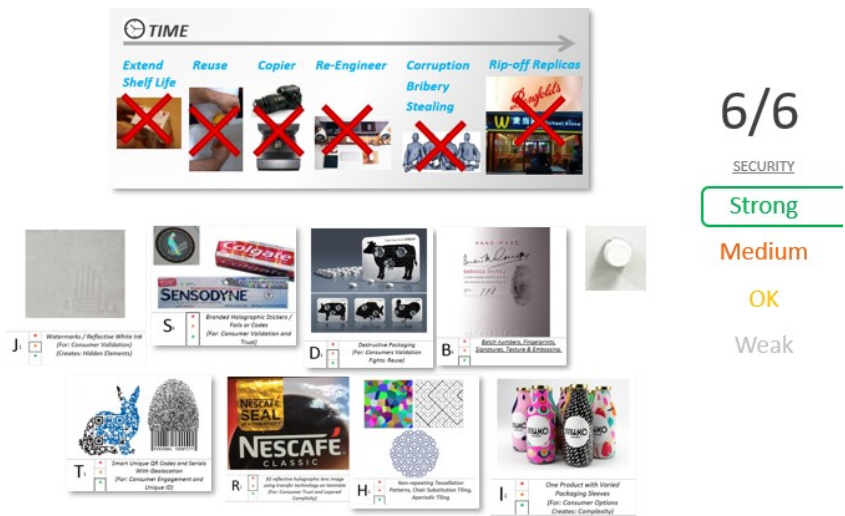


Figure 92. Prototype 5 tested against the Success Criteria (rating 6 out of 6).

4.3.3 Feedback

The Industry Partner was asked to complete a brief Workshop Feedback survey on the 30th May 2018, approximately half a year after the conducted Workshop event, to allow for the Industry Partner to implement the recommendations and for the survey to capture if the workshop outputs were effective and valuable to the stakeholders. Figure 93 presents the 6 survey questions with a requested rating out of 7. The scale from 1 to 7 is outlined under the first question or detailed in full in Chapter 3.0 Research Design, Section 3.1.2 Study 2 – Workshop Evaluation Feedback Survey).

Anti-Counterfeiting Workshop Feedback Questions

Q1. Did the Workshop help you in learning about Counterfeiters Capabilities?

Rating = 7

1 = it was a waste of our time, we would not recommend it to other businesses

2 = not as good as expected, it could have been much better

3 = not too bad, a bit confusing

4 = neutral

5 = good, we learnt a few things and it was helpful

6 = great, we learnt a lot of things and got much out of it that we can apply into the future

7 = excellent, we learnt a lot of valuable things and are implementing the learnings, I would recommend it to other businesses

Q2. Did the Workshop help you in learning about Anti-Counterfeiting Options?

Rating = 7

Q3. Did the Workshop help you in learning about how to think differently about bundling securities to trump counterfeiters?

Rating = 7

Q4. Was the Workshop Security Elements helpful?

Rating = 7

Q5. Has your business taken action on any of the discovered security options?

Rating = 7 We have developed 4 NPD products since the workshop and as a first measure have implemented security seals and embossing on our outer cartons. We are planning on implementing further measures as part of packaging upgrades down the track and with the aim of continuing to adapt/innovate and stay on step ahead of potential counterfeiters.

Q6. Overall, was the workshop and report valuable to your business?

Rating = 7 Yes - Definitely

Figure 93. Workshop Evaluation Feedback Survey Results.

4.4 Analysis (Study 2) - Qualitative Industry Appraisals

4.4.1 Overview for Analysis

The purpose of the second assessment is to discuss the results from the Anti-Counterfeiting Workshop model developed and tested at the University of Melbourne with an unidentified Industry Partner representing an Australian SME exporter. Thus, the objective to test the research question is restated: To develop and test an anti-counterfeiting workshop for the food industry to support informed group decisions that are valuable to both the business and consumer needs.

Therefore, the structure of the analysis for Study 2, set out in Section 4.4 is as follows. Firstly, the analysed results taken from the ranked appraisals from the SME Industry Partner are discussed (Section 4.4.2), following the conversation of how Design Impacts on SME Acceptance (Section 4.4.3), lastly presenting the discussion of how Design Impacts on SME Protection (Section 4.4.4).

4.4.2 SME Appraisals

Elements Overview

The first analysis of the workshop was to identify if there was any correlation between the individual rejected elements that were omitted due to unsuitability to the unique SME business needs. The list of elements is shown in Figure 94 displaying the full set of 30 elements presented to the Industry Partner stakeholders with the omitted elements identified by greyed out cells.

REF	DESCRIPTION	REF	DESCRIPTION	REF	DESCRIPTION
 A ¹	VOID PANTOGRAPH, SECURITY PAPER	 K ¹	MICROPRINTING	 U ¹	COVERT ULTRA HIGH FREQUENCY RFID CHIPS
 B ¹	BATCH No, FINGERPRINTS, TEXTURE & EMBOSSING	 L ¹	THICKER INKS, TEXTURED SURFACES	 V ¹	NFC CHIP OR STICKER
 C ¹	RECOGNISABLE UNIQUE PACKAGING	 M ¹	OVI (OPTICALLY VARIABLE INKS)	 W ¹	PRINTED MEMORY SENSING WIRELESS LABELS
 D ¹	DESTRUCTIVE PACKAGING	 N ¹	COVERT TAGGENT INKS AND READERS	 X ¹	DESTRUCTIVE SCRATCH LAYER, REVEAL CODE
 E ¹	UNIQUE SHAPED PRODUCT	 O ¹	INVISIBLE INK	 Y ¹	PHOTORECOGNITION TECHNOLOGY
 F ¹	MOULD-IN BRANDING	 P ¹	VISIBLE AND INVISIBLE FIBRES	 Z ¹	SPRAY ADHESIVE DATA DOTS
 G ¹	STAMPED PATTERNS & BRANDING	 Q ¹	THERMOCHROMIC INKS	 A ²	WINDOW REVEALING COLOUR STICKERS
 H ¹	NON-REPEATING TASSALLATION PATTERNS ETC.	 R ¹	3D REFLECTIVE HOLOGRAPHIC LAMINATE	 B ²	DESTRUCTIVE LAYERED PACKAGING
 I ¹	ONE PRODUCT WITH VARIED PACKAGING SLEEVES	 S ¹	BRANDED HOLOGRAPHIC STICKERS, FOILS	 C ²	AUTHENTICITY APPS FOR CONSUMERS
 J ¹	WATERMARKS / REFLECTIVE WHITE INKS	 T ¹	SMART UNIQUE QR CODES WITH GEOLOCATION	 D ²	SIMPLE ELECTRONICS/LIGHTING

Figure 94. Workshop 30 Anti-Counterfeiting Elements showing Omitted Elements.

Accepted and Rejected Elements

The 30 total elements, approximately 10 elements representing three groups each: (1) Design-Driven, (2) Technology, and (3) Design-Driven + Technology, were analysed comparing their number of votes and the number of omitted elements per group as shown in Table 29. The elements are ranked on their number of votes from largest to smallest. 6 votes indicate the element has full indorsement from all stakeholders.

Table 29. Study 2 Co-Appraised Stakeholder Ranked Votes for 30 Anti-Counterfeiting Elements showing Accepted and Rejected Appraisals across Three Types: (1) Design-Driven, (2) Technology and (3) Design-Driven and Technology.

REF	DESCRIPTION	VOTES	EXTEND	REUSE	COPY	RE-ENGINEER	STEALING	RIP-OFF	Design-Driven Element	Technology Element	Accepted or Rejected
F ¹	MOULD-IN BRANDING	6			x	x	x	x	1		<i>Accepted</i>
S ¹	BRANDED HOLOGRAPHIC STICKERS, FOILS	6			x	x	x	x	1	1	<i>Accepted</i>
B ¹	BATCH No. FINGERPRINTS, TEXTURE & EMBOSsing	5		x	x	x			1		<i>Accepted</i>
J ¹	WATERMARKS / REFLECTIVE WHITE INKS	5	x		x	x	x	x	1	1	<i>Accepted</i>
H ¹	NON-REPEATING TASSALLATION PATTERNS	4		x	x	x		x	1		<i>Accepted</i>
Y ¹	PHOTORECOGNITION TECHNOLOGY	4	x	x	x	x		x	1	1	<i>Accepted</i>
D ¹	DESTRUCTIVE PACKAGING	3		x	x				1		<i>Accepted</i>
G ¹	STAMPED PATTERNS & BRANDING	2	x	x	x	x		x	1		<i>Accepted</i>
T ¹	SMART UNIQUE QR CODES WITH GEOLOCATION	2	x	x	x	x		x	1	1	<i>Accepted</i>
C ²	AUTHENTICITY APPS FOR CONSUMERS	2	x	x	x	x	x	x	1	1	<i>Accepted</i>
A ¹	VOID PANTOGRAPH, SECURITY PAPER	1		x	x	x			1	1	<i>Accepted</i>
C ¹	RECOGNISABLE UNIQUE PACKAGING	1			x	x			1		<i>Accepted</i>
I ¹	PRODUCT WITH VARIED PACKAGING SLEEVES	1		x	x	x			1		<i>Accepted</i>
L ¹	THICKER INKS, TEXTURED SURFACES	1			x	x		x	1	1	<i>Accepted</i>

R ¹	3D REFLECTIVE HOLOGRAPHIC LAMINATE	1			x	x	x	x		1	Accepted
B ²	DESTRUCTIVE LAYERED PACKAGING	1		x	x	x			1		Accepted
E ¹	UNIQUE SHAPED PRODUCT	0			x		x	x	1		Rejected
K ¹	MICROPRINTING	0			x	x		x	1	1	Rejected
M ¹	OVI (OPTICALLY VARIABLE INKS)	0			x	x	x			1	Rejected
N ¹	COVERT TAGGENT INKS AND READERS	0			x	x	x			1	Rejected
O ¹	INVISIBLE INK	0	x		x	x				1	Rejected
P ¹	VISIBLE AND INVISIBLE FIBRES	0	x		x	x		x		1	Rejected
Q ¹	THERMOCHROMIC INKS	0	x		x	x			1	1	Rejected
U ¹	COVERT ULTRA HIGH FREQUENCY RFID CHIPS	0			x	x	x			1	Rejected
V ¹	NFC CHIP OR STICKER	0			x	x	x		1	1	Rejected
W ¹	PRINTED MEMORY SENSING WIRELESS LABELS	0			x	x	x			1	Rejected
X ¹	DESTRUCTIVE SCRATCH LAYER, REVEAL CODE	0			x	x	x			1	Rejected
Z ¹	SPRAY ADHESIVE DATA DOTS	0	x		x	x	x	x		1	Rejected
A ²	WINDOW REVEALING COLOUR STICKERS	0			x	x	x	x		1	Rejected
D ²	SIMPLE ELECTRONICS/LIGHTING	0			x	x	x	x	1	1	Rejected

4.4.3 Design Impact on SME Acceptance

Design-Driven elements represented security achieved through designer capabilities. Technology elements represented outsourced commercial applications. Design-Driven and Technology elements represented technology applications that required designer capabilities to integrate the application or create content for its digital engagement. From this analysis, a summary of totals is presented in Table 30 comparing elements grouped into the three types showing totals for accepted and rejected frequencies and percentages. Noticeable larger proportions are highlighted in bold.

Table 30. Study 2 Elements Grouped by Type showing Accepted and Rejected Totals

<i>ELEMENTS GROUPED BY TYPE</i>	TOTALS		ACCEPTED		REJECTED	
	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%
<i>Design-Driven Elements</i>	9	30.0%	8	88.9%	1	11.1%
<i>Technology Elements</i>	10	33.3%	1	10.0%	9	90.0%
<i>Design-Driven + Technology Elements</i>	11	36.7%	7	63.6%	4	36.4%
TOTAL ELEMENTS	30	100.0%	16	53.3%	14	46.7%

Note. The Accepted and Rejected Proportions (%) are calculated across rows using the Totals frequencies per group type as the 100% (For example. Accepted Design-Driven Elements are 8/9 = 88.9% acceptance).

The Totals column shows 9 of the 30 elements were selected to represented Design-Driven Elements, 10 per Technology Elements and 11 per Design-Driven and Technology Elements. The Industry stakeholders co-appraised the elements, (without awareness of the grouped element types) and awarded them based on their suitability to their unique business needs. Elements with no votes were Rejected. The Rejected elements omitted was 1 element from the Design-Driven group, 9 elements from the Technology group and 4 elements from the combined Design-Driven and Technology group. When comparing the Accepted and Rejected proportions, the Design-Driven group was positively perceived with a significant 89% accepted elements, whilst the Technology group was negatively perceived and had a significant result of 90% rejected elements. The combined Design-Driven and Technology group was also positively perceived with 64% elements accepted for further co-creation. This analysis clearly indicates that design-driven

elements were positively perceived as a practical and accessible method of deterring counterfeiting, offering flexibility for unique tailoring to specific business needs. Stakeholders expressed their lack of awareness of how Design-Driven security elements could be utilised as deterrent hurdles and were delighted that there were many options available that were low cost and applicable to their needs. They also stated that the technology elements complicated the current adopted supply chain and increased costs significantly, not suiting their SME business plan.

Further in support of this, all elements voted with 2 votes or above were found in the Design-Driven or Design-Driven and Technology groups. The Technology Element: R1 '3D Reflective Holographic Laminate' received only 1 vote. This demonstrates the significant need to promote and increase awareness of Design-Driven security elements or Technologies that enable Design-Driven attributes that are appropriate for SME business needs. The top-rated elements with 6 votes each were the Design-Driven element F1: 'Moulded-in Branding' due to the ability to hinder re-engineering the packaging easily with the Design-Driven and Technology element S1: 'Branded Holographic Stickers and Foils' as they saw the opportunity to design their own sticker and apply it to the stock they had already produced in waiting for distribution.

4.4.4 Design Impact on SME Protection

The Industry Partner were very interested in learning that one of the co-created prototypes (Figure 95) used a minimum of 3 elements to achieve full deterrence of the six counterfeiter's capabilities defined in the Success Criteria sheet. The Prototype bundled three elements consisting of K1: 'Microprinting', H1: 'Non-repeating Tessellation Patterns' and Y1: Photo-recognition Technology' which together strengthened the SMEs brand insurance and with the adoption of the Design-Driven Influencing Factors (DDIFs as defined in Study 1), had the potential to build strong consumer trust.

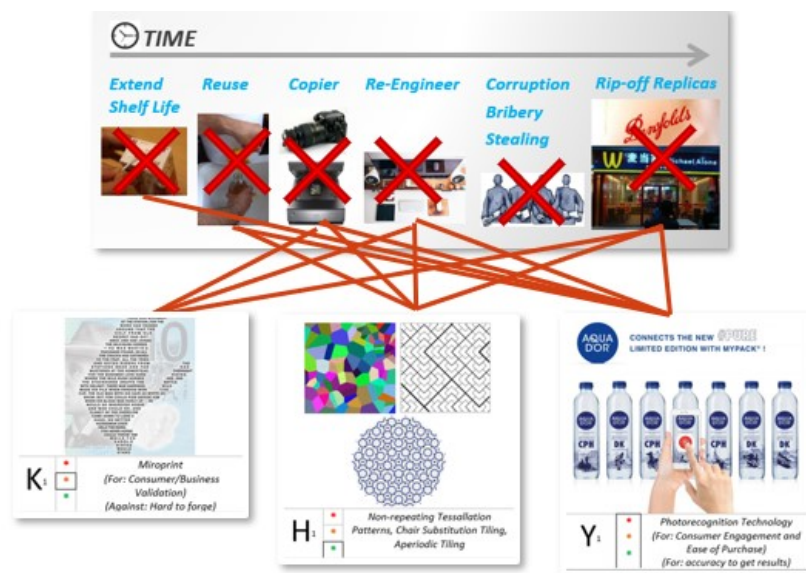


Figure 95. Study 2 Co-Created Prototype using 3 Design-Driven Elements that Deter all Six Counterfeiter's Capabilities.

Finally, the workshop model was assessed 6 months post-event to understand the impact the workshop had on the Industry Partner and if they positively gained value by their attendance. The feedback insights regarding the feedback survey showed that the Industry Partner saw the Workshop as a business changing event that unlocked new methods that could be easily actioned and implemented in various phased rollouts. The stakeholders clearly stated that they had commenced implementing anti-counterfeiting strategies identified in the workshop that were primarily design-driven applications and considered the workshop an overall success.

4.5 Results (Study 3) - Quantitative Consumer Survey

4.5.1 Overview for Results

Firstly, the Minitab analysis outputs are provided for reference in the *Study 3 Online Survey Statistical Analyses* (Appendix G). The results are sampled from the two true populations studied, assuming normality due to the large sample sizes taken and the rules of Central Limit Theorem. The data was initially examined using descriptive statistics (Section 4.3.2) to test for normality, spread and equal variance, missing data, outliers and any necessary adjustments required to address skewed distributions. Following the descriptive statistics summaries, four major tests (with Test 2 subdivided into A and B) were defined as: (1) Multiple Correspondence Analysis (MCA) (Section 4.3.3), (2A) Analysis of Variance (ANOVA) General Linear Model (GLM) comparing means *between* 2 populations, (2B) ANOVA GLM comparing means *within* 2 populations, and (3) a Binary Logistic Regression.

Test 1 assessed the multivariate factors through an MCA, selected to examine the binomial ('selected', 'not-selected') responses to identify the security element 'factors' that significantly contributed to the overall variance of data. The relationships between the bundles of elements was also explored. The results informed the following major investigation using ANOVA GLM tests.

Test 2A and 2B adopted an ANOVA GLM to investigate the research question: *Do cultures of varying 'trust propensities' comparatively expect different levels of 'security' to trust unbranded products authenticity across 'food categories', 'packaging formats', 'demographic profiles' and product 'status levels'?* As the question compared two populations with multiple factors, the ANOVA GLM was repeated to explore two-fold: Test 2A - the overarching differences *between* the populations, and Test 2B - the differences *within* each population.

The first GLM Test (2A) was to compare the true mean differences between the two country populations using an interaction between the (1) Country across their fixed factors of (2) Categories, (3) Demographics (Life Stage, Gender, Living Arrangements and Income Quintiles) and (4) Trust Propensity, to see if the populations expected Total Trusted Security means was significantly different.

The second GLM test (2B) investigated the true mean differences within the individual countries fixed factors to see if the expected Total Trusted Security means were related to (or influenced by) their independent factors. This section investigates

The Hypotheses are restated with test identifiers defined in each section (for example $2_A H_1 = \text{Test 2A, Alternative (1) Hypothesis}$), and the statistical assumptions discussed. Both tests report on the impact of consumers ‘Trust Propensity’ on expected security elements assessed through an Interaction Study. To further support the GLM results, a post-hoc Tukey’s Pairwise Test was conducted to review the difference in means reported at the end of the ANOVA GLM results.

Test 3 uses a Binary Logistic Regression adopted to obtain the Odds Ratio’s (ORs) with 95% confidence intervals (CI) between the compared individual security elements to identify a hierarchy ranking per country.

4.5.2 Descriptive Statistics

Independent Variables (Demographic Descriptive Statistics)

Firstly, the raw data was assessed for incomplete cases which are described in full in the justification of omitted cases and recoding of variables found in Chapter 3, Section 3.2. From the manipulated data, descriptives statistics were obtained and reported. The countries demographic variables (Table 31), were independently sampled from the true populations pertaining to (1) Life Stages, (2) Gender, (3) Living Arrangement and (4) Gross Household Income. Descriptive statistics for participants (5) Place of Residence is separately reported as specific country regions could not be compared. The recoding of variables criteria is outlined in each variable report section as follows.

Table 31. Participant Demographics showing Frequencies and Proportions compared across Countries recorded over 2017-2018.

Variables	Australia n= 6263		China n= 7195	
	<i>f</i>	%	<i>f</i>	%
Life Stages				
18-24	43	0.7	60	0.8
25-34	1151	18.4	2845	39.5
35-44	1340	21.4	2289	31.8
45-54	1555	24.8	1403	19.5
55-64	1597	25.5	548	7.6
65+	577	9.2	50	0.7
Gender				
Male	2786	44.5	3649	50.7
Female	3477	55.5	3546	49.3
Living Arrangements				
Adult no kids	3708	59.2	1522	21.2
Adult w Preteen	1302	20.8	3206	44.6
Adult w Teen	691	11.0	1353	18.8
Adult w Postteen	278	4.4	63	0.9
Adult w Parent	284	4.5	1051	14.6
Income Quintiles				
Most disadvantaged	1508	24.1	1251	17.4
Quintile 2	1471	23.5	1429	19.9
Quintile 3	1042	16.6	1872	26.0
Quintile 4	1322	21.1	1292	18.0
Most affluent	920	14.7	1351	18.8

Recoded Age into 6 groups defining Life Stages

Recoded Living Arrangments into 5 groups defining Adults living with or without children or with parents.

Recoded Income groups into Quintiles ranging from Most disadvantaged to Most affluent.

Life Stage Variable

All participants stipulated their age and the discrete data was recoded into 6 life stage groups ranging from young adult to retiree (Figure 96). All life stage groups represent a decade, except for group 1 which defines the young adults aged 18 to 24 years.

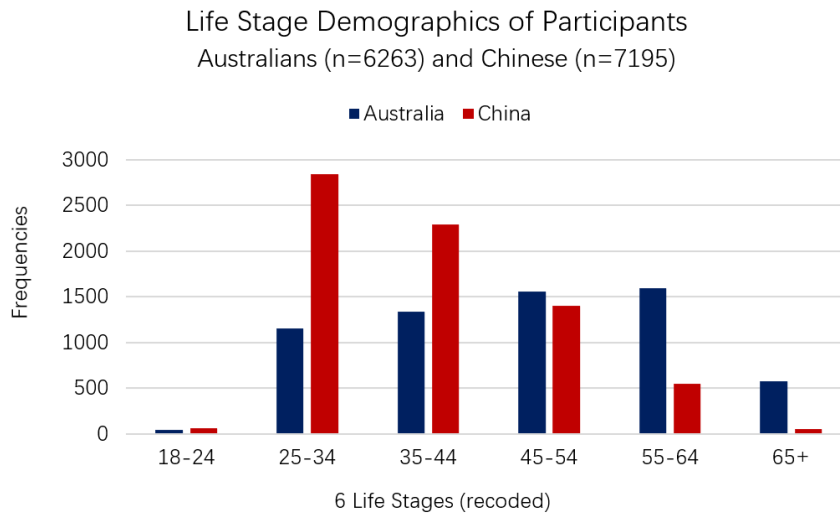


Figure 96. Life Stage Distribution of Study Participants.

Gender Variable

The cross-section of participants represented a gender balance with males (Aust: 45%; China: 51%), and females (Aust: 56%; China: 49%) participating. Figure 97 depicts the distribution of males and females across Australian and Chinese participants.

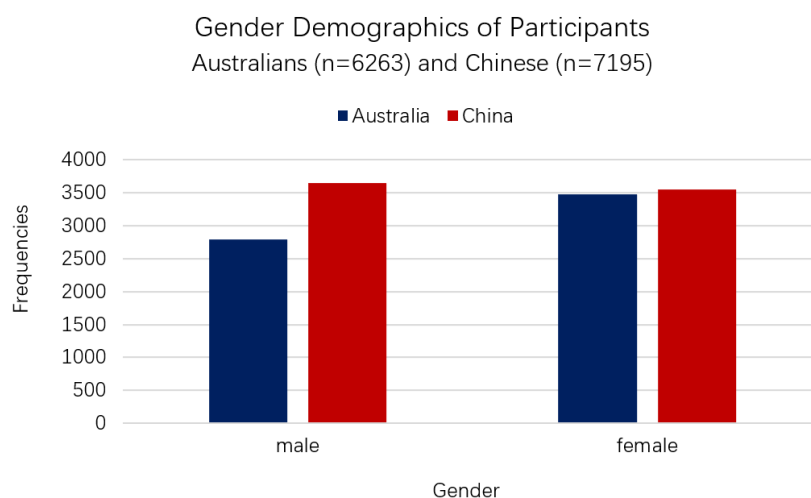


Figure 97. Gender Distribution of Study Participants.*Living Arrangement Variable*

The questions pertaining to the participants Living Arrangements allowed for the additional option to choose 'Other' which then prompted for additional information. The collected 'Other' participant responses were translated if necessary and then recoded (Table 32) under the 6 defined categories of (1) Adult no kids, (2) Adult with a Preteen, (3) Adult with a Teen, (4) Adult with a Post Teen, (5) Adult living with Parents and (6) Omit (unknown status). As stated in the Omitted Cases section, group 6: Omit was excluded due to lack of, or unclear information. Groups 2, 3 and 4 all have dependents living within the household that are 17 or younger. Groups 1 and 5 have no dependents under the age of 18 years and therefore are defined as an adult only household. This includes children that are 18 and over still living at home, who may or may not be the acting participant in the study.

Table 32. Living Arrangements Recoded Groups and Criteria for Inclusion.

Recoded Variable	Criteria
(1) Adult no kids	Adult/s not living with child/ren (incl. single/s, friend/s, partner/s, empty nester/s and retiree/s).
(2) Adult with a Preteen*	Adult/s living with dependent/s, (0 – 13 years) (incl. grandparent/s who care for grandchild/ren part-time).
(3) Adult with a Teen*	Adult/s living with dependent/s, (between 13 – 17 years) (incl. multi-generational families and guardian/s).
(4) Adult with a Post Teen*	Adult/s living with adult child/ren, (18 years or over) (incl. independent children).
(5) Adult living with Parents	Adult participant, 18 years or over, living with parent/s or guardian/s (incl. carers of parents and all adult household).
(6) Omit (unknown status)	unknown living arrangement status.

* Families with dependent children

Income Quintiles Variable

Participants were asked to select from grouped income bands that best represented their estimated combined household gross income which was expressed in the respective currency (either Australian \$ Dollars or Chinese ¥ Renminbi). The income bands ranged

from \$15,000/¥15,000 or less, to \$250,000/¥250,000 or greater. To allow country comparison, the data from the two countries was standardised and recoded into one variable based on 5 income quintiles. Figure 98 demonstrates the spread of data across the 5 quintiles per country. The ‘Most disadvantaged’ is represented by Quintile 1 which holds the lower 20% of participants income selected. The ‘Most affluent’ is represented as Quintile 5, the upper 20% of declared income.

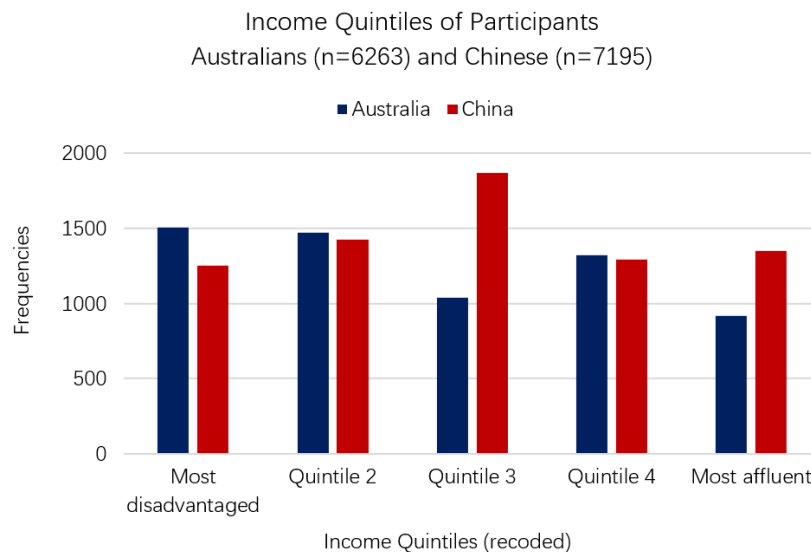


Figure 98. Income Quintiles of Participants per Country.

Place of Residence Variable

The participants selected place of residence is captured as nominal data and country comparison was not applicable due to geographical locations. Table 33 outlines the Australian States and Chinese Regions in detail.

The Australian participant variable was grouped by the 8 Australian States: New South Wales (28%), Victoria (27%), Queensland (22%), South Australia (8%), Western Australia (8%), Tasmania (3%), Australian Capital Territory (2%), and Northern Territory (1%) ordered by greatest to smallest sample size.

The Chinese variable under the 5 Chinese Major Regions: Eastern China (29%), South Central China (29%), Western China (22%), Northern China (12%), North-Eastern China (8%), is listed here in order of sample proportion size.

Table 33. Participant Residential Region Profiles showing Frequencies and Proportions compared across Countries recorded over 2017-2018.

			Australia n= 6263			China n= 7195		
Residential Regions			<i>f</i>	%		<i>f</i>	%	
Australian Capital Territory (ACT)			117	1.9		Eastern China	2087	29.0
New South Wales (NSW)			1748	27.9		North-Eastern China	571	7.9
Northern Territory (NT)			38	0.6		Northern China	865	12.0
Queensland (QLD)			1356	21.7		South Central China	2080	28.9
South Australia (SA)			506	8.1		Western China	1592	22.1
Tasmania (TAS)			160	2.6				
Victoria (VIC)			1703	27.2				
Western Australia (WA)			635	10.1				

The distribution of recruited Australian participants and their identified Place of Residence is visualised in Figure 99 with approximately 77% of participants collectively residing in New South Wales (NSW), Victoria (VIC) and Queensland (QLD). The remaining 23% are living in Western Australia (WA), South Australia (SA), Tasmania (TAS), Australian Capital Territory (ACT), and Northern Territory (NT).

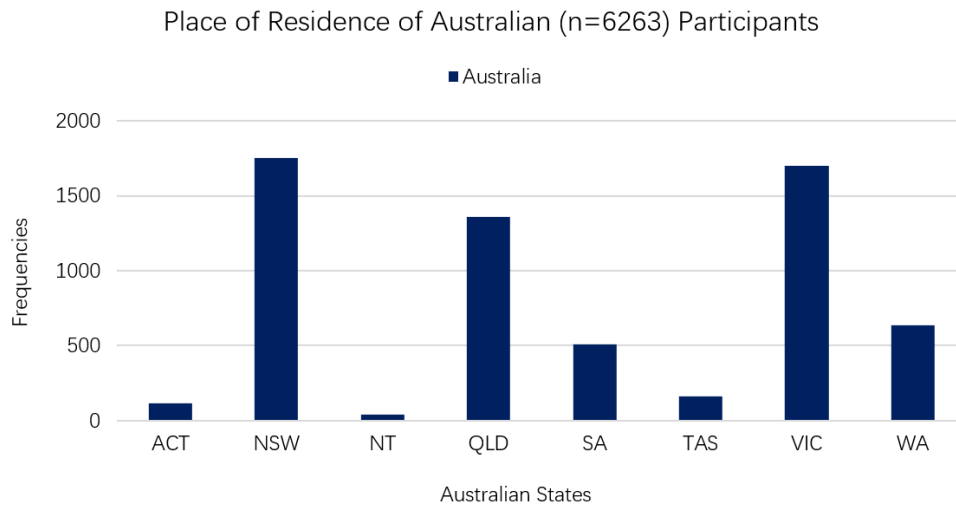


Figure 99. Distribution of Participants Place of Residence within Australia (measured in frequencies).

The spread of recruited Chinese participants are profiled in Figure 100 with just over 80% of participants residing in Eastern China, South Central China and Western China. The remaining 20% of participants live within North China and North-East China.

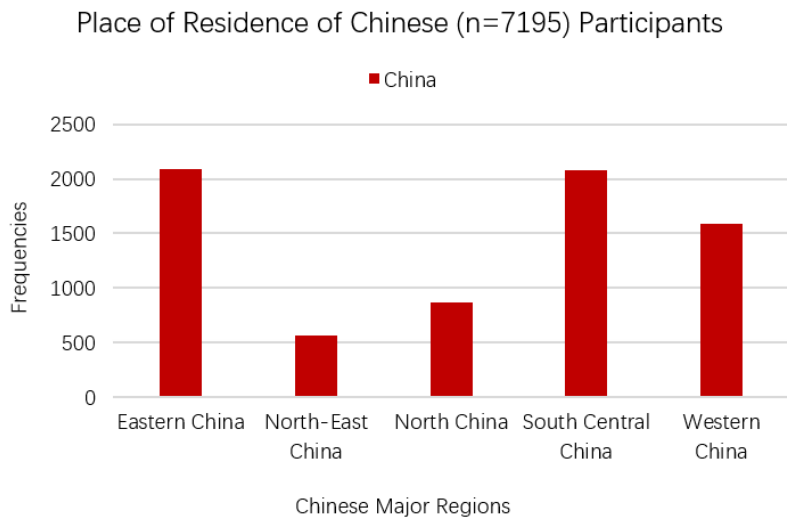


Figure 100. Distribution of Participants Place of Residence within China (shown in frequencies).

Control Variable (Food Categories Descriptive Statistics)

Participants initially recruited under 18 Food Categories (original level), were later recoded into 10 food categories (higher level). For example, the original groups of ‘Yogurt’, ‘Milk Drinks’, ‘Ice Cream’ and ‘Cheese’ were collated into a new category identified as ‘Dairy’. Another example is the combination of the meat data from the two variables ‘Beef’ and ‘Pork’.

Table 34 displays the participant recoded frequencies and proportions per country across the 10 categories which consists of: 1) Wine, 2) Coffee and Tea, 3) Chocolate, 4) Dairy, 5) Baby Formula, 6) Vegetables, 7) Fruits, 8) Grains, 9) Meats, and 10) Olive Oil.

Table 34. Food Categories with Allocated Participants showing Frequencies and Proportions per Country.

Variables	Australia n= 6263		China n= 7195	
	<i>f</i>	%	<i>f</i>	%
Food Categories (higher level)				
Wine	337	5.4	400	5.6
CoffeeTea	673	10.7	802	11.1
Chocolate	345	5.5	398	5.5
Dairy	1328	21.2	1600	22.2
BabyForm	344	5.5	399	5.5
Vegetables	1005	16.0	1198	16.7
Fruit	865	13.8	799	11.1
Grains	334	5.3	402	5.6
Meat	694	11.1	797	11.1
OliveOil	338	5.4	400	5.6

Recoded 18 Food Categories into 10 groups (higher level)

Dependent Variables (Recoding and Descriptive Statistics)

Security Elements Variable (Recoding)

Dependent Variables were recorded as binary (Selected, Not Selected) responses to the 7x options (5x Security Element Options, 1x Other Option and 1x None of These Option) per food category. This identified participants expectations of what builds perceived trustful authenticity. Multiple responses were allowed and captured with possible selections ranging from 0 to 6 elements (0 = none of these and 6 = all elements selected including the 'other' option). The data resulted in dependent variables that could be calculated with outputs of frequencies, means, proportions and hierarchical rankings. A sum of the total 'Everyday' security and the total 'Premium' responses per nominated security elements was calculated to create a new variable coded as 'Total Trusted Security' score. This allowed the independent variables to be tested against the Total Trusted Security dependent variable to see how much security is perceived as trustworthy. The percentages of selected elements per category were also reported and compared.

Trust Propensity Mean Variable

Participants inclination to trust food producers, suppliers and regulators was also tested to study any possible correlation between consumers trust propensity and their expectation of security. They were asked to rate their trust of the food industry based on 6 food industry partners (Table 35) with the question: “Please indicate the extent to which you agree or disagree that you trust each of the following”. The 7-point Likert Scale was defined by the range of 1 = “Strongly disagree” to 7 = “Strongly agree”.

Table 35. Participant Trust Propensities of Food Suppliers and Regulators measured on a 7-point Likert Scale showing Mean and Standard Deviation per Country (2017-2018).

Trust Propensity of:	Australia		China	
	n= 6263		n= 7195	
	M	sd	M	sd
People I buy products from	4.50	1.12	5.02	1.11
Online retailers	4.11	1.24	4.85	1.17
Local producers	5.31	1.11	5.03	1.13
Foreign producers	3.53	1.36	5.01	1.18
Officials in my country*	4.35	1.39	4.99	1.23
Officials in foreign countries*	3.29	1.53	5.11	1.18

* who regulate the production of goods

M = mean, sd = standard deviation

Trust Propensity Score is the mean of the total participant responses measured on the 7-point Likart scale.

Trust-stakeholder groups were assessed under the headings of: (1) People I buy products from, (2) Online retailers, (3) Local producers, (4) Foreign producers, (5) Officials in my country who regulate the production of goods, (6) Officials in foreign countries who regulate the production of goods. Each case was then averaged across the 6 levels to collate an average ‘Trust Propensity Score’ identifying the participants inclination to trust the food industry. This score is further examined across the two cultures in Section 4.6 Analysis (Study 3).

Following on from this section is the Statistical tests and results describing the outputs investigating the relationships between countries and their respective independent, dependent and control variables, reporting on their total mean responses against the explored security elements.

4.5.3 *Test 1 - Multiple Correspondence Analysis*

Comparison of Two Populations Individually Ranked Security Elements

The Multiple Correspondence Analysis (MCA) was used to test the multivariate binary data of each security element against all other elements based on their 'selected' and 'unselected' proportions to identify their level of influence on consumers trust per country.

Hypotheses

The first research questions null hypothesis and its alternative was revisited:

1 H_0 : All the security elements contribute the same influence on consumer trust per country.

1 H_1 : All the security elements do not contribute the same influence on consumer trust per country.

Factor Definition

The participants responses to the security elements resulted in categorical binary data of 'selected' and 'unselected'. For example, the Australian Made Logo: 'selected' (indicated by the abbreviated name: 'AustMade') and 'unselected' (indicated by an 'X' after the first letter which in this case is 'AX'). The survey allowed multiple selections in the one question and therefore a multivariate analysis was required to extrapolate the factors (or elements) that contributed to the overall data variance to distinguish their level of influence. The 5 individual security elements are defined by their two selection factors in Table 36.

Table 36. Multiple Correspondence Analysis (MCA) Factor Definitions by Security Elements.

Factors	<i>Selected</i>	<i>Unselected</i>
Australian Made Logo	AustMade	AX
Design and Materials	Design	DX
Use Once Packaging	OncePack	OX
Currency Graphics	Currency	CX
Scan Tech with a Smart Phone	ScanQR	SX

Points on the MCA Column Plots that are more distant from the centre origin identify categories that have more influence. Opposing points on the plot indicate a category contrast. To obtain factors that contribute approximately 85% to the total variance, 4 Components were considered for each country which are represented and reported on. The MCA Column Plots for Australia (Figure 101) and China (Figure 102) pertain to Components 1 and 2 (left graph) and Components 3 and 4 (right graph). From these Components, impacting clusters and individual factors that have the greatest influence on consumers trust are identified.

Australia Results

The Australian results (Figure 101 left graph) show **Component 1** on the horizontal axis which accounts for approximately 35% of the overall variance and highlights the cluster of four ‘unselected’ elements ‘SX’, ‘CX’, ‘DX’ and ‘OX’ as the furthest away from the centre of origin indicating no elements were the most weighted contributing factors. **Component 2** reported on the vertical axis, contributes 55% cumulative proportion of variance, clearly marks the AustMade element at point -3 from the origin which is the greatest influential factor compared to all the other elements which are clustered close to the origin with little contribution to variance. **Component 3** (Figure 101 right graph) on the horizontal axis, equals a cumulative proportion of 73% of the total variance. It reports the non-selected Currency element ‘CX’ (approximately 1.6 from the origin) with the greatest influence which is opposed to both the non-selected Design element ‘DX’ and the non-selected OncePack element ‘OX’ (approximately -0.8 from the origin). Lastly, covering 87% of the cumulative variance, **Component 4**, highlights ‘SX’ (approximately -1.7 from the origin) as the most influential factor, with the contrasting ‘CX’ element (approximately 1.3 from the origin).

The Australian Column Plots with Components 1 to 4 all considered indicate each security element contributing approximately an equal minimal level of influence on Australian consumer trust, except for the Australian Made logo and Awards (AustMade) element which alone is the most weighted factor with the greatest influence. It is noteworthy, that when the 'AustMade' element is omitted from analysis, the results indicate that the remaining elements have equal weighting which results in the null hypothesis being rejected. However, for the purposes of this research, the AustMade element was included in the results. Therefore, including the 'AustMade' element in the analysis, it suggests that the null hypothesis, all the security elements contribute the same influence on Australian consumers trust, was rejected.

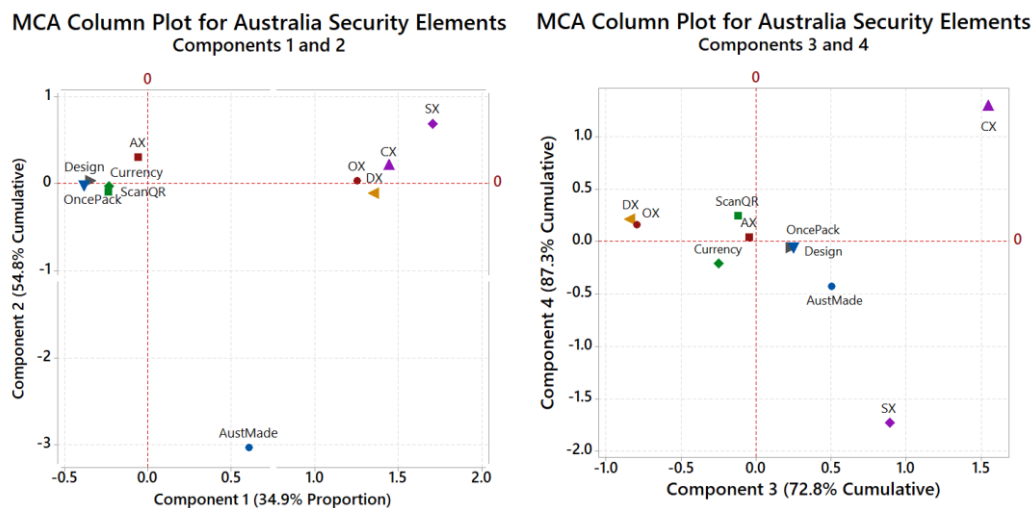


Figure 101. Multiple Correspondence Analysis (MCA) Column Plots for Australia Trusted Security Elements (Graph left: Components 1 and 2, Graph right: Components 3 and 4).

China Results

The Chinese results contrast in comparable weights. **Component 1** (Figure 102 left graph) measured on the horizontal axis, accounts for approximately 27% of the overall variance with the 'AustMade' (approximately -0.7 from the origin) followed by the 'Design' element (approximately -0.6 from the origin), the remaining 'selected' elements are closely positioned and therefore also contribute similar influence. **Component 2** reported on the vertical axis, accounts for an additional 22% of the variance (49% cumulative proportion) representing the equally contrasting 'selected' elements, AustMade (approximately -0.6 from the origin) and Design (approximately 0.6 from the origin) as the most influential factors. Continuing the Chinese results (Figure 102 right

graph), **Component 3** (67% cumulative proportion) measured on the horizontal axis indicates an equal contrast between the elements ‘AustMade’ (approximately -0.7 from the origin) to ‘ScanQR’ (approximately 0.7 from the origin). With the ‘unselected’ elements noted, the ‘selected’ Design element is the second largest contributor to variance. **Component 4** (84% cumulative proportion) identifies the ‘selected’ element ‘Currency’ (approximately 0.65 from the origin) as the most influential factor, opposed to its ‘unselected’ counterpart ‘CX’ (approximately -0.8 from the origin). Visually assessing all 4 Components of the Chinese Column Plots, there is an evident ordered rank of importance per element with the top 2 considered influential factors, expressed in Component 1 to 3, being AustMade and Design. The remaining ‘selected’ elements are also valuable to consumers contributing approximately equally to the overall variance and closely positioned to AustMade and Design.

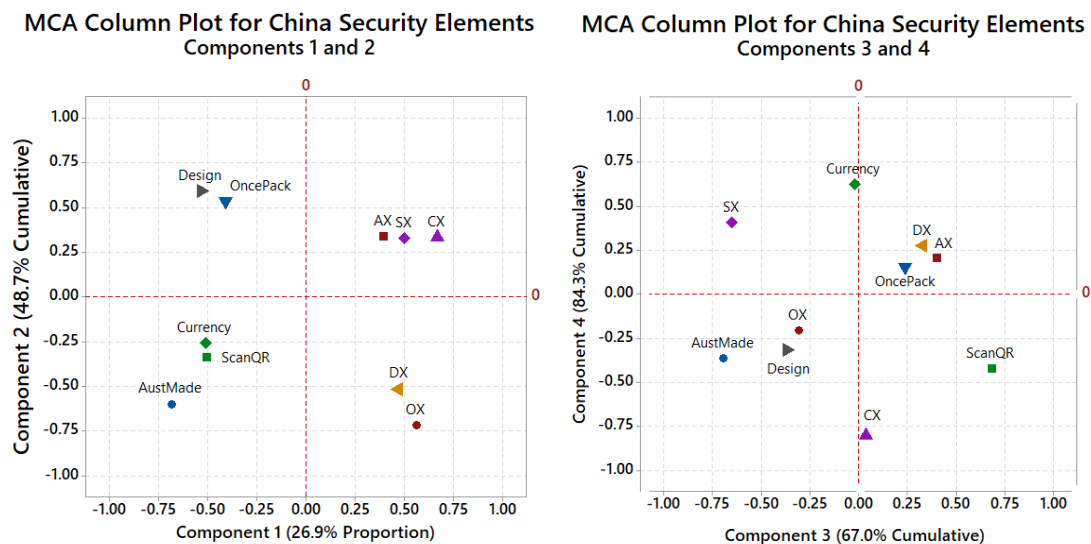


Figure 102. Multiple Correspondence Analysis (MCA) Column Plots for China Trusted Security Elements (Graph left: Components 1 and 2, Graph right: Components 3 and 4).

To further investigate the relationships between security elements and the factors that influence their trust, the demographic variables and the food category variables were tested against the Total Trusted Security responses for each country. The ANOVA used for assessing the second research questions and respective hypotheses is reported in the following section.

4.5.4 Test 2A - ANOVA General Linear Model with Interaction and Tukey's DOM Test

Comparison between Two Populations Total Trusted Security over Independent Variables

Hypotheses

The second research questions null hypothesis (H_0) and its alternatives (H_1) was revisited:

$2_A H_0$: There is no difference *between* the countries true means when comparing consumers expected Total Trusted Security over the fixed factors of 1) Food Categories; 2) Life Stages; 3) Gender; 4) Living Arrangements; 5) Income Quintiles; 6) Place of Residence; and 7) Trust Propensity.

($2_A H_0$: $\mu_1 - \mu_2 = 0$)

$2_A H_1$: There is a difference *between* the countries true means when comparing consumers expected Total Trusted Security over the fixed factors of 1) Food Categories; 2) Life Stages; 3) Gender; 4) Living Arrangements; 5) Income Quintiles; 6) Place of Residence; and 7) Trust Propensity.

($2_A H_0$: $\mu_1 - \mu_2 \neq 0$)

Assumptions

The residual plots (Figure 103) were observed for normality and fit. Although the Histogram indicates that the data is right-skewed, the Central Limit Theorem can be assumed for normality due to large sample sizes. The Residuals Verses Fits graph indicates an equal spread of variance and the Residuals Versus Order graph suggests the residuals are uncorrelated. The significance level was set to 0.05 and a two-tailed alternative hypothesis test was investigated.

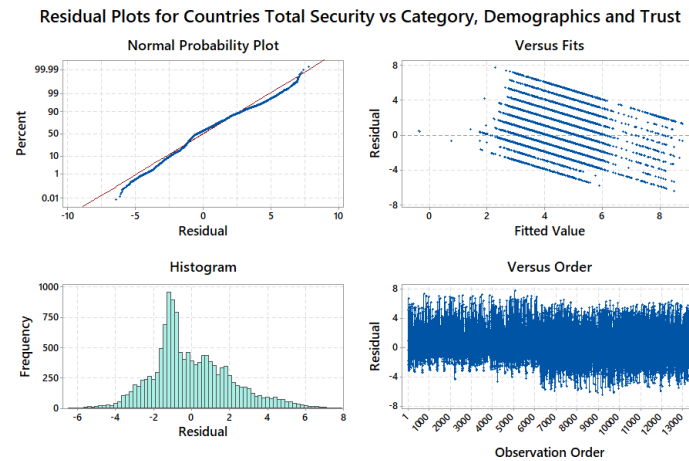


Figure 103. Residual Plots showing data fit for ANOVA test.

Results

The ANOVA GLM assessed the Total Trusted Security responses against the factors: Country, Food Category, Demographics and Trust Propensity with an Interaction study to compare Country against the fixed factors as summarised in Table 37.

The factor ‘Country’ resulted in a high F-statistic and significant P -value, ($F_{(1,13398)} = 13.5$, $P < 0.001$) indicating the difference between China - Australia was not in line with the null hypothesis ($2_A H_0$), that the two means difference = 0, thus, was rejected. The interaction observations results pertaining to Country*Category ($F_{(9,13398)} = 5.29$, $P < 0.001$), Country*LifeStage ($F_{(5,13398)} = 14.1$, $P < 0.001$), Country*LivingArrangements ($F_{(4,13398)} = 3.6$, $P < 0.01$), Country*IncomeQuintiles ($F_{(4,13398)} = 22.0$, $P < 0.001$) and Country*TrustPropensity ($F_{(6,13398)} = 12.6$, $P < 0.001$) all returned P -values < 0.01 , indicating that the populations security expectations across the explored factors are significantly different (reject $2_A H_0$). In contrast, the countries Gender factors reported a low F-statistic of $F_{(1,13398)} = 1.9$ and a P -value = 0.17 which is greater than the set significance level of 0.05 suggesting that the observed patterns between Country*Gender did not vary according to expected Total Trusted Security means and as such, the null hypothesis ($2_A H_0$) was not rejected for Gender.

Table 37. ANOVA GLM: Interaction Comparison of Populations expected Total Trusted Security across Food Categories, Demographics and Trust Propensity Variables (Dec 2018).

Fixed Factors	F-value (df,error)	P-value
Country:	$F_{(1,13398)} = 13.45,$	$P < 0.001$
Category:	$F_{(9,13398)} = 9.12,$	$P < 0.001$
LifeStage:	$F_{(5,13398)} = 6.31,$	$P < 0.001$
Gender:	$F_{(1,13398)} = 0.36,$	$P = 0.55$
LivArr	$F_{(4,13398)} = 4.01,$	$P < 0.01$
IncomeQuintiles	$F_{(4,13398)} = 20.63,$	$P < 0.001$
TrustPropensity	$F_{(6,13398)} = 84.56,$	$P < 0.001$
Interactions		
Country*Category	$F_{(9,13398)} = 5.29,$	$P < 0.001$
Country*LifeStage	$F_{(5,13398)} = 14.05,$	$P < 0.001$
Country*Gender	$F_{(1,13398)} = 1.85,$	$P = 0.17$
Country*LivArr	$F_{(4,13398)} = 3.59,$	$P < 0.01$
Country*IncomeQuintiles	$F_{(4,13398)} = 21.97,$	$P < 0.001$
Country*TrustPropensity	$F_{(6,13398)} = 12.62,$	$P < 0.001$
<i>R-sq. 24.43%</i>		

FACTORS: Country (2): Australia, China. Category (10): Wine, Coffee and Tea, Chocolate, Dairy, Baby Formula, Vegetables, Fruit, Grains, Meat, OliveOil. LifeStage (6): 18-24 yrs, 25-34 yrs, 45-54 yrs, 55-64 yrs, 65+ yrs. Gender (2): Male, Female. Living Arrangements (5): Adult no kids, Adult+Preteen, Adult+Teen, Adult+Postteen, Adult+Parent. Income Quintiles (5): Most disadvantaged, Quintile 2, Quintile 3, Quintile 4, Most affluent. TrustPropensity (7 levels) 1= weak trust, 7 = strong trust.

The Tukey Pairwise Comparisons Test graphing the difference in means per 'Country' factor with 95% confidence interval is shown in Figure 104 and the Descriptive Statistics and Tukey's pairwise comparison shown in Table 38.

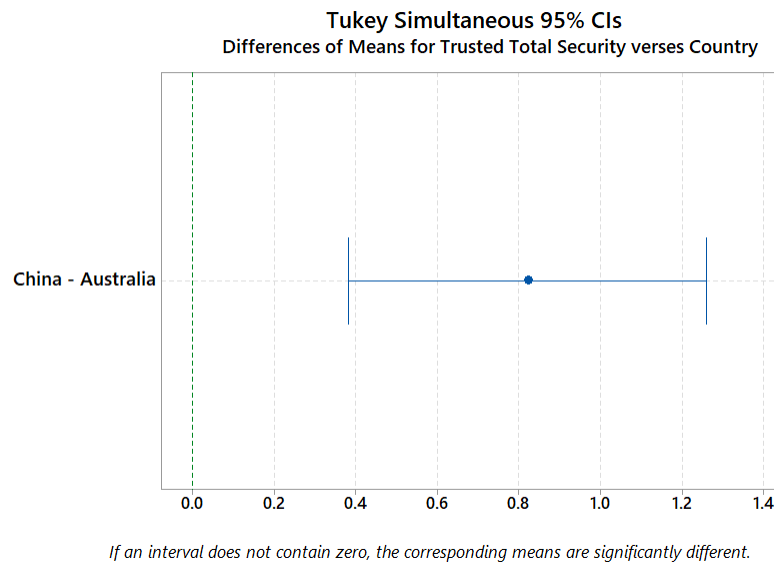


Figure 104. The Tukey's Difference in Means Test between China's and Australia's Total Trusted Security shown with a 95% confidence interval.

The true Total Trusted Security mean estimate, between Chinese Total Trusted Security – Australian's Total Trusted Security, equates to approximately 1 unit with a 95% confidence interval ranging from +0.4 to +1.3 approximately, which does not contain zero indicating significance in means difference. Descriptive Statistics for expected Total Trusted Security per China and Australia are shown in the top-half of Table 38 followed by the Tukey's Pairwise Comparison statistics. China's Total Trusted Security mean score is approximately 1 security element greater than Australia's Total Trusted Security mean score with an adjusted P -value < 0.001 resulting in a statistically significant difference in means.

Table 38. Descriptive Statistics and Tukey Pairwise Comparisons for Australian and Chinese Expected Total Trusted Security (Dec 2018).

Descriptives	Average Total Security		
	Mean	Standard deviation	n
China	5.08	2.45	7195
Australia	3.29	1.92	6263
ANOVA for Country: $F(1,13398) = 13.45, p < 0.001$			
Comparisons	Adjusted Estimate	95% confidence interval*	Adjusted p -value
China - Australia	0.82	(0.38, 1.26)	< 0.001

* Estimated using Tukey's Honest Significant Difference (HSD)

These results suggest that the two countries expectations of Total Trusted Security elements on food packaging differs with China's expected security mean greater than Australian's, therefore an investigation into the differences between country factors is now presented.

4.5.5 Test 2B - ANOVA General Linear Model with Interaction and Tukey's DOM Test

Comparison within Two Populations Total Trusted Security over Independent Variables

Hypotheses

The second research question's null hypothesis (H_0) and its alternatives (H_1) was revisited:

2_B H_0 : There is no difference *within* each country's expected Total Trusted Security means compared across the factor levels of 1) Food Categories; 2) Life Stages; 3) Gender; 4) Living Arrangements; 5) Income Quintiles; 6) Place of Residence; and 7) Trust Propensity.

$$(H_0 : \mu_{\text{Factor (all levels)}} = \mu_{\text{Factor (all levels)}})$$

2_B H_1 : There is a difference *within* each country's expected Total Trusted Security means compared across the factor levels of:

H_{1a} :	Food Categories (FC)	$H_{1a} : \mu_{\text{FC}(1-10)} \neq \mu_{\text{FC}(1-10)}$
H_{1b} :	Life Stages (LS)	$H_{1b} : \mu_{\text{LS}(1-6)} \neq \mu_{\text{LS}(1-6)}$
H_{1c} :	Gender (GR)	$H_{1c} : \mu_{\text{GR}(1-2)} \neq \mu_{\text{GR}(1-2)}$
H_{1d} :	Living Arrangements (LA)	$H_{1d} : \mu_{\text{LA}(1-5)} \neq \mu_{\text{LA}(1-5)}$
H_{1e} :	Income Quintiles (IQ)	$H_{1e} : \mu_{\text{IQ}(1-5)} \neq \mu_{\text{IQ}(1-5)}$
H_{1f} :	Place of Residence (PR)	$H_{1f} : \mu_{\text{PR}(1-n)} \neq \mu_{\text{PR}(1-n)}$
H_{1g} :	Trust Propensity (TP)	$H_{1g} : \mu_{\text{TP}(1-7)} \neq \mu_{\text{TP}(1-7)}$

Assumptions

For both countries tested, the null hypothesis states that the expected Total Trusted Security means across the Factor Levels are equal, whereas the alternative is that they are not equal. The alpha significance level was set to 0.05 and the alternative hypothesis is a two-sided test.

The ANOVA GLM Residual Plots for Australia (Figure 105) and China (Figure 106) were observed to check the fit of each country data to the analysis model. The Australian Residual Plot Histogram indicates the data spread is right-skewed. Normal distribution is assumed using the Central Limit Theorem based on the large sample sizes taken. The Residual Versus Fits graphs for both countries indicates equal variances and both the Residual Versus Order graphs show random uncorrelated plots. Therefore, the Residual Plots for both countries align to the assumption of normality and fit for the ANOVA GLM.

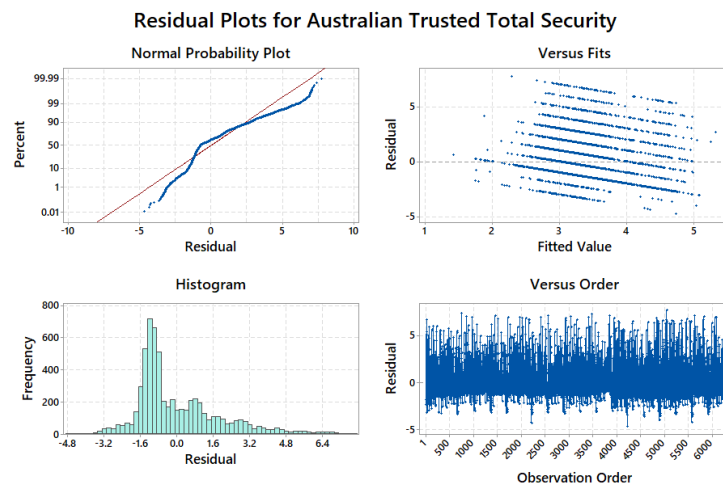


Figure 105. Residual Plots for Australian Trusted Total Trusted Security.

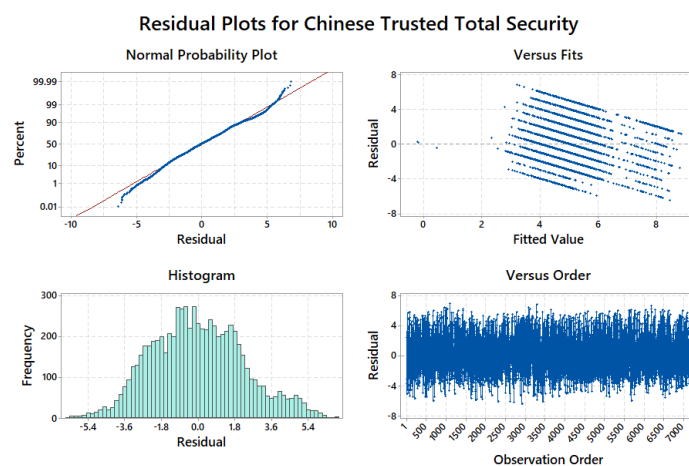


Figure 106. Residual Plots for Chinese Trusted Total Trusted Security

Results

The ANOVA GLM Main Effects Plots summarise the Total Trusted Security means for the two cohorts: Australia (Figure 107) and China (Figure 108) tested against their respective 5 Independent Variables. The Trust Propensity variable is later defined. A red dashed line is referenced at the Total Trusted Security point 4 to compare spread of country plots. It is noteworthy that all mean data points for Australian variables all fall under the Total Trusted Security point 4 with all Chinese mean data points breaching point 4 on all assessed independent variables. This visually suggests Chinese participants expect more security on average compared to that of Australians.

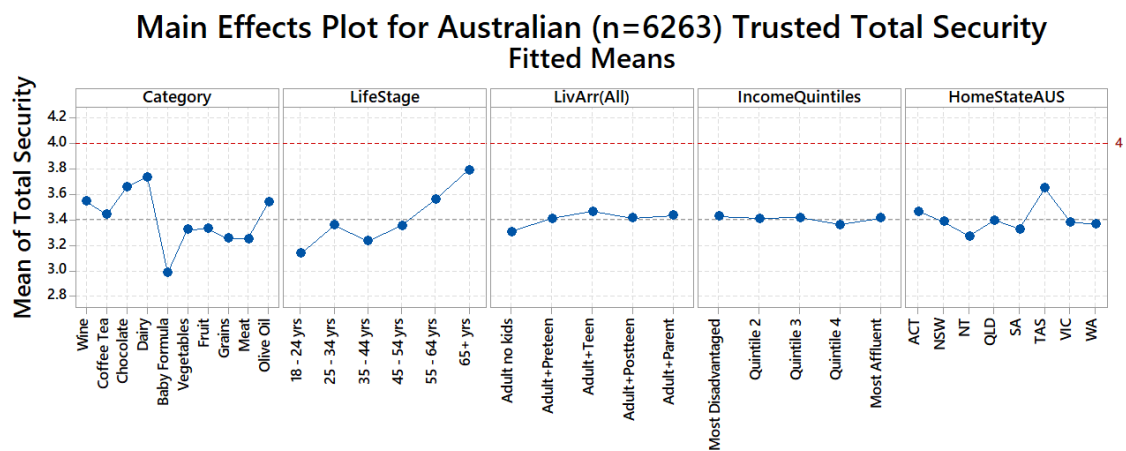


Figure 107. Australian Main Effects Plot of Total Trusted Security across Variables.

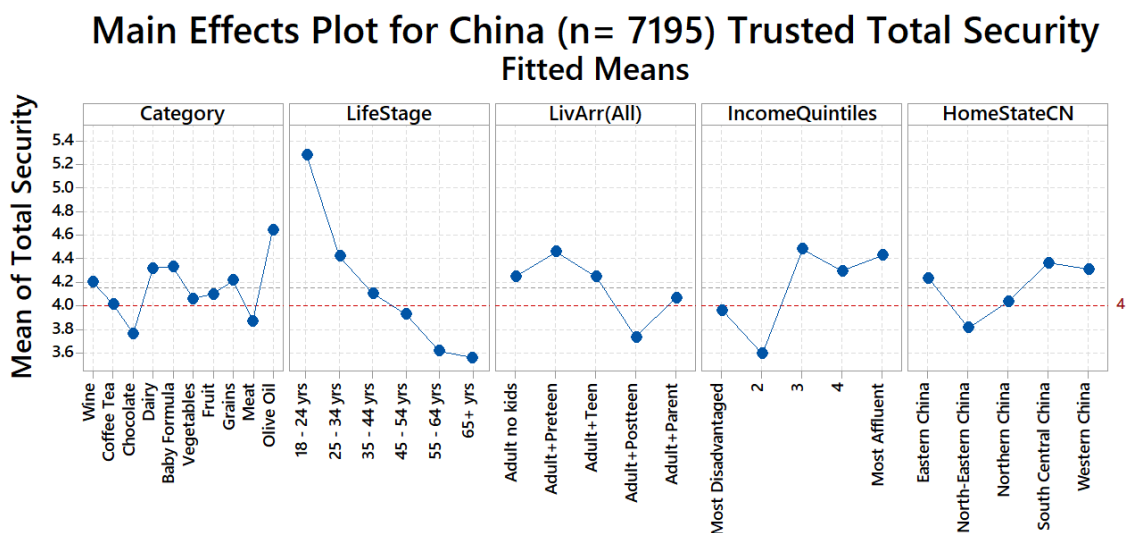


Figure 108. Chinese Main Effects Plot of Total Trusted Security across Variables.

Overview Statistical Summary

A summary of statistical results is shown for the ANOVA GLM tests for Australia (Table 39) and China (Table 40). To reduce complexity of analysis, the insignificant Gender factor was removed from the analysis which did not impact end results.

The Australian results (Table 39) indicates a significant difference in means within participants expected Total Trusted Security over the variables: Food Categories ($F_{9,6227} = 8.5$, $P < 0.001$), Life Stages ($F_{5,6227} = 7.5$, $P < 0.001$) and their Trust Propensity ($F_{6,6227} = 40.0$, $P < 0.001$) which all reported high F-values and significant P-values therefore, the null hypothesis of equal means was rejected. The variables: Living Arrangements ($F_{4,6227} = 1.5$, $P = 0.2$), Income Quintiles ($F_{4,6227} = 0.23$, $P = 0.9$) and Place of Residence ($F_{7,6227} = 0.6$, $P = 0.8$) returned low F-values and P-values greater than the significance value of 0.05 and thus the null hypothesis, in these cases, was not rejected.

Table 39. ANOVA GLM: Total Trusted Security across Food Categories, Demographics and Trust Propensities of Australian Participants (Dec 2018).

AUSTRALIAN		
Fixed Factors	F-value (df_{error})	P-Value
Category:	$F_{(9,6227)} = 8.50$,	$P < 0.001$
LifeStage:	$F_{(5,6227)} = 7.50$,	$P < 0.001$
LivArr (Dependents)	$F_{(4,6227)} = 1.49$,	$P = 0.2$
Income Quintiles	$F_{(4,6227)} = 0.23$,	$P = 0.9$
Residence (Australia)	$F_{(7,6227)} = 0.60$,	$P = 0.8$
TrustPropensityMean:	$F_{(6,6227)} = 40.02$,	$P < 0.001$
<i>R-sq = 5.81%</i>		

The Chinese outputs (Table 40) all returned statistically significant results for: Food Categories ($F_{9,7162} = 6.7$, $P < 0.001$), Life Stages ($F_{5,7162} = 15.1$, $P < 0.001$), Living Arrangements ($F_{4,7162} = 7.1$, $P < 0.001$), Income Quintiles ($F_{4,7162} = 38.6$, $P < 0.001$), Place of Residence ($F_{7,7162} = 8.7$, $P < 0.001$) and their Trust Propensity ($F_{6,7162} = 107.8$, $P < 0.001$). The largest F-values were detected in Chinese Trust Propensity over Total Trusted Security and the Income Quintiles over Total Trusted Security indicating the greatest difference in means. The null hypothesis of equal means within factor levels was therefore, rejected.

Table 40. ANOVA GLM: Total Trusted Security across Food Categories, Demographics and Trust Propensities of Chinese Participants (Dec 2018).

CHINESE		
Fixed Factors	F-value (df,error)	P-Value
Category:	$F_{(9,7162)} = 6.65,$	$P < 0.001$
LifeStage:	$F_{(5,7162)} = 15.13,$	$P < 0.001$
LivArr (Dependents)	$F_{(4,7162)} = 7.14,$	$P < 0.001$
Income Quintiles	$F_{(4,7162)} = 38.57,$	$P < 0.001$
Residence (China)	$F_{(4,7162)} = 8.74,$	$P < 0.001$
TrustPropensityMean:	$F_{(6,7162)} = 107.80,$	$P < 0.001$
$R-sq = 15.96\%$		

These results indicate that there is a difference between consumers trusted Total Trusted Security and the levels within each Fixed Factor tested across the two populations. Difference of means are significantly evident for all Chinese factors and only 3 Australian factors suggesting their impact on consumers expectations of security elements.

Detailed Factor Results

The 6 factors and their respective levels are now presented individually, each tested against the null hypothesis of equal means. Provided within each Factor analysis is a summary statistics table to detail the significance of the results.

Interval Plots

The provided Interval Plots act to visualise the data across the grouped levels showing the sample means and 95% confidence intervals for each. Supportive interval plots are summarised in Section 4.6 Analysis (Study 3) for visualising the interpretation of results.

Summary Statistics Tables

Descriptive statistics are provided along with calculated fitted means and their respective 95% confidence intervals. The confidence intervals were derived from the reported estimates and standard errors. The Difference in Means (DOM) are grouped according to Tukey's method; means that do not share a letter are significantly different. The last column summarises the statistical significance of each factor level, indicated by either 1, 2 or 3 asterisks that represent a three-tiered P -value of <0.05 , <0.01 and <0.001 respectively (Refer to Table footnotes for further definitions).

Food Category (H₀, H_{1a})

Interval plots are provided below to demonstrate Australian (Figure 109) and Chinese (Figure 110) Food Categories listed from the least to the most Total Trusted Security expected across the 10 food categories. The Australian overall expected Total Trusted Security mean ranges between 2.5 and 4 elements approximately. The Chinese overall expected Total Trusted Security means is between 4 to 6 Total Trusted Security elements including the 95% confidence intervals. Australia expected the least security elements on Baby Formula which is contrasted by the importance placed on it by the Chinese, ranking it just below Olive Oil. Considering Chocolate, Australia placed it second highest, China placed it the least compared across categories.

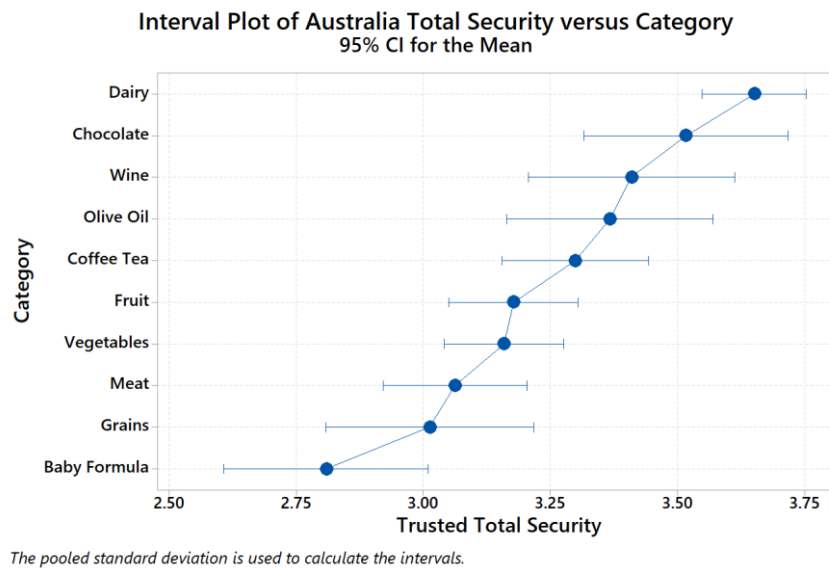


Figure 109. Interval Plots of Australian Food Categories ordered from smallest to largest expected Total Trusted Security.

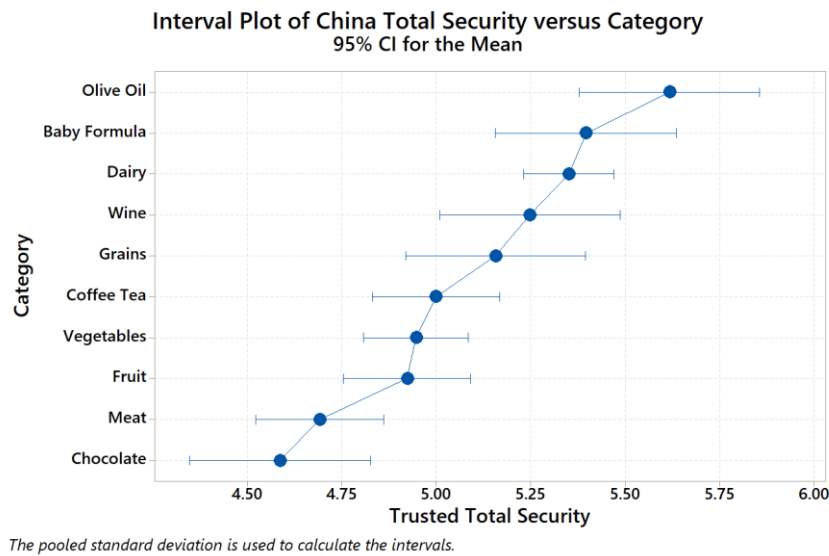


Figure 110. Interval Plots of Chinese Food Categories ordered from smallest to largest expected Total Trusted Security.

The summary statistics (Table 41) compares Australia and China Total Trusted Security across the Food Categories. Results are shown below as fitted means and their 95% confidence intervals followed by their *P*-value.

Table 41. ANOVA GLM: Total Trusted Security across Individual Food Categories per Country (Dec 2018).

Australia (n = 6263)							China (n = 7195)						
Total Security							Total Security						
Analysis of Variance	n	Fitted Mean	SEM	95% CI†	DOM	Sig.	Analysis of Variance	n	Fitted Mean	SEM	95% CI†	DOM	Sig.
Category (higher)							Category (higher)						
Wine	337	3.55	0.14	(3.28, 3.82)	abc		Wine	400	4.20	0.25	(3.71, 4.69)	abc	
CoffeeTea	673	3.44	0.12	(3.21, 3.68)	bc		CoffeeTea	802	4.01	0.23	(3.56, 4.46)	bcd	
Chocolate	345	3.66	0.14	(3.39, 3.93)	ab	**	Chocolate	398	3.76	0.25	(3.27, 4.25)	e	***
Dairy	1328	3.74	0.10	(3.54, 3.94)	a	***	Dairy	1600	4.32	0.23	(3.87, 4.77)	ab	**
BabyForm	344	2.98	0.14	(2.71, 3.25)	d	***	BabyForm	399	4.33	0.25	(3.84, 4.82)	ab	
Vegetables	1005	3.32	0.11	(3.10, 3.54)	bcd		Vegetables	1198	4.06	0.23	(3.61, 4.51)	cde	
Fruit	865	3.33	0.11	(3.11, 3.55)	bcd		Fruit	799	4.10	0.23	(3.65, 4.55)	cde	
Grains	334	3.25	0.14	(2.98, 3.52)	cd		Grains	402	4.22	0.25	(3.73, 4.71)	abcd	
Meat	694	3.25	0.12	(3.02, 3.49)	cd	*	Meat	797	3.87	0.23	(3.42, 4.32)	de	***
OliveOil	338	3.54	0.14	(3.27, 3.81)	abc		OliveOil	400	4.64	0.25	(4.15, 5.13)	a	***
ANOVA	Category: $F_{(9,6227)} = 8.50, P < 0.001$						ANOVA	Category: $F_{(9,7162)} = 6.65, P < 0.001$					

Sig. = Statistical Significance Rating: * *P*-value < 0.05; ** *P*-value < 0.01; *** *P*-value < 0.001; SEM = Standard Error Mean; †95% Confidence Interval; DOM = Difference of Means Tukey's Pairwise Grouping (Means that do not share a letter are significantly different). Factor coding (-1, 0, +1); Total Security equals the combined selected elements for everyday and premium;

Australian responses identified 4 categories of significant difference to the other remaining 6 categories that aligned to the true mean. Australians expected the highest levels of security on Dairy: 3.7 (3.5, 3.9) $P < 0.001$, and Chocolate: 3.7 (3.4, 3.9) $P < 0.01$. The categories with the lowest expected security were Baby Formula: 3.0 (2.7, 3.3)

$P < 0.001$, and Meat: 3.3 (3.0, 3.5) $P < 0.05$. Overall, Australian's expect a total average of 3 to 4 security elements which is food category specific. Categories of Wine, CoffeeTea, Vegetables, Fruit, Grains and Olive Oil all returned P -values greater than the significance level of 0.05 suggesting no difference from the true Australian Total Trusted Security mean. The Dairy, Chocolate, Baby Formula and Meat results suggest that there are differences between categories, statistically significant from the true population mean. These results indicate a pattern that does not conform to the null hypothesis that all category means are equal. Therefore, the Food Category null hypothesis, was rejected.

China's results had statistically highly significant categories with $P < 0.001$ for Olive Oil 4.6 (4.2, 5.1), Meat 3.9 (3.4, 4.3), and Chocolate 3.8 (3.3, 4.3), and significant results for Dairy 4.3 (3.9, 4.8) $P < 0.01$. Olive Oil, Baby Formula and Dairy were the top three categories with the most expected Total Trusted Security averaging around 4 to 5 expected security elements. Meat and Chocolate were ranked last with an average of 4 security elements. Significant difference of means was not found in categories of Baby Formula, Wine, Grains, CoffeeTea, Vegetables and Fruit. Overall, the results indicate categories that differ significantly to the true population mean and therefore, the null hypothesis of equal means was rejected.

In comparison, consumers from Australia and China both expected statistically significant different securities on categories of Dairy, Chocolate and Meat. On average across all categories, China expected an estimated 4 security elements compared to Australia expecting 3 security elements approximately suggesting an increase of 1 security element difference. The results suggest category mean differences within country factor levels that are statistically significant that point to the alternative hypothesis (H_{1a}) of different means across categories.

Life Stage (H_0 , H_{1b})

The summary statistics (Table 42) are reported for the Total Trusted Security over Life Stage per Australia and China. The results are reported in the format of Fitted Means (95% confidence intervals) and P -values.

Australian results indicate significance with Life Stages of 35-44: 3.2 (3.0, 3.4) $P < 0.05$, Stage 55-64: 3.6 (3.4, 3.7) $P < 0.05$, and Stage 65+: 3.8 (3.6, 4.0) $P < 0.001$. Life Stages 18-24, 25-34 and 45-54 were not found significant. The overall Life Stages showed a slightly

positive relationship with expected Total Trusted Security increasing with age. The Australian expected Total Trusted Security mean differed across Life Stages pointing to the null hypothesis to be rejected.

China in comparison found all Life Stages to be significant except for Stage 35-44. Stages 18-24: 5.3 (4.6, 6.0) and 55-64: 3.6 (3.2, 4.1) had high significance at $P < 0.001$. Stage 25-34: 4.4 (4.0, 4.8), Stage 45-54: 3.9 (3.5, 4.4) and Stage 65+: 3.6 (2.8, 4.3) were significant at $P < 0.05$. Chinese Total Trusted Security means differed across age with a negative decline; younger generations expecting 5 elements on average compared to older consumers expecting 4 approximately. Thus, the null hypothesis was rejected.

Table 42. ANOVA GLM: Total Trusted Security across Life Stage per Country (Dec 2018).

Australia (n = 6263)							China (n = 7195)						
Total Security							Total Security						
Analysis of Variance	<i>n</i>	Fitted Mean	SEM	95% CI†	DOM	Sig.	Analysis of Variance	<i>n</i>	Fitted Mean	SEM	95% CI†	DOM	Sig.
Life Stage (in years)							Life Stage (in years)						
18-24	43	3.14	0.30	(2.55, 3.73)	abc		18-24	60	5.29	0.36	(4.58, 6.00)	a	***
25-34	1151	3.36	0.10	(3.16, 3.56)	bc		25-34	2845	4.42	0.21	(4.01, 4.83)	b	**
35-44	1340	3.24	0.10	(3.04, 3.44)	c	*	35-44	2289	4.10	0.21	(3.69, 4.51)	c	
45-54	1555	3.35	0.09	(3.17, 3.53)	c		45-54	1403	3.93	0.22	(3.50, 4.36)	cd	*
55-64	1597	3.56	0.09	(3.38, 3.74)	ab	*	55-64	548	3.61	0.23	(3.16, 4.06)	d	***
65+	577	3.79	0.12	(3.56, 4.03)	a	***	65+	50	3.56	0.39	(2.80, 4.33)	bcd	*
ANOVA	Life Stage: $F_{(5,6227)} = 7.50, P < 0.001$						ANOVA	Life Stage: $F_{(5,7162)} = 15.13, P < 0.001$					
Sig. = Statistical Significance Rating: * p -value < 0.05; ** p -value < 0.01; *** p -value < 0.001; SEM = Standard Error Mean; †95% Confidence Interval; DOM = Difference of Means Tukey's Pairwise Grouping (Means that do not share a letter are significantly different); Factor coding (-1, 0, +1); Total Security equals the combined selected elements for everyday and premium;													

Living Arrangements (H0, H1c)

The summary statistics are presented (Table 43). Australia's Living Arrangement group: 'Adult no kids' was significant with a fitted mean and confidence interval of 3.3 (3.1, 3.5) and a $P < 0.05$. The factor level means on average was 3.4 Total Trusted Security expected across all groups resulting in no significance with $F_{(4,6227)} = 1.49, P = 0.2$, therefore the null hypothesis of equal means was not rejected for Australia.

The China results identified 'Adult-Preteen' group as statistically highly significant ($P < 0.001$) with fitted mean and confidence interval of 4.5 (4.0, 4.9). The factor overall was significant with $F_{(4,7162)} = 7.14, P < 0.001$, therefore the null hypothesis of equal means was rejected.

Table 43. ANOVA GLM: Total Trusted Security across Living Arrangements per Country (Dec 2018).

Australia (n = 6263)							China (n = 7195)						
Total Security							Total Security						
Analysis of Variance	n	Fitted Mean	SEM	95% CI†	DOM	Sig.	Analysis of Variance	n	Fitted Mean	SEM	95% CI†	DOM	Sig.
Living Arrangements							Living Arrangements						
Adult no kids	3708	3.31	0.09	(3.13, 3.49)	a	*	Adult no kids	1522	4.25	0.22	(3.82, 4.68)	ab	
Adult+Preteen	1302	3.41	0.11	(3.19, 3.63)	a		Adult+Preteen	3206	4.46	0.22	(4.03, 4.89)	a	***
Adult+Teen	691	3.47	0.12	(3.24, 3.71)	a		Adult+Teen	1353	4.25	0.22	(3.82, 4.68)	ab	
Adult+Postteen	278	3.41	0.15	(3.12, 3.70)	a		Adult+Postteen	63	3.73	0.36	(3.02, 4.44)	ab	
Adult+Parent	284	3.44	0.14	(3.17, 3.71)	a		Adult+Parent	1051	4.07	0.22	(3.64, 4.50)	b	
ANOVA	Living Arrangements: $F_{(4,6227)} = 1.49, P = 0.2$						ANOVA	Living Arrangements: $F_{(4,7162)} = 7.14, P < 0.001$					

Sig. = Statistical Significance Rating: * P-value < 0.05; ** P-value < 0.01; *** P-value < 0.001; SEM = Standard Error Mean; †95% Confidence Interval; DOM = Difference of Means Tukey's Pairwise Grouping (Means that do not share a letter are significantly different). Factor coding (-1, 0, +1); Total Security equals the combined selected elements for everyday and premium;

Income Quintiles (Ho, H1d)

The summary statistics shown in Table 44 show no significance across all Australian Quintile groups whereas in comparison, the Chinese groups are significant across all groups. The Fitted Means and 95% Confidence Intervals are all reported in the tables alongside the Significance ratings. There is no difference in means across the Australian Quintiles with $F_{(4,6227)} = 0.23, P = 0.9$, therefore, the null hypothesis of equal means is not rejected.

China's Quintile 2, 3 and 5 (Most affluent) are statistically highly significant ($P < 0.001$) compared to Quintile 1 (Most disadvantaged) and Quintile 4. The Total Trusted Security fitted means range from Quintile 2: 3.6 to Quintile 3: 4.5 on average indicating differences among groups and therefore, the null hypothesis was rejected.

Table 44. ANOVA GLM: Total Trusted Security across Income Quintiles per Country (Dec 2018).

Australia (n = 6263)							China (n = 7195)						
Total Security							Total Security						
Analysis of Variance	n	Fitted Mean	SEM	95% CI†	DOM	Sig.	Analysis of Variance	n	Fitted Mean	SEM	95% CI†	DOM	Sig.
Income Quintiles							Income Quintiles						
Most disadvantaged	1508	3.43	0.10	(3.23, 3.63)	a		Most disadvantaged	1251	3.96	0.23	(3.51, 4.41)	b	**
Quintile 2	1471	3.41	0.10	(3.21, 3.61)	a		Quintile 2	1429	3.59	0.23	(3.14, 4.04)	c	***
Quintile 3	1042	3.42	0.11	(3.20, 3.64)	a		Quintile 3	1872	4.48	0.23	(4.03, 4.93)	a	***
Quintile 4	1322	3.36	0.11	(3.14, 3.58)	a		Quintile 4	1292	4.30	0.23	(3.85, 4.75)	a	*
Most affluent	920	3.42	0.11	(3.20, 3.64)	a		Most affluent	1351	4.43	0.23	(3.98, 4.88)	a	***
ANOVA	Income Quintiles: $F_{(4,6227)} = 0.23, P = 0.9$						ANOVA	Income Quintiles: $F_{(4,7162)} = 38.57, P < 0.001$					

Sig. = Statistical Significance Rating: * P-value < 0.05; ** P-value < 0.01; *** P-value < 0.001; SEM = Standard Error Mean; †95% Confidence Interval; DOM = Difference of Means Tukey's Pairwise Grouping (Means that do not share a letter are significantly different). Factor coding (-1, 0, +1); Total Security equals the combined selected elements for everyday and premium;

Place of Residence (H_0 , H_{1e})

The summary statistics (Table 45) confirm no significant different regions for Australia and all Chinese regions as significant. North-Eastern China's fitted mean and confidence interval of 3.8 (3.3, 4.3) and South-Central China 4.4 (3.9, 4.8) both were significantly different from the other regional means reporting a P -value of $P < 0.001$. Western China reported 4.3 (3.9, 4.8) significant at $P < 0.05$. Although, Eastern China and Northern China did not have significant results, the overall factor statistics resulted in $F_{(4,7162)} = 8.74$, $P < 0.001$ pointing to regions that have different means to the true population mean and therefore, the null hypothesis was rejected.

Table 45. ANOVA GLM: Total Trusted Security across Residence Region per Country (Dec 2018).

Australia (n = 6263)							China (n = 7195)						
Total Security							Total Security						
Analysis of Variance	n	Fitted Mean	SEM	95% CI†	DOM	Sig.	Analysis of Variance	n	Fitted Mean	SEM	95% CI†	DOM	Sig.
Residence Region							Residence Region						
ACT	117	3.47	0.19	(3.10, 3.84)	a		Eastern China	2087	4.23	0.22	(3.80, 4.66)	ab	
NSW	1748	3.39	0.09	(3.21, 3.57)	a		North-Eastern China	571	3.81	0.24	(3.34, 4.28)	c	***
NT	38	3.27	0.32	(2.64, 3.90)	a		Northern China	865	4.04	0.23	(3.59, 4.49)	bc	
QLD	1356	3.40	0.09	(3.22, 3.58)	a		South Central China	2080	4.36	0.23	(3.91, 4.81)	a	***
SA	506	3.33	0.11	(3.11, 3.55)	a		Western China	1592	4.31	0.23	(3.86, 4.76)	a	*
TAS	160	3.65	0.17	(3.32, 3.98)	a		ANOVA	Residence: $F_{(4,7162)} = 8.74$, $P < 0.001$					
VIC	1703	3.39	0.09	(3.21, 3.57)	a								
WA	635	3.37	0.11	(3.15, 3.59)	a								
ANOVA	Residence: $F_{(7,6227)} = 0.60$, $P = 0.8$												

Sig. = Statistical Significance Rating: * P -value < 0.05; ** P -value < 0.01; *** P -value < 0.001; SEM = Standard Error Mean; † 95% Confidence Interval; DOM = Difference of Means Tukey's Pairwise Grouping (Means that do not share a letter are significantly different). Factor coding (-1, 0, +1). Total Security equals the combined selected elements for everyday and premium;

Trust Propensity (H_0 , H_{1f})

The summary statistics (Table 46) present Australia with 6 levels that are significant compared to China which reports 4 levels significant. Whilst, the significant differences between levels is not of research importance, the indicated correlations are. In summary, Australia and China both reported large F -statistics and significant P -values of Australia: $F_{(6,6227)} = 40.0$, $P < 0.001$, and China: $F_{(6,7162)} = 107.8$, $P < 0.001$, indicating evidence that the null hypothesis, all levels have equal means, was rejected.

Table 46. ANOVA GLM: Total Trusted Security across Trust Propensity per Country (Dec 2018).

Australia (n = 6263)							China (n = 7195)						
Total Security							Total Security						
Analysis of Variance	<i>n</i>	Fitted Mean	SEM	95% CI†	DOM	<i>Sig.</i>	Analysis of Variance	<i>n</i>	Fitted Mean	SEM	95% CI†	DOM	<i>Sig.</i>
Trust Propensity							Trust Propensity						
1 Strongly Disagree	37	2.12	0.32	(1.49, 2.75)	d	***	1 Strongly Disagree	3	0.45	1.31	(-2.12, 3.02)	e	**
2	146	3.11	0.17	(2.78, 3.44)	bcd	*	2	22	3.45	0.49	(2.49, 4.41)	cde	
3	883	3.00	0.10	(2.80, 3.20)	cd	***	3	196	3.96	0.19	(3.59, 4.33)	de	
4	2900	3.15	0.08	(2.99, 3.31)	c	***	4	1700	4.32	0.11	(4.10, 4.54)	d	
5	1761	3.45	0.08	(3.29, 3.61)	b		5	2931	4.73	0.10	(4.53, 4.93)	bc	**
6	452	4.35	0.11	(4.13, 4.57)	a	***	6	1864	4.90	0.11	(4.68, 5.12)	b	***
7 Strongly Agree	84	4.69	0.22	(4.26, 5.12)	a	***	7 Strongly Agree	479	7.25	0.14	(6.98, 7.52)	a	***
ANOVA	Trust Propensity: $F_{(6,6227)} = 40.02, P < 0.001$						ANOVA	Trust Propensity: $F_{(6,7182)} = 107.80, P < 0.001$					
Sig. = Statistical Significance Rating: * <i>P</i> -value < 0.05; ** <i>P</i> -value < 0.01; *** <i>P</i> -value < 0.001; SEM = Standard Error Mean; †95% Confidence Interval; DOM = Difference of Means Tukey's Pairwise Grouping (Means that do not share a letter are significantly different); Factor coding (-1, 0, +1); Total Security equals the combined selected elements for everyday and premium;													

To further the analysis specifically on the individual security elements importance to consumers and their selection comparison of each other, a Binomial Logistic Regression was undertaken to obtain odds ratios and confidence intervals to understand each elements impact per countries expectations.

4.5.6 Test 3 - Binary Logistic Regression

Individual Security Elements Expected per Country

A Binary Logistic Regression was used to assess participant responses on expected individual security elements and the results comparing the two populations.

Hypotheses

The null hypothesis and its alternative were revisited:

- 1 H₀: All the security elements selection likelihood is equal compared across each country.
- 1 H₁: All the security elements selection likelihood is not equal compared across each country.

Therefore, the obtained result outputs (Table 47) present the individual elements expected proportions with 95% confidence intervals, including the odds ratios and their respective 95% confidence intervals. *P*-values corresponding to the odds ratios are also obtained assessing the significant comparison between the two populations odds ratio ranges.

Odds ratios and their respective 95% confidence intervals compared across the two populations reported statistically significant *P*-values for all elements indicating that the two populations expectations are significantly different, and each element varies in cultural perceived value.

The likelihood odds ratios indicate that Chinese participants are 5.5 times less likely to expect the Australian Made Logo and Awards element to build their trust of the products authenticity compared to the Australian participants. In contrast, all remaining 4 elements are 'more likely' to be selected by the Chinese participants as trustworthy security elements compared to Australian participants with ScanQR (8 times more likely); DesignMat and Currency (5 times more likely); and PackOnce (2.4 times more likely). These results suggest that a greater proportion of the Chinese population expect more types of security on food packaging to build their authenticity trust, compared to

Australian participants. The Australian results show 90% of respondents selected the Australian Made Logo and Awards element as the element of trust with little selection of other elements reported.

Table 47. Country Participants of Nominated Security Elements Expected on Australian Food Packaging Categories shown in Proportions and Odds Ratios with Respective 95% Confidence Intervals and resulting *P*-values.

Element	Australia (n=7239)	China (n=7255)	China relative to Australia	
	% (95% CI)	% (95% CI)	OR (95% CI)	<i>p</i> -value
AustMade	90.9 (90.2, 91.6)	63.7 (62.6, 64.8)	0.18 (0.16, 0.19)	<i>p</i> < 0.01
Currency	14.0 (13.2, 14.8)	43.7 (42.5, 44.8)	4.75 (4.38, 5.15)	<i>p</i> < 0.01
PackOnce	23.8 (22.8, 24.8)	42.5 (41.4, 43.6)	2.37 (2.21, 2.55)	<i>p</i> < 0.01
ScanQR	11.9 (11.1, 12.6)	50.8 (49.6, 51.9)	7.65 (7.03, 8.33)	<i>p</i> < 0.01
DesignMat	20.4 (19.4, 21.3)	53.3 (52.2, 54.5)	4.47 (4.15, 4.81)	<i>p</i> < 0.01
Other	2.7 (2.3, 3.1)	0.1 (0.1, 0.2)	0.05 (0.02, 0.09)	<i>p</i> < 0.01
None	2.8 (2.4, 3.2)	2.4 (2.1, 2.8)	0.86 (0.70, 1.06)	<i>p</i> < 0.01
Total Mean	32.2 (31.1, 33.3)	50.8 (0.50, 0.52)	0.46 (0.43, 0.49)	<i>p</i> < 0.01

CS = Currency Security Printing; CI = Approximate 95% Confidence Interval; OR = Estimated Odds Ratio for Australia relative to China; Significance level $\alpha = 0.05$; OR 95% CI using Woolf's Method; Total Mean calculated from the total sum of the 5 defined elements (AustMade, Currency, PackOnce, ScanQR, and DesignMat) and averaged.

The following Section 4.6 Analysis (Study 3) takes these results and discusses their significance, statistically and practically for academic research and for the food industry.

4.6 Analysis (Study 3) - Quantitative Consumer Survey

4.6.1 Overview for Analysis

The purpose of the final major study is to discuss the results from the quantitative online survey conducted in Australia and China, comparing the differences ‘between’ and ‘within’ the two populations, when considering security elements that build trust. Thus, the objective is restated: To compare consumer’s trust perceptions and security expectations cross-culturally across exported food products and packaging.

Henceforth, the structure of the analysis for Study 3 in Section 4.6 is as follows: Firstly, the analysed results taken from the trust propensity scores are compared and discussed (Section 4.6.1), a comparison ‘between’ cultures is presented (Section 4.6.2), and the comparison within ‘cultures’, considering sub-profiles in detail, is critiqued (Section 4.6.4), finally, the value of each element is weighted and compared (Section 4.6.5).

All summaries are reserved for Chapter 5 Conclusion of this dissertation.

4.6.2 *Trust Propensity Compared*

From the outputs taken from Section 4.5 Results (Study 3) a Trust Propensity Score was created by aggregating the averages of the participant's responses placed on a 7-point Likert scale measuring the trust of the food industry. The Likert scale ranged from 1 = 'strongly mistrust' to 7 = 'strongly trust'. The mid-point is the average score of 4 = neutral or unknown. To demonstrate the Trust Propensity comparison between Australia and China, Figure 111 depicts the Food Categories (from Wine to Olive Oil) grouped by the 6 Trust groups tested (from People I buy products from to Foreign Official Regulators). The Australian results clearly indicate clusters of results, with each trust-stakeholder group distinct from the others. In contrast, the Chinese responses are similar across each trust-stakeholder group. The approximate average Australian Trust Propensity rating for each group is as follows: (1) Trust People: 4.4, (2) Trust Online: 4.0, (3) Trust Local: 5.3, (4) Trust Foreign: 3.5, (5) Trust Official Local: 4.3 and (6) Trust Official Foreign: 3.2, indicating an overall neutral response of 4 approximately with a standard deviation of 0.95. The Chinese plots in comparison all appear to conform to a unified rating between 4.5 and 5.3 indicating a slightly higher trust propensity than Australians. However, the groups are not strongly differentiated over the 6 trust-stakeholder groups and collectively rate responses around the 5-point mark.

This analysis depicts distinct groups for the Australian respondents strongly trusting Local Producers over the 10 food categories with an average of 5.3 points trust propensity score compared to their lowest trust group of Foreign Officials regulating the food industry with a negative trust propensity rating averaging 3.3 points. This suggests that Australians trust Australian-made and local produced food products whereas, they are sceptical of foreign regulators generally indicating that Australian-made is preferred by Australian's and perceived significantly trustworthy compared to other countries.

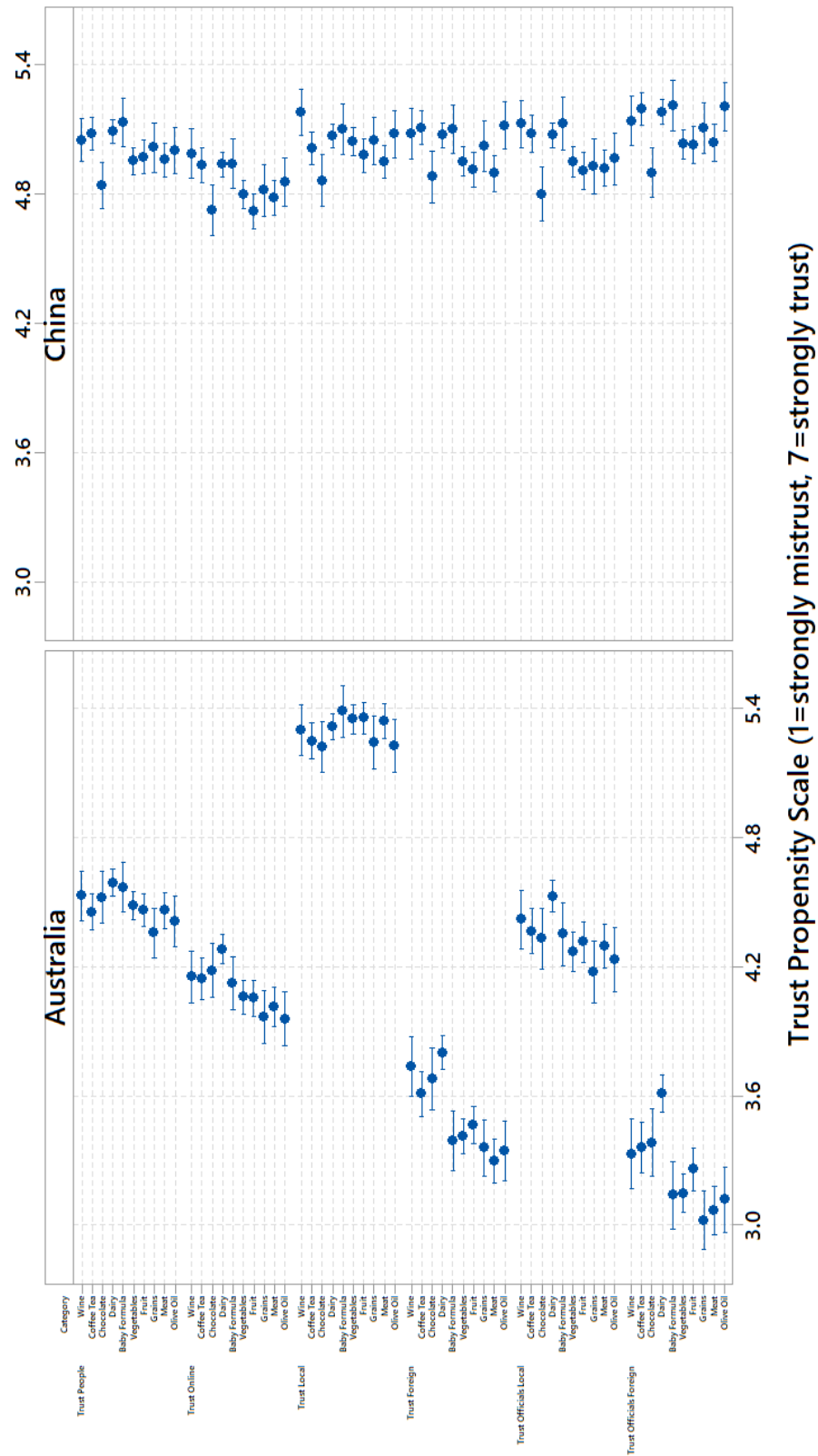
Chinese respondents did not deviate largely from approximately 5-points trust propensity over all trust groups and across all food categories. Interestingly, when comparing across food categories, chocolate stood out as the lowest rated on trust when considered against all groups of the food industry.

Overall, there are cultural differences that drive trust and the results shown indicate that although China rates all the food industry approximately the same, it is ranked just above

neutral (4-points). This suggests that as a country, there is generally low trust. Australian on the other hand is openly responsive to all the groups assessed on the Food Industry signifying an ability to appraise their country's producers, regulators and foreign actors freely without any implications. The Chinese representatives could be reporting reserved responses due to cultural acceptance of food industry challenges. The results still maintain to the theory that the Chinese are risk adverse and have not shown clear evidence that they positively trust the food industry actors either locally or internationally.

The ANOVA GLM assessment of factors within each population is shown. The Trust Propensity versus Total Trusted Security Interval Plot (Figure 112) compares the two countries levels ranging on a Likert Scale from 1 – 7 (Refer to Trust Propensity variable for definitions). The two countries both indicate a positive correlation across the two variables of trust and expected security. When the Trust Propensity is rated low the expected Total Trusted Security also reflects a low rating. Participants inclined to trust the food industry also increased their nominations of the Total Trusted Security elements. Specifically, the Chinese have a strong, positive correlation between the associated variables compared to the Australian's relationship which is less correlated but still indicates a slight incline. Interestingly, the Chinese results are weighted approximately equal on 1: Strongly Distrust and 7 Strongly Trust which the Interval Plot reveals. The correlation indicates that when consumers trust the food industry stakeholders, they trust their claims and callouts presented on pack and look for additional levels of security to distinguish that the product is authentic and from the trusted sources. Consumers with a strong trust propensity suggest they trust the true sources, are seeking out their authentic goods, knowingly they are targeted by fraudulent risks and thus, an increased security expectation result. If they trusted the sources and had no heightened perceived risk of counterfeiting or corrupt threats, then an increased in security elements would not be seen. Thus, the relationship strongly suggests that when the Trust Propensity Score is high, consumers perceived risk of threats are also high impacting on consumers searching for proactive securities that prove authenticity. This strongly supports the theoretical framework proposal that exposed consumers, seeking authentic goods have heightened perceived risk resulting in forensic searching for multi-layered authenticity measures.

Interval Plot showing Trust Propensity of the Food Industry (2017-2018) 95% Confidence Intervals for the Sample Means



Panel variable: Country
Individual standard deviations are used to calculate the intervals.

Figure 111. Interval Plots showing Trust Propensity of the Food Industry and Food Categories per Country.

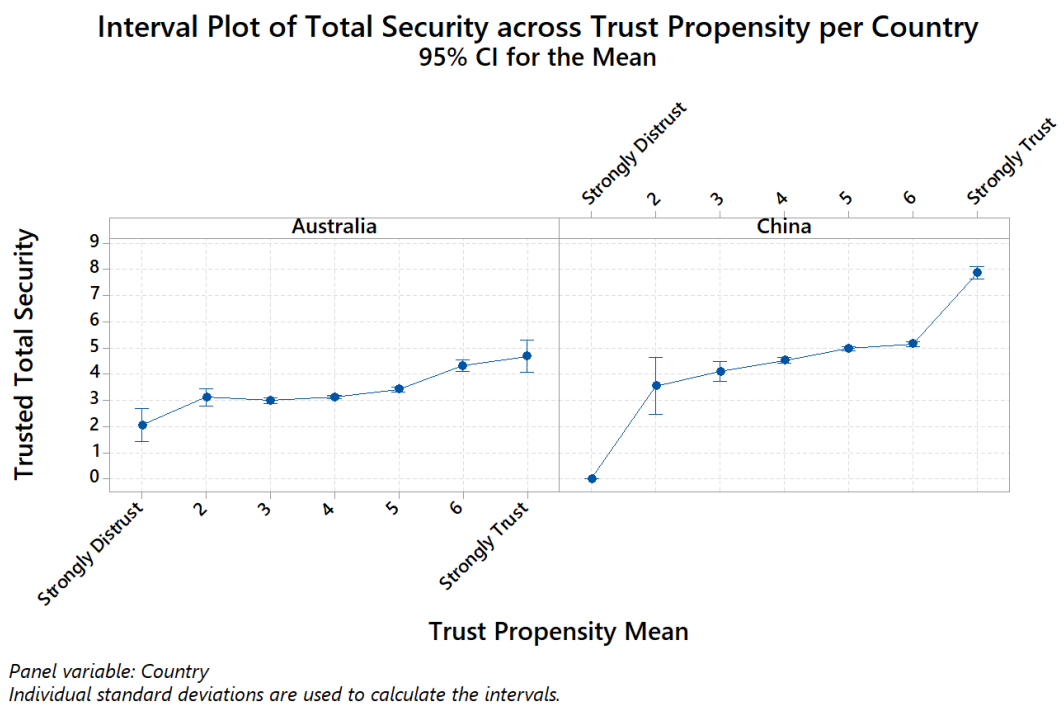


Figure 112. Interval Plot of Total Trusted Security across Trust Propensity per Country.

4.6.3 *Comparison Between Cultures*

Individual Element Expectations

The Results from the Multiple Correspondence Analysis (MCA) (Section 4.5.3) strongly indicate significant differences between the two cultures and their expectations of individual security elements. The Australian respondents highly ranked the Australian Made Logo and Awards as the number 1 element expected to justify a products authenticity from Australia with all other elements as less important or even not required. The analysis of these results reveal that Australian's put weighted faith in the Australian Made Logo and perceive the country of origin emblem as a given trustworthy callout. This supports the results from the Australian Trust Propensity Scores which rate high on Australian local producers.

In comparison, the Chinese consumers did not carry the same trust of the Australian Made Logo although did not disregard its importance. They clearly responded to all the presented elements to some degree with all elements approximately contributing to the same level of variance. The 'Other' option was also often selected suggesting the Chinese consumers were seeking more than what was presented. These learnings are imperative for Australian SME exporters to China who often softly judge their own products using their own biased trusting standards. By learning from these results that Chinese consumers expect much higher levels of security, SME business should be compelled to invest in both design and technology applications that will return value in the form of authenticity checks, essential for initial and ongoing trust. This research is pertinent in pointing out the clear differences between cultural expectations of both countries perceptions of the Australian Made Logo and any country of origin claims. Although, identity icons like the Australian Made Log is a vital trust element, it clearly is not satisfactory on its own for Chinese acceptance.

To extrapolate the analysis further and visualise the impact, the MCA Column Contributions Inertia values were compared across countries (Table 48) with data bars used to indicate factor influence strength. The Australian's Inertia values confirmed the AustMade elements influential weight compared to the remaining elements. In contrast, the Chinese Inertia values indicated an equal weighting per element, 'selected' and 'unselected (X)'. The Chinese results show that the top two influential factors were 'AustMade' and 'Design' elements (apart from the 'OX' and 'CX' elements identified as

‘not selected’), with the remaining security elements closely clustered in positioned pertaining to similar influence and importance. The results suggest that the null hypothesis, that all the security elements contribute the same influence on Chinese trust, was not rejected. The Australian’s selected the ‘AustMade’ and all other factors were approximately not expected for authenticity proof. This calls for a shift in education for Australian exporters to recognise the clear differences between security and design expectations.

Table 48. Multiple Correspondence Analysis (MCA) Column Contribution Inertia Results for Multivariate Factors Influencing on Consumer Trust per Country (2018).

ID	Factors	Inertia Results	
		China	Australia
1	AustMade	0.128	0.182
2	AX	0.072	0.018
3	Currency	0.088	0.028
4	CX	0.113	0.172
5	OncePack	0.085	0.047
6	OX	0.115	0.153
7	ScanQR	0.102	0.025
8	SX	0.098	0.176
9	Design	0.107	0.042
10	DX	0.093	0.159

Data bars indicating factors contributing influence on the overall variance
 Factors defined by full name = 'selected' and X = 'unselected'

Differences Between Demographic and Trust Factors

The ANOVA GLM was adopted to test between the two populations to distinguish significant differences between the two true population means. It was evident that the two cultures statistically were significantly different ($P < 0.001$, 95% confidence interval) on expected security elements when assessed on Food Categories, Life Stages, Living Arrangements, Income Quintiles and across their Trust Propensity Scores. The Tukey DOM test portrays a clear means difference greater than 0 with the 95% confidence interval weighted positively towards China expecting more security. The only factor that did not show any differences between cultures was the assessment on Gender (Section 4.5.4 Results). These results overall indicate that expectations to prove authenticity differs greatly between Australia and China and exporting SME businesses need to be made aware of the implications on their anti-counterfeiting and trust building element

selection. It is established that risk perceptions impact on societies exposed to more threats and scandals and the Chinese results reveal an increased desire for increased security elements in:

- (1) measured quantity,
- (2) element type,
- (3) bundled combinations, and
- (4) premium design and materials.

This initial test does not granularly show the impact micro-cultures play and the changes of expectations over demographics and trust propensities. Therefore, the investigation is extended through the second assessment, Test 2B, focusing on the differences *within* each culture and demonstrating the comparative expectations of security elements per country per sub-profile.

4.6.4 Comparison Within Cultures

The analysis of results from Section 4.5 ANOVA GLM with two Main Effects Plots, referenced for Australia (Figure 113) and China (Figure 114), demonstrate the comparable differences between the two cultures. A red reference line is included at point 4 to show a common comparison line for both sets of results. All Australian plotted results fall below the 4-point line, whereas, the Chinese results breach the 4-point line. These multi-panel graphs visually reveal the significant differences within each culture across the 5 factors portraying sub-profiles of each country.

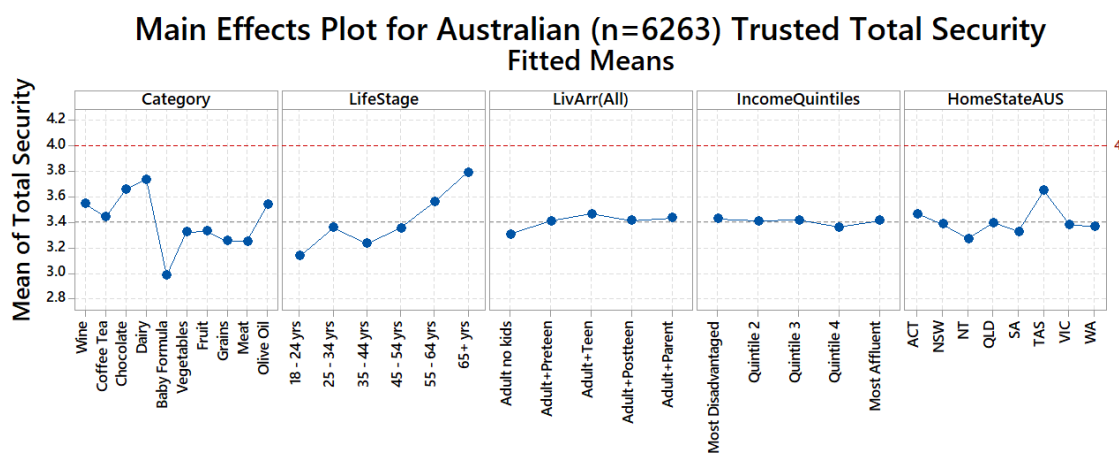


Figure 113. Revisited Australian Main Effects Plot of Total Trusted Security across Variables.

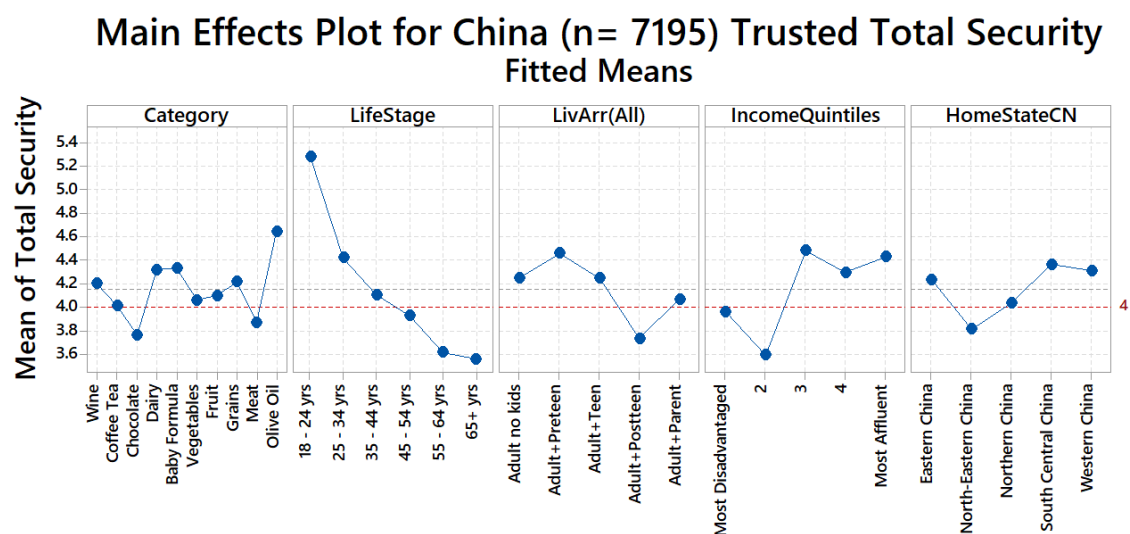


Figure 114. Revisited Chinese Main Effects Plot of Total Trusted Security across Variables.

The sub-profiles of Food Categories, Life Stage, Living Arrangement, Income Quintiles, and Place of Residence, overall, show that the Australian analysis averages expected security below the red reference line approximately at the 3.4 point compared to the Chinese expected security averaged above the red reference line at 4.2 point showing a 0.8 point increase for Chinese results compared to Australia. This clarifies the differentiation between the culture's expectations. The sub-profiles detailing the differentiation of cultures is now discussed.

Food Categories Analysis

The two Countries expected Total Trusted Security sample means with 95% confidence intervals were plotted against the factor 'Food Category' with the 10 category levels (Figure 115). Distinct differences across the Countries is evident with Australian groups falling well below the 4-element mark and China above.

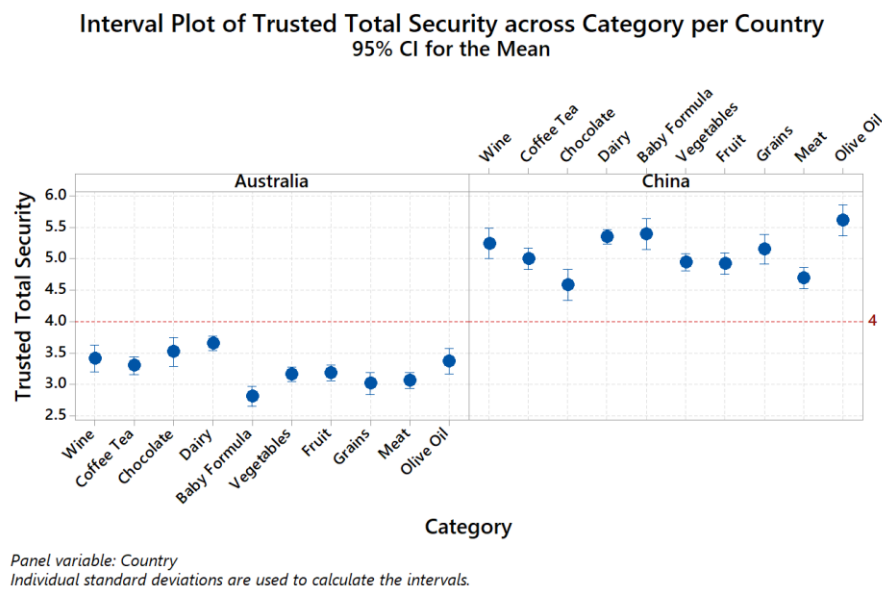


Figure 115. Interval Plot of Total Trusted Security across Food Categories per Country.

The Food Category (results reported in Chapter 4, Section 4.3.5), shows the continuing contrast with the Australian's low expectations of security required on Baby Formula (3.0) compared to their highest ranked category which is Dairy (3.8). When considering the specific elements that contribute to trusting authenticity for Australian's a Binary Logistic Regression showed results of the Australian Made Logo and Awards element as the leading element with over 90% of Australian participants selecting it and unselecting all other elements. The only other element awarded second place is the Premium Design

and Materials element suggesting that country of origin and design contribute the most to authenticity for Australians. This explains the low rating for most food categories and all other factors considered. The Chinese lowest rated food category was Chocolate (3.7) and the highest was Olive Oil (4.7) presenting a full 1-unit difference between the averages. The food categories that showed increased security expectations was Olive Oil, Baby Formula, Dairy, Grains and Wine. Surprisingly, Chocolate and meat were the lowest rated categories. These two categories being the lowest categories for Chinese comparatively equalled the highest categories rated for Australians again supporting the significant differences between the two cultures.

Overall, the true means within the food categories appraised by the Australians show statistically significant differences between Dairy, Baby Formula, Chocolate and Meat. For the Chinese, significant differences exist between Olive Oil, Meat, Chocolate and Dairy. This indicates that Australian exporting businesses such as SMEs need to assess their security elements against food category appropriateness to ensure consumers acceptance and trust of authenticity.

The Life Stages Analysis

The interval plot (Figure 116) comparing the countries Total Trusted Security across the Life Stage variable suggests a comparably different trend between Australia's and China's expectations as they age.

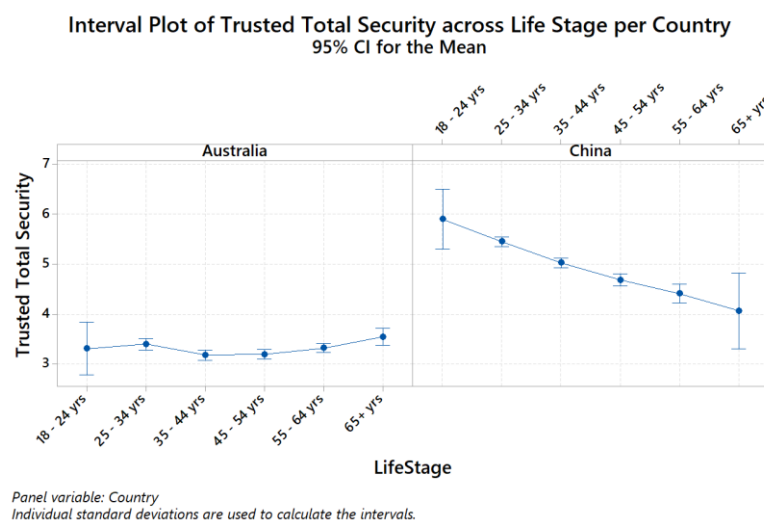


Figure 116. Interval Plot of Total Trusted Security across Life Stage per Country.

On visual assessment, Australian's have a slight, positive relationship expecting more security as they age. China's responses indicate a strong, negative correlated relationship between expected Total Trusted Security and Life Stage with the younger generations expecting 6 total securities approximately on average, which declines steadily to an expected 4 Total Trusted Security elements by the life stage of 65+. The Australian results show true mean differences between the three age groups 65+; 55-64; and 35-44 while the Chinese results show significant difference of means between all age groups except for the age group 35-44. The analysis indicates age groups can be a contributor to different expectations and needs considering the number of security elements and which matter most to each sub-group. This also highlights that the younger Chinese generations are more risk adverse and potentially have the means to acquire products that are more premium with the expectation that security is at the upmost levels with a clear negative regression of the number of elements as age increases.

The Living Arrangements Analysis

A two-panel interval plot (Figure 117) compares the countries Total Trusted Security across Living Arrangements. Australian's Living Arrangements plateau mid-way between 3 – 3.5 elements with little difference among profiles. Chinese expect more securities in comparison and differ between the Living Arrangement groups especially when the respondent identifies their youngest member of a family as a Preteen - between 0 to 13 years of age (refer to Table 27 for further group definitions and inclusions). The Adult+Preteen includes families with young children, and it is considered an important factor for Chinese parents, or guardians to want to provide the best for their dependent/s supporting the Chinese statistical results showing a significant increase for this living arrangement profile, expected security elements at point 5.5. This shows that Australian SME exporters need to consider this specific demographic when using the DDIFs especially the User-Purposed factor for family-oriented needs.

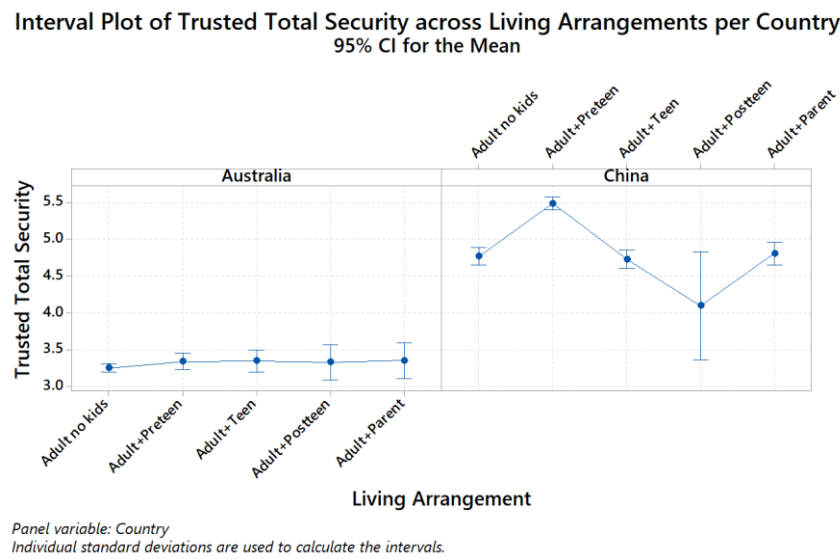


Figure 117. Interval Plot of Total Trusted Security across Living Arrangement per Country.

The Income Quintiles Analysis

The analysis for the Australian's Income Quintiles (Figure 118) shows no differences between each sector and average approximately at 3.6 Total Trusted Security elements. The Chinese groups are all significantly different and indicate an overall positive correlation with increased income influencing expected number of security elements. However, the highest peak of expected security is found at Quintile 3 with comparatively high Quintiles 4 and 5 following just below. This indicates that those with expendable income will invest in security elements as their purchases are less restrained to the necessities of general life with the higher quintiles representing consumers seeking high quality premium products. Thus, premium categories support the additional expense that may be incurred through the investment of Design-Driven security elements that capture these markets. With this say, the lower Quintiles 1 and 2 still show interest in numerous security elements with Quintile 1 expecting above 4.5 and Quintile 2 just below. Comparisons between cultures clearly portray Chinese consumers as more concerned about product authenticity and whom require a significant investment of layered elements to earn their Initial Trust.

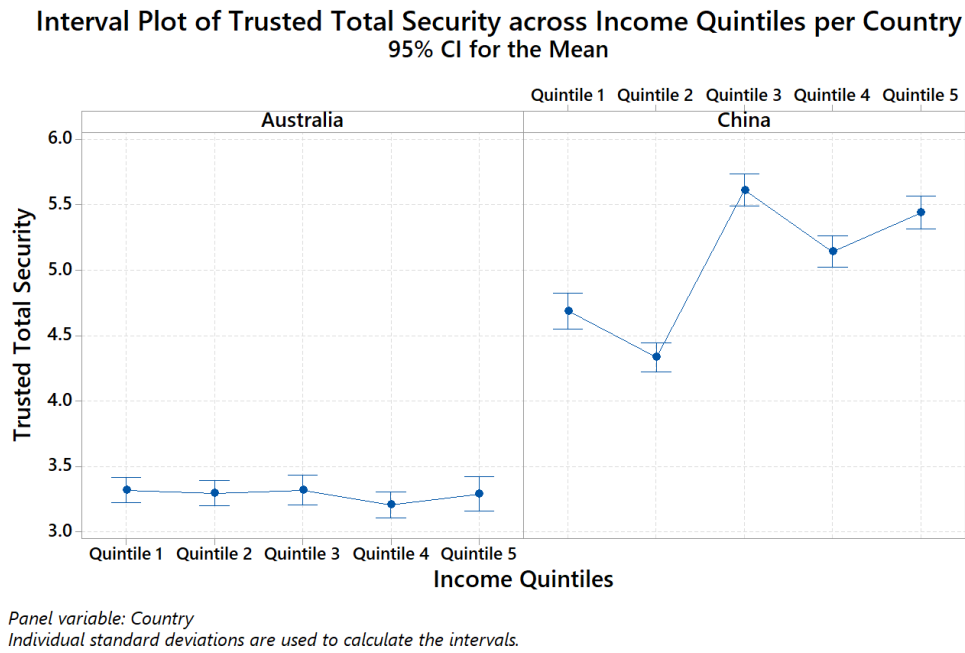


Figure 118. Interval Plot of Total Trusted Security across Income Quintiles per Country.

The Place of Residence Analysis

Australian's Place of Residence groups are plotted across Total Trusted Security (Figure 119). All groups compared, little variation deviates from 3 expected securities approximately, except for Tasmania which increases to over 4 security elements. It is noted that the confidence intervals overlap and indicate that Australia respondents from all states have equal means.

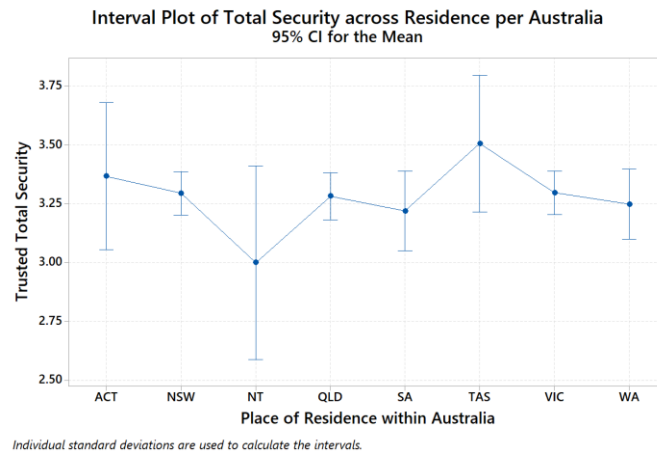


Figure 119. Interval Plot of Total Trusted Security across Residence per Australia.

The Chinese groups in comparison, are shown in Figure 120 which suggest profound differences of expected Total Trusted Security per region. North-Eastern China's estimated mean is approximately 4.3 compared to the remaining 4 other regions which range between 4.8 and 5.3 elements on average. True means differ between North-Eastern China, South Central China and Western China. As these regions represent extremes cultural differences in food, language and customs, it is expected to see differences in expectations of security as well. This shows that within a country the size of China, micro-cultures exist and therefore regional differences pertaining to security needs require further examination and adjustment prior to export. Ideally, aiming at the higher end of the spectrum which is above 5 units of security would satisfy the lower sub-profiles such as North-Eastern China.

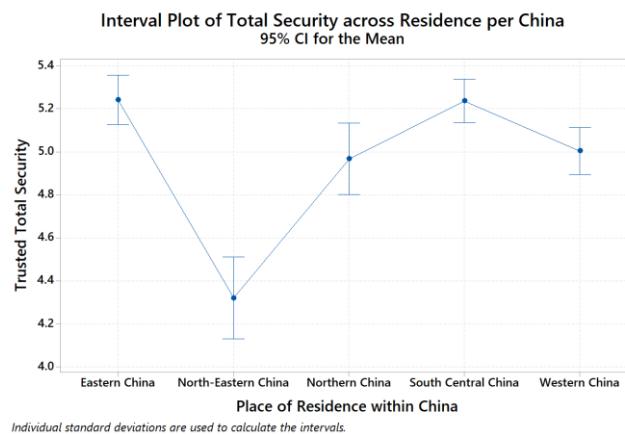


Figure 120. Interval Plot of Total Trusted Security across Residence per China.

4.6.5 The Weighted Value of the Elements

The Binary Logistics Regression (Section 4.5.6 Results for Test 3) was used to compare the likelihood of element selection using proportions per country. The assessment was made across the food categories to identify if specific categories impacted on security expectations. To visually demonstrate the analysis taken from the results, Interaction Plot graphs are presented to signify the comparisons and importance of each element. Figure 121 demonstrates the Interaction Plot (left) and the Main Effects Plot (right) with Fitted Means presenting the Austmade Logo likelihood of selection ratios across the Food Categories per Country (Australia referenced as Blue and China indicated as Red). The differences when selecting the 'AustMade Logo' show Australian's expecting it approximately 85-95% on every food category whereas the Chinese ranged between 55%-70% selected rate across the food categories. This shows the Chinese are significantly less likely to select the Australian Made Logo element than Australians, over all the food category presented suggesting the need for additional security support to build Chinese trust. Complimentary 'Layering' security elements was also identified in Study 1 as a DDIF (Section 5.2.1) and again supported in this study. The Chinese likelihood of selecting the AustMade element is comparatively lower than Australians. However, Chinese still expect the country of origin labels to be present supporting the 'Identity Links' factor listed again in Study 1 DDIFs.

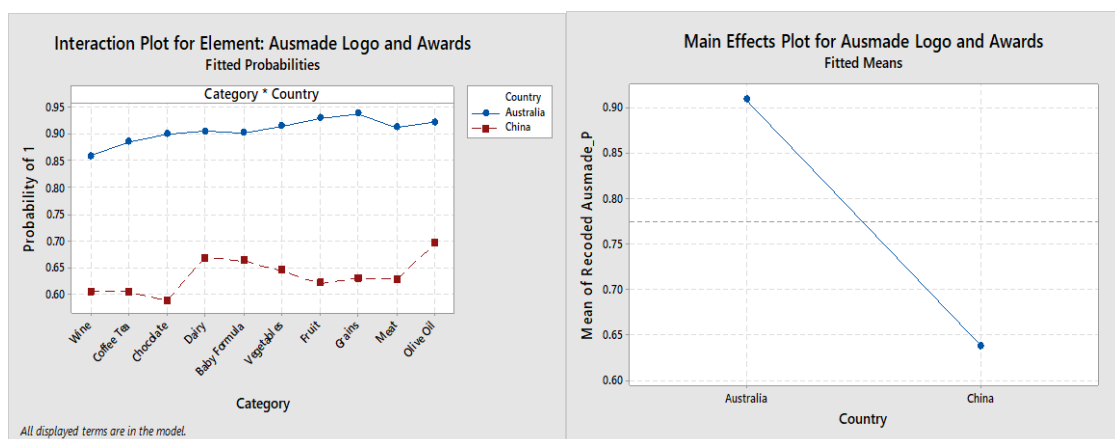


Figure 121. Australian Made Logo and Awards Element (left) Interaction Plot, (right) Main Effects Plot over Food Categories per Country.

The Interaction Plots and Main Effects Plots with Fitted Means are independently reported for the remaining 4 elements showing Currency (Figure 122), PackOnce (Figure

123), ScanQR (Figure 124), and DesignMat (Figure 125). Collectively, all the graphs indicate that over all individual security elements, between 40% to 50% of Chinese participants expected each element in comparison to the Australian participants were preferred only the AustMade element on average.

The Currency Graphic, representing all types of securities found on currency banknotes was again perceived strong by the Chinese communities (Figure 122). The food groups did not strongly impact the likelihood of the element's selection. However, Chocolate and Meat were considered the lowest and Wine, Dairy, Baby Formula and Olive Oil were on the higher scales towards 50% of participants expected to select the Currency element. Thus, Currency graphics are considered by the Chinese as appropriate for the food industry and thus the unusual security element is shown to be 'Fitted' to the new application of food products which supports the DDIFs identified in Study 1. Currency graphics would require educated designers to implement such securities such as the design committee employed by the RBA. The graphics are identified by their complexities yet long lasting duration of deterrence. Thus, their increased investment reduces the short term need to continually refresh designs, using the theory of a master-artwork that communicates sophistication and a warning of deterrence.

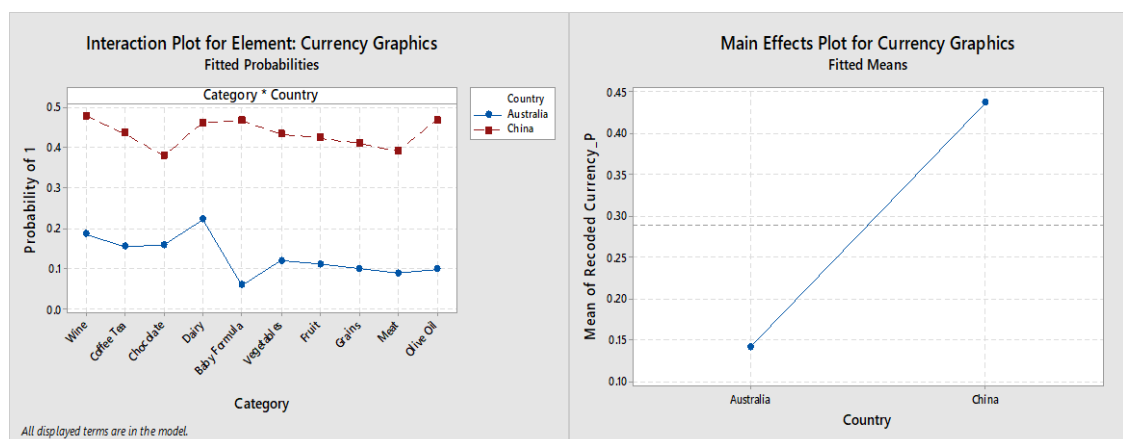


Figure 122. Currency Security Graphics Element (left) Interaction Plot, (right) Main Effects Plot over Food Categories per Country.

The Use Once Packaging represented destructive packaging that could not be used beyond its initial purpose (Figure 123). Interestingly, the Chinese and the Australian responses both differed significantly across the food categories considered. The Chinese surprisingly showed less likelihood of selected One-Use Packaging on Meat, Vegetables

and Chocolate. These results could suggest that many of the Chinese respondents do not often purchase meat and vegetables in packaging in the first place and therefore, do not consider the need for packaging at all. Interestingly though, the Once-Use element drew out greater peaks and troughs across the food categories over the two cultures when compared to all other elements which are seen to be more level. One-Use packaging could also be perceived as a negative attribute by those looking for more sustainable means. On the other hand, One-Use packaging, that uses simple destructive features such as shrink wrap layering, enables the outer packaging to be torn away revealing a recyclable bottle or structural pack that could be used. The Main Effects Plot still demonstrates that the One-Use element is significantly more likely to be selected by Chinese consumers compared to Australian consumers indicating another form of design-related contribution that can reduce counterfeiting attempts through the capability: 'Reuse' (Study 2 Counterfeiters Capabilities).

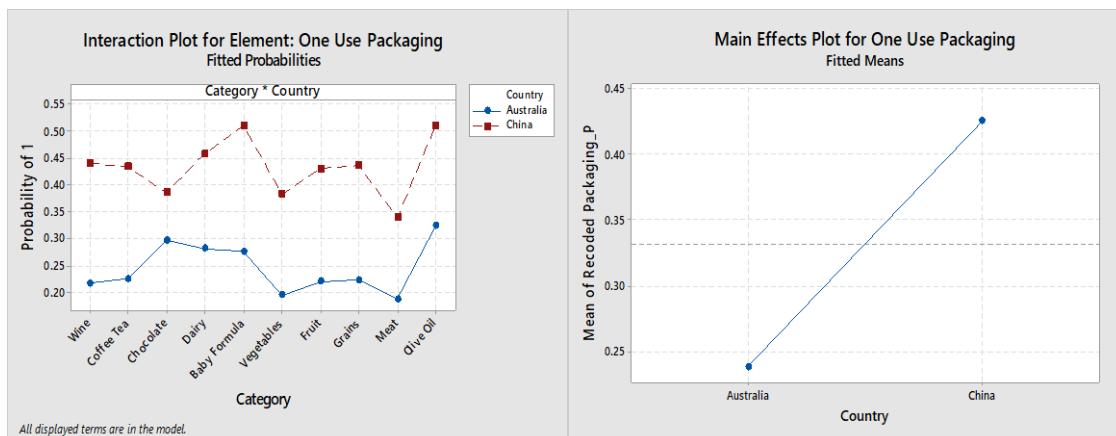


Figure 123. Pack Use Once Element (left) Interaction Plot, (right) Main Effects Plot over Food Categories per Country.

The likelihood of selecting the Scan ID element as shown in Figure 124 shows again the Chinese participants significantly higher than the Australian participants as the Scan ID element offers additional layers of information and heightens the engagement through a familiar cue that is commonly placed and expected within the Chinese community. Study 1 identified the QR code as an Everyday application which may reduce the overall communication of Premium status. However, it is the designed content and the designed embedding of the QR code or other Scan ID elements that can increase trust of the technology. Thus, DDIFs place a powerful role in the acceptance of these technologies which are shown to be expected as another source of checking for authenticity. SME

brands have often commented that QR codes are not widely used in Australian implying that in their experiences, they wouldn't use them. Such comments need to be readdressed as cultural drivers change perspectives of technologies and as previously established in the literature, the Chinese represent a tech savvy culture that look for novel and new innovations. Common technologies can be refreshed through design with creative content and engagement that builds consumer trust.

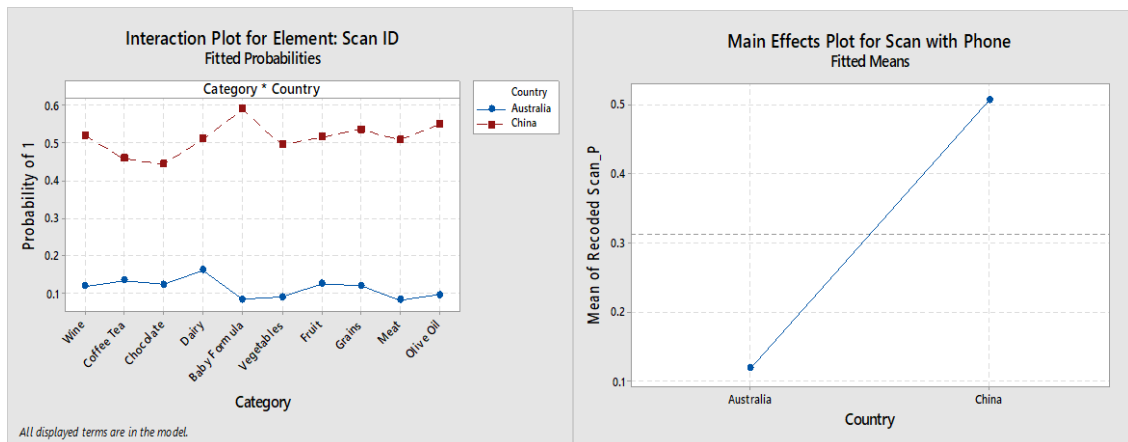


Figure 124. Scan QR Element (left) Interaction Plot, (right) Main Effects Plot over Food Categories per Country.

The Interaction Plot reporting the 'Design' element (Figure 125), is essential for many Chinese respondents showing a substantial growth in selection rate that peaked at 70% of Chinese consumers expecting high quality design and materials to prove authenticity.

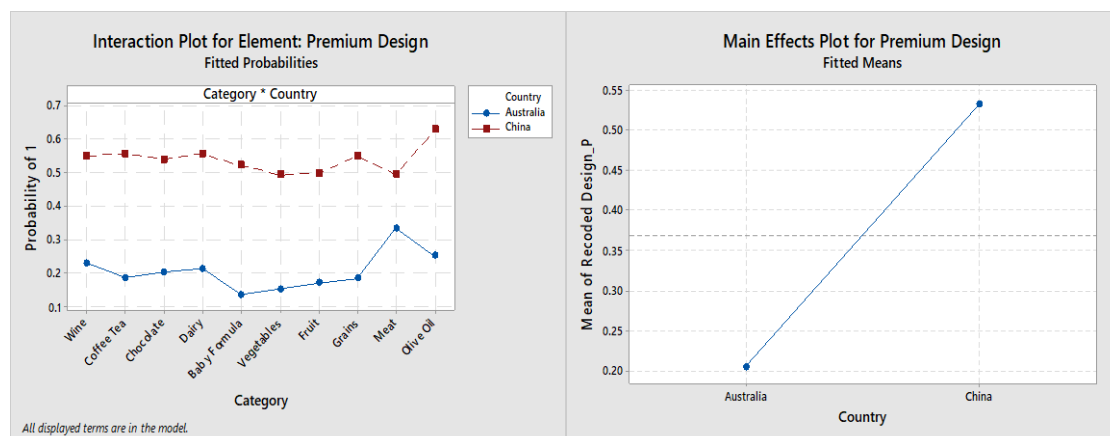


Figure 125. Design and Materials Element (left) Interaction Plot, (right) Main Effects Plot over Food Categories per Country.

Once again, this indicates the need to integrate technology into the overall design which is referred to in Study 1 as the 'Embed' Design-Driven Influencing Factor DDIF.

Although, technology stickers still offer flexibility and ease of application, to strengthen consumer's trust of them, they require branding and integration. Design security elements are also strong in deterring counterfeiters through intricate complexities that consumers appreciate and recognise as a form of sophistication. Non-repeating complex patterns, reflectors to disrupt scanners and copiers, revealing text such as Void Pantographs and Moire lines that merge when photocopied. These examples, of design-driven elements, utilised by high-targeted industries such as Currencies and Casinos can be design-transferred to the food industry.

This calls for a shift in design education and for designers to be equipped to act as the next generation of trust guardians using design-driven securities embedded into the holistic design. Following the identified DDIFs identified in Study 1 and the samples of 30 elements presented in Study 2 provide guidance to the future educators of designers.

Chapter 5:

Conclusion

The purpose of this chapter is to present the research conclusions from the three studies conducted, the identified limitations of each, and the final recommendations made for practical implications.

Therefore, the overall structure of the chapter is as follows: Section 5.1 will present the overall conclusions with sub-sections summarising the thesis steps (Section 5.1.1), the pertinent findings that are significant academically and/or practically to both the food industry and the design education and service sectors (Section 5.1.2). In addition to this section, the findings resulting from the restated research questions and confirmed hypotheses from each study will be committed into a proposed theory model. Section 5.2 will address identified limitations of the three research studies and Section 5.3 will advise final recommendations with practical suggestions for implementation of the findings and future research.

5.1 Conclusions

Brief Summary

Counterfeiting is still growing. Its impact has not reduced, even with the increased development and implementation of smart packaging and high-tech anti-counterfeiting applications. The anti-counterfeiting industry is pushing for interconnected products through the Internet of Things (IoT) which is proposed to solve the counterfeiting issue. However, fraudsters seek to work in parallel. Avoiding an authentic business's jurisdictions, not intruding in high protected, high detection markets. This means that smart packaging solutions support brand protection and targeted consumers. It does not however, protect against unmet markets that show a potential demand for the product opening clear pathways for fraudsters to thrive.

Small-to-Medium businesses are exceptionally vulnerable as they often do not have the investments to procure detection methods, nor reactive legal actions against identified fraud criminals. Thus, SME brands, new to international markets, need to consider anti-counterfeiting deterrent strategies that are effective for their unique business needs and which will build consumer trust. Many technological applications are available and are continuously being developed in response to the ever-evolving issue of counterfeiting. Awareness of technology-based applications are being promoted by the service providers and industry bodies benefiting from them. Alternatively, there are many design-driven deterrents that act as disruptors to counterfeiting efforts. Design-based applications are overlooked because they are not sponsored or commercialised. It is through designers that such strategies are to be implemented and applied for the FMCG and consumer product industries.

Consumer Trust is fragile and easily destroyed. To instigate the relationship between consumers and new unfamiliar brands is to establish '*Initial Trust*'. Initial Trust is the term given to the relationship development cycle that describes a potential consumer's '*reward attraction*' based on their satisfaction of provided information in order to act on the trust transaction. When regarding consumers who have been '*exposed*' to counterfeiting awareness, either through direct or indirect experiences, their '*perceived risk*' is heightened. Perceived risk impacts consumers scepticism and trust becomes more allusive to establish. The Risk Society predicts whole cultures to be influenced by shifts

in risk perceptions as governments and regulations trail behind rapid developments of digital online trade. Therefore, brands are no longer trusted solely on their reputation and their products are scrutinised due to the potential risk of fraud. Assessments are being made on multiple levels of authenticity. Websites, Retail channels, Origin Transparency and Third-party testimonials all play a part in presenting trustworthy brand information online. Packaging Design provides a vital level of security to brands and the presentation of trustworthy elements on the product is essential to placate the extreme auditing behaviours coined in the research as '*forensic searching*'. Trust elements that provide security need to emulate a 'reward attraction' weightier than the perceived risk of counterfeiting for brands to earn Initial Trust. Once Initial Trust has been founded with the authentic brand, consumers satisfied with the transaction experience will be unlocked to establish consumer loyalty. Therefore, Initial Trust is the prize competed for by fraudsters and unfamiliar brands whilst, design-deterrents are vital in warning off potential efforts that seek to work in parallel to a brands jurisdiction.

Design as a deterrent has been employed through many industries and applications over time. Currencies have adopted numerous design-oriented deterrents using the principle of sophistication and intricates that act as tripping hurdles in the aim to frustrate potential fraudsters efforts. Design has been proven to be effective in disarming capabilities of counterfeiters. Products that are reliant on an unmonitored circulatory distribution model that uses strong design deterrents and an identifier for authenticity checks include banknotes, cheques, credit cards, casino chips, concert tickets, lotto tickets and so on. The FMCG industry including the food and beverage industry are similar in nature to high security products as previously mentioned as they often operate on the unmonitored distribution models. Track-and-trace applications offer monitored systems for brands looking to invest in interconnected networks however, many emerging SME brands are looking for simple but effective solutions that can springboard them through the early stages of establishment and protect their IP, reputation and build consumer trust. Therefore, design-deterrents offer alternatives to the high-tech anti-counterfeiting industry and case studies have shown many FMCG businesses using such strategies in defence against counterfeiting. However, many SME businesses are unaware of these resources and therefore, this research is pertinent in identifying and summarising fraudsters tactics. By defining their strategies, limitations are exposed which enables brands to develop and tailor counter-responses that deter fraudsters tools of choice.

The methodology (Chapter 3) adopted to address the research questions (restated below), refined by theories and concepts taken from the literature review (Chapter 2), defined the three complimentary research studies, consecutively conducted.

The first two studies qualitatively assessed and compared perceptions and influencers of consumers and industry expectations of security elements. The findings from these studies then were used to inform the third major quantitative online survey study. This study was to sample and compare perceptions of two populations with clear differences in counterfeiting risk exposure levels. This was to investigate if expectations of security were significantly different across the two cultures, food groups, trust propensities and the sub-profile demographics. Individual security elements were also interrogated to expose elements individual significance across the two populations.

Research Conclusions

The conclusions of the three studies are presented with the research questions and accepted hypotheses committed in line with the findings with generalised practical implications proposed.

Study 1

As a pilot, Study 1 used a Qualitative Multivariate Analysis (QMA) that is founded on the Participatory Action Research (PAR) methodology to inquire on the research question: *Does design impact consumer's acceptance and perceived value of anti-counterfeiting securities applied to food packaging?* The analysed results of Study 1 (Chapter 5, Section 5.2) provided clear evidence that the alternative hypotheses were to be accepted, stating that, Design-driven security elements positively impact consumers acceptance of them as trustworthy and valuable, compared to non-design-driven elements.

The collective findings from Study 1 present five Design-Driven Influencing Factors (DDIF) (detailed in Section 4.2.2) identifying methods that influence consumer trust which are: (1) Fitted: Appropriateness of the Design/Technology (Capability); (2) Layered: Married levels of detailed authenticity checks (Transparency); (3) Identity Linked: Connections to country of origin (Familiarisation); (4) User-Purposed: Invitation to engage through perceived attraction (Reward); (5) Embedded: Professional product using holistic design (Ability).

These factors have compounding effect when applied together. The research shows that the more factors aptly integrated into a product's packaging increases a consumer's likelihood to accept the product as trustworthy and valuable. These findings are practically significant to businesses hesitant in investing in design and technology applications. It also empowers emerging SME businesses that are solely reliant on design-based elements not ready to upscale to high-tech solutions. DDIFs show to build consumer trust as the research supports the theory that *design is a form of security*. In conclusion of Study 1, design is king and can make or break the success of a product, brand or anti-counterfeiting technology. Agricultural businesses have been seen to underestimate design's value to their product and technological investments for IP protection. This research shows that design adds positive values to consumers perceptions when assessing unknown brands that are assessed in a doubting culture.

Study 2

Study 2 was designed to test the developed anti-counterfeiting model, using the combined methodologies Participatory Action Research (PAR) and the Problem-Oriented Case Study, to inquire on the following research question: *Would an anti-counterfeiting workshop, facilitating multiple stakeholders through co-creative strategies that use design-driven deterrents and anti-counterfeiting technologies, positively impact on exporting SME decision making and planning?* The analysis results from Study 2 (Chapter 4, Section 4.3) including the Industry Partner's feedback survey ratings concluded that the assumed alternative hypothesis was accepted. Therefore, it is stated: the anti-counterfeiting workshop model positively impacted the decision making of the exporting SME business and prompted a plan of action.

The 30 presented anti-counterfeiting elements were grouped into three categories ranging from (1) Design-Driven Elements; (2) Technology Elements; and (3) Design-Driven Technology Elements. The findings from the Industry Partner's nominations and rejections of the 30 elements indicate a strong preference for Design-Driven Elements with 89% accepted, and the Design-Driven Technology Elements with 64% accepted. However, the majority of Technology elements were rejected with only 10% accepted.

These findings are practically significant for the anti-counterfeiting industry as the research strongly suggests that SME businesses are seeking alternatives to technology-based elements and design-driven elements offer multiple benefits to brand protection, marketing and consumer engagement. Commercial offerings from the anti-counterfeiting industry need to consider designer connections that can drive the technology's success from the perspective of SME businesses needs. These findings draw attention to the design educators and challenges them to consider the role design can play in defending against the risk of counterfeiting. Designers need to build their knowledge and use their skillsets to develop new design-deterrents, not only applicable to the food industry, but for the protection of all forms of design outputs. This research call for design schools to equip the next generation of design professionals in preparing, developing and applying Design-Driven Deterrents to counter-attack the exponentially growing threat of counterfeiting and its impact on the reputation of design artefacts. This research opens up discussion on how designers could act as the guardians of products by implementing deterrent design.

Study 3

The research question driving the third investigation is revisited here: *Do cultures of varying 'trust propensities' comparatively expect different levels of 'security' to trust unbranded products authenticity across 'food categories', 'packaging formats', 'demographic profiles' and product 'status levels'?* Multiple hypotheses were defined to test this research question through 4 levels of statistical tests which are defined within the thesis per test. The research concludes that the results provide strong evidence that the alternative overarching hypothesis was to be accepted. Therefore, it is reframed here as a concluding statement: Cultures exposed to counterfeiting risks tend to increase their expectations of security, information and design levels, differing greatly to cultures that are not regularly exposed to risk.

Over the four tests of enquiry, the findings show significant differences between the two populations and their expectations of security, information and design.

For the Chinese culture, all presented security elements were significant and played an equal role in establishing consumers trust in a product's authenticity. In contrast, the Australian culture is greatly dependent on the Australian Made Logo, believing in its authenticity which brings with it perceived quality assurance. Many Australian businesses, because of their bias towards the quality of their own product, underestimate the lack of faith put into their country's trust icons. Thus, this research demonstrates clearly that additional and layered security, information and design is needed to establish and maintain initial trust.

There are statistically significant differences between and within the two cultures which this research demonstrates across food categories, demographics, geolocations and propensities of trust. Overall, these differences become practically important when considering a business's unique needs against Chinese consumers expectations. This research, due to the large sample sizes taken, enables SME businesses to justify security and design investments across all food categories, whether yoghurt or premium wine as consumers with heightened perceived risk are looking for trust elements to confirm authenticity. Risk exposure varies also across the Chinese demographics which supports the need to test a product against the micro-cultures evident throughout China. Online e-commerce enables fraudsters reach to branch into metropolitan cities through to remote agricultural villages. Therefore, trading in China requires prerequisites in

applying additional security for all regions and economical districts. Overall, it is shown that the more expendable income a person has, the more security, information and design is expected, and trust propensity increases suggesting consumers willingness to insure their purchases from producers and suppliers they trust.

Elements presented represented security, information and design. China's likelihood of selecting all the security elements was significantly greater than Australia, except for the Australian Made Logo and Awards which was greater for Australia. This again supported the assumption that a culture that is exposed to risk greatly increases their expectation of trust elements. This practically impacts SME businesses and MNEs alike in aiding their preparation in mitigating risk, investments and forecast returns on consumer trust and market growth. Therefore, this research is pertinent in providing the evidence needed for frugal SMEs to justify action in applying proactive deterrents that do not need to be expensive and labour intense high-tech solutions but elements that are Design-oriented and user-centred. Elements that are strengthened through Design-Driven Influence Factors. Thus, it is concluded that the two cultures expectations are clearly polarised and that SME brands preparation, in brand and consumer protection, needs to consider these cultural differences when putting into place an anti-counterfeiting business plan for export.

The final theoretical model proposed, as a result of these conclusions, is presented below. The theoretical framework argues that consumers with a heightened exposure to counterfeiting risks causes consumers evaluation of new products and brands to be intensely altered towards a forensic style of assessment. Consumers seek multiple levels of authenticity checks and confirmations that go beyond common country of origin claims and logos. Such consumers found in China, have shown to have 'searching behaviours' that are sceptical of many elements and even with the use of multiple levels, if the applications are not design-driven, that is shown with a high level of sophistication and professionalism in presentation, they can lose their effectiveness and worse, fail as being perceived as trustworthy. Therefore, 5 Design-Driven Influence Factors (DDIFs) were identified as security influencers necessary for consumer trust to be established and belief in the brand's authenticity winning initial trust over counterfeiters. These DDIFs not only confirm trust for a consumer but also proactively act as counterfeiting deterrents. Therefore, the theory stands that design drives the success and acceptance of anti-counterfeiting technologies and DDIFs act as strengthening agents of this success.

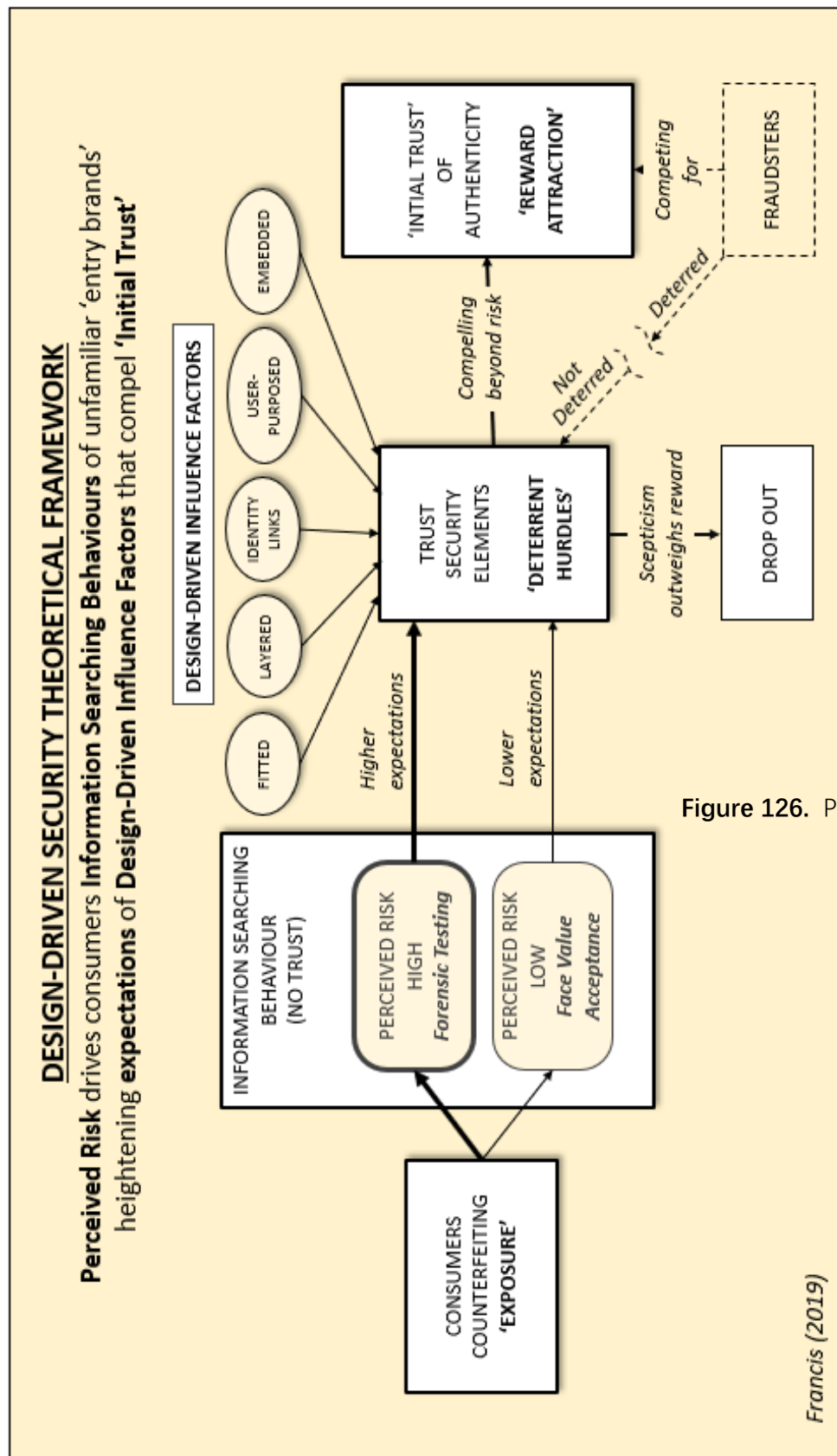


Figure 126. Proposed Theoretical Framework

5.2 *Discussion of Limitations*

As previously stated, this research focuses on food packaging counterfeiting and is limited to resources that impact the packaging of a product. The research did not address food theft, food security, food tampering or food traceability other than providing definitions of these terms and how they differ to food counterfeiting. With this focus, the information drawn on the phenomenon is taken from literature, industry reports and research studies dealing with perceptions from Industry and Consumers. It did not interview or have access to communications with any fraudsters, thus, counterfeiter's capabilities are deduced from resources available to designers themselves and may not be all encompassing of all fraud tools and tactics. The list is to provide a guide for SME brands to target and disarm whilst strengthening their brand protection for consumers benefits.

Counterfeiting in the food industry is evolving and fraudsters tactics are enhanced with access to new advanced tools being made available. Therefore, the tools defined as the *Counterfeiter's Capabilities* (Chapter 2, Section 2.1.9) is limited to today's resources and methods. Assessment of modern capabilities should be revised if new technologies are released and ease of access is evident. Other technologies that could be considered in this list is 3D scanning for rapid re-engineering and sourcing imagery online through mass-design databases such as Shutterstock or Creative Market. These areas are considered under the actions copy and re-engineer. However, they require more research to justify their unique listing in the counterfeiter's capabilities list.

The research studies were limited to the visual elements presented to the consumers for appraisal. Therefore, further research is required to strengthen the results findings to validate Design-Driven Influence Factors (DDIFs) and their true impact on anti-counterfeiting applications acceptance. Another limitation is that design is hard to measure, and it is recognised here that although design can be subjective, it has been shown that transfer of recognisable and trustworthy elements such as currency graphics can be considered on novel applications such as the food industry to build initial trust. Therefore, it is argued that design contributes more than market appeal but trustworthy security acceptance. Delivery of the design is listed in the DDIFs. This research does not distil these factors further and requires additional investigation into their justification.

The workshop model was positively appraised by the Industry Partner. Although, the model was trialled once, the feedback is limited to one business and therefore, is limited. In order to reinforce its findings, the workshop model requires additional trials and refinement, prior to rollout. However, the results from the workshop model demonstrate vital findings extracted from the nomination and elimination of co-selected elements. The model is yet to be validated and so, the findings of preferred design-driven elements over technology elements qualitatively alerts brands of alternative deterrent measures available and highlights the unmet needs of SMEs within the Anti-Counterfeiting service industry.

Finally, this research is limited due to the nature of the counterfeiting problem. Fraudsters can be studied and observed from afar and rare opportunities present themselves of direct encounters with fraud criminals to gain insights into their reasons and methods of attack. For this very reason, this research is valuable as illuminates new ground for research to consider. Where designers are brought into the limelight and considered future champions of design protection.

5.3 *Recommendations*

Recommendations are made to further expand academic research in the less established multi-disciplinary fields of criminology, brand protection and design research. This research serves to challenge the anti-counterfeiting service industry in its fast pace towards high-tech promotion and offers alternative and potentially disruptive offerings that are design-driven deterrents. With these significant findings, further research is called for to contribute substance around the skeleton framework of counterfeiter's capabilities, the workshop model, Design-Driven Influence Factors (DDIFs), the 30 reviewed anti-counterfeiting elements and the overall practically significant findings demonstrating polarised expectations across consumers with varied risk exposure.

The Counterfeiters Capabilities identified in the research require additional trialling. Food packaging designs need to be developed with the adoption of deterrent elements from the reserve pool (30 anti-counterfeiting elements) strategically bundled to disarm fraud tactics. These new food packaging designs, once shown to disempower fraudsters, could act as educational case studies to the food industry and provide a go-to resource for designers and brand managers alike.

The workshop model also could be further developed for online rollout. Its benefits were shown to education and align business stakeholders and support them in making informed group decisions promoting action on applied anti-counterfeiting investments. It is recommended that the 30 elements researched and collated for the workshop represent current anti-counterfeiting elements reviewed within 2017. However, additional contribution and updates are required for these elements to maintain effectiveness. Therefore, a database of design and technology resources, commonly assessed on investment, difficulty and methods of application could be proven beneficial to the expanding exporting communities of Australia and beyond.

To further educate the food industry, and call to action the design education circles, academic publications are necessary in presenting the findings of this thesis that expose the differences between: cultures of varying risk exposure; expectations of security, information and design over populations and demographics; design and its role as a security element; the significant influence design has on the acceptance of anti-

counterfeiting technology; and the presentations of industry workshops and webinars such as the recently presented Food Fraud series webinar hosted by the International Association of Food Protection (IAFP) (Francis, 2019a).

Finally, extension of this research should be integrated into universities and higher education platforms within fields of Design, Marketing, Business and Agri-Business schools that are placed to leverage the learnings from this research to develop new design courses and curriculums based on design deterrence. Course materials could incorporate case studies of design successes and failures against attempted counterfeiting. Other recommendations for material include an online dynamic database of design deterrent strategies and technologies that are not pushed by industry sponsors and offer designers an ever-expanding resource of tools for future application. This recommendation is highly relevant to the design practice in general as these learnings are not restricted to the food industry alone and have transfer applications to act as design deterrence for all consumer products. In a world where fraud is impacting consumer trust globally, it is paramount that food and product designs are to be protected by multiple lines of defence. Therefore, design deterrence is the next step for designers to embrace. Design deterrence would not be a new discipline, but another toolkit upgrade of current design practices and education who can empower brands and move them from vulnerability to an informed and reinforced standpoint. Although counterfeiting is affecting all forms of industries in and out of the FMCG circles, designers are pre-enrolled in the development and management of such systems and this research nominates them to be the deliverers of best practice and actors of protection for future consumer goods. Design and designers add value through design-deterrence. This is the next milestone step for design education.

Bibliography

- ABCNEWS. 2015. *Cherries in fake 'Tasmanian-grown' packaging sold by the box load in China and Vietnam* [Online]. Available: <https://www.abc.net.au/news/2015-06-05/cherries-in-fake-tasmanian-grown-boxes-sold-overseas/6526438> [Accessed].
- ABS 2016. Industry Statistics Dataset, Open Source. In: STATISTICS, T. A. B. O. (ed.).
- ACBR. 2019. *Australia China Business Review* [Online]. Available: <http://acbr.com.au/> [Accessed April 15, 2019].
- ACG. 2019. *The Anti-Counterfeiting Group* [Online]. Available: <https://www.a-cg.org/> [Accessed April 15, 2019].
- APIA. 2019. *Active and Intelligent Packaging Industry Association* [Online]. Available: <https://www.aipia.info/index.php> [Accessed 28 January 2019].
- ALBRECHT, C., HOLLAND, D., MALAGUEÑO, R., DOLAN, S. & TZAFRIR, S. 2015. The Role of Power in Financial Statement Fraud Schemes. *Journal of Business Ethics*, 131, 803-813.
- ALMAS, R. 1999. Food Trust, Ethics and Safety in Risk Society.
- ARPPE-TABBARA, R., TABBARA, M. & SØRENSEN, T. J. 2019. Versatile and Validated Optical Authentication System Based on Physical Unclonable Functions. *ACS Applied Materials & Interfaces*, 11, 6475-6482.
- ARPPE, R. & SORENSEN, T. J. 2017. Physical unclonable functions generated through chemical methods for anti-counterfeiting.
- BABU, H. U., SORK, W. & RAUHE, H. 2010. Anti-counterfeiting using reflective micro structures - Based on random positioning of microstructures. IEEE.
- BACH, T. 2016. *RE: The Rio de Janeiro's 2016 Opening Olympic Ceremony Speech*.
- BAE, H. J., BAE, S., PARK, C., HAN, S., KIM, J., KIM, L. N., KIM, K., SONG, S.-H., PARK, W. & KWON, S. 2015. Biomimetic Microfingerprints for Anti-Counterfeiting Strategies. *Advanced Materials*, 27, 2083-2089.
- BAIRD, D. E. & FISHER, M. 2005. Neomillennial user experience design strategies: Utilizing social networking media to support "always on" learning styles. *Journal of educational technology systems*, 34, 5-32.
- BAMOSSY, G. & SCAMMON, D. L. 1985. Product Counterfeiting: Consumers and Manufacturers Beware. *Advances in Consumer Research*, 12, 334-339.
- BANDURA, A. 2008. *Reconstrual of "Free Will" From the Agentic Perspective of Social Cognitive Theory*.
- BANSAL, D., MALLA, S., GUDALA, K. & TIWARI, P. 2013. Anti-Counterfeit Technologies: A Pharmaceutical Industry Perspective. Austria: OSTERREICHISCHE APOTHEKER VERLAGSGESELLSCHAFT.
- BARBER, B. 1983. *The logic and limits of trust*, New Brunswick, N.J. : Rutgers University Press, c1983.
- BART, Y., SHANKAR, V., SULTAN, F. & URBAN, G. L. 2005. Are the Drivers and Role of Online Trust the Same for All Web Sites and Consumers? A Large-Scale Exploratory Empirical Study. *Journal of Marketing*, 69, 133-152.
- BAUER, H. H., GREYER, M. & LEACH, M. 2002. Customer Relations Through the Internet. *Journal of Relationship Marketing*, 1, 39.
- BAUER, R. A. 1960. *Consumer behaviour as risk taking*, Chicago : American Marketing Association, c1960.

- BECK, U. 1992. *Risk society : towards a new modernity*, London : Sage, 1992.
- BECKETT, E. 2018. Food Fraud affects many supermarket staples, so how do you choose the good stuff?
- BECKLEY, J. H., PAREDES, D. & LOPETCHARAT, K. 2012. *Product innovation toolbox: a field guide to consumer understanding and research*, John Wiley & Sons.
- BELANGER, F., HILLER, J. S. & SMITH, W. J. 2002. Trustworthiness in electronic commerce: the role of privacy, security, and site attributes. *The Journal of Strategic Information Systems*, 11, 245-270.
- BERG, J., DICKHAUT, J. & MCCABE, K. 2008. Trust, Reciprocity, and Social History. In: BACHMANN, R. & ZAHEER, A. (eds.) *Landmark Papers on Trust. Volume 1.*: Elgar Reference Collection. International Library of Critical Writings on Business and Management, vol. 10. Cheltenham, U.K. and Northampton, Mass.: Elgar.
- BERG, L. 2004. Trust in food in the age of mad cow disease: a comparative study of consumers' evaluation of food safety in Belgium, Britain and Norway. *Appetite*, 42, 21-32.
- BERRY, L. L. 1995. Relationship Marketing of Services--Growing Interest, Emerging Perspectives. *Journal of the Academy of Marketing Science*, 23, 236-245.
- BERTRAND, M., MULLAINATHAN, S. & SHAFIR, E. 2006. Behavioral Economics and Marketing in Aid of Decision Making among the Poor. American Marketing Association.
- BOEDEKER, M. 1995. New-type and traditional shoppers: a comparison of two major consumer groups. Emerald Group Publishing, Ltd.
- BROWN, A., COLLARD, S. & SPEARRITT, M. 2017. Recent Trends in Banknote Counterfeiting. Reserve Bank of Australia.
- CAMERER, C. 2003. *Behavioral game theory : experiments in strategic interaction*, Princeton University Press.
- CASELL, J. J. M. M. E. & BICKMORE, T. B. M. M. E. 2000. External Manifestations of Trust Worthiness in the Interface. *Communications of the ACM*, 43, 50-56.
- CHAUDHRY, P., CORDELL, V. & ZIMMERMAN, A. 2005. Modelling Anti-Counterfeiting Strategies in Response to Protecting Intellectual Property Rights in a Global Environment. *The Marketing Review*, 5, 59-72.
- CHAUDHRY, P. & ZIMMERMAN, A. 2013. *Protecting your intellectual property rights. [electronic resource] : understanding the role of management, governments, consumers and pirates*, New York, NY : Springer, c2013.
- CHAUDHRY, P. E. & CESAREO, L. 2017. Fake and pirated: do consumers care? *Journal of Business Strategy*, 38, 11-19.
- CHAUDHRY, P. E., ZIMMERMAN, A., PETERS, J. R. & CORDELL, V. V. 2009. Preserving intellectual property rights: Managerial insight into the escalating counterfeit market quandary. *Business Horizons*, 52, 57-66.
- CHEN, F., ZHU, J., CAO, P., WANG, X. & HUO, P. 2018. Research on Anti-counterfeiting Image Generation Algorithm Based on Halftone-Micro-Character. IEEE 18th International Conference on Communication Technology (ICCT).
- CHESKIN, R. & STUDIO, A. S. 1999. *eCommerce Trust Study* [Online]. Available: <http://publicis.sapient.com/en-us.html> [Accessed].
- CHEUNG, H. H. & CHOI, S. H. 2011. Implementation issues in RFID-based anti-counterfeiting systems. *Computers in Industry*, 62, 708-718.
- CHOW, D. 2010. Anti-counterfeiting strategies of multi-national companies in China: how a flawed approach is making counterfeiting worse. *Georgetown Journal of International Law*.
- CHRISTENSEN, C. M. 2006. The Ongoing Process of Building a Theory of Disruption. *Journal of Product Innovation Management*, 23, 39-55.

- CHURCHILL, G. A. & IACOBUCCI, D. 2005. *Marketing research : methodological foundations*, Thomson/South-Western.
- COLEMAN, J. S. 1990. *Foundations of social theory. [electronic resource]*, Cambridge, Mass. : Belknap Press of Harvard University Press, 1990.
- CORBITT, B. J., THANASANKIT, T. & YI, H. 2003. Trust and e-commerce: a study of consumer perceptions. *Electronic Commerce Research and Applications*, 2, 203-215.
- CORDELL, V. V., WONGTADA, N. & KIESCHNICK, R. L. 1996. Counterfeit Purchase Intentions: Role of Lawfulness Attitudes and Product Traits as Determinants. United States: ELSEVIER SCIENCE PUBLISHING CO INC.
- COULTON, P. 2015. Playful and Gameful Design for the Internet of Things. In: NIJHOLT, A. (ed.) *More Playful User Interfaces: Interfaces that Invite Social and Physical Interaction*. Singapore: Springer Singapore.
- COX, D. F. 1967. Risk taking and information handling in consumer behavior.
- CRAW, P. J., LELAND JR, L. S., BUSSELL, M. G., MUNDAY, S. J. & WALSH, K. 2006. The Mural as Graffiti Deterrence. *Environment & Behavior*, 38, 422-434.
- CRESSEY, D. R. 1953. *Other people's money : a study in the social psychology of embezzlement*, Glencoe, Ill. : Free Press, [1953].
- CRUTCHLEY, E. B. 2014. *Innovation Trends in Plastics Decoration and Surface Treatment : Decorative Effects on Moulded Plastics*.
- CUBBON, C. 2019. *Unique Design: using custom shaped labels, bottle profile and textures* [Online]. Available: <https://creativepool.com/chris-cubbon/projects/artisan-gin-branding-and-design> [Accessed April 17, 2019].
- D. JIANG, L., GUO, C. N. & ZHANG, J. 2008. Anti-counterfeiting with a Random Pattern. IEEE.
- D.SCHOOL 2016. Design Thinking Bootcamp Bootleg. Stanford Design School.
- DATADOT. 2019. *DataDot Technology Overview* [Online]. DataDot Technology USA. Available: <http://www.datadotusa.com/technology.htm> [Accessed April 16, 2019].
- DEFRA 2014. Elliott Review into the Integrity and Assurance of Food Supply Networks: Final report - a national food crime prevention framework.
- DEGUILLAUME, F., VOLOSHYNOVSKLY, G. & PUN, T. 2010. *Character and Vector Graphics Watermark for Structured Electronic Documents Security*. United States patent application.
- DESCARTES, R. 1641. *Meditations on first philosophy*, Cambridge University Press.
- DEUTSCH, M. 1960. The Effect of Motivational Orientation upon Trust and Suspicion. *Human Relations*, 13, 123-139.
- DEWEY, J. 1938. *Experience and education*, New York, The Macmillan company, 1938.
- DIGITASLBI 2015. Connected Commerce Survey.
- DO3D. 2019. *Superman Justice League Logo* [Online]. Available: superman-justice-league-chest-s-logo-emblem-3d-printable-model-print-file-stl-do3d-03 [Accessed April 18, 2019].
- DONEY, P. M. & CANNON, J. P. 1997. An examination of the nature of trust in buyer-seller relationships. *Journal of Marketing*, 61, 35.
- DONTHU, N. & GARCIA, A. 1999. The Internet shopper. *Journal of Advertising Research*, 39, 52-58.
- DORMINEY, J., FLEMING, A. S., KRANACHER, M.-J. & RILEY JR, R. A. 2012. The Evolution of Fraud Theory. *Issues in Accounting Education*, 27, 555-579.
- DOVEY, K., WOLLAN, S. & WOODCOCK, I. 2012. Placing Graffiti: Creating and Contesting Character in Inner-city Melbourne. *Journal of Urban Design*, 17, 21-41.
- DYNATA 2017. Panel Quality: Our Values Answers to ESOMAR'S 28 Questions. Research Now (Dynata).

- ECONOMIST, T. 2017. Online Shopping is Booming: Alibaba demonstrates the benefits of breadth. *The Economist*. Special Report: eCommerce ed.
- EISEND, M. & SCHUCHERT-GÜLER, P. 2006. Explaining counterfeit purchases: A review and preview. *Academy of marketing science review*, 2006, 1.
- EISER, J. R., MILES, S. & FREWER, L. J. 2002. Trust, perceived risk, and attitudes toward food technologies. *Journal of Applied Social Psychology*, 2423.
- ELANGO VAN, A. R. & SHAPIRO, D. L. 1998. Betrayal of Trust in Organizations. *Academy of Management Review*, 23, 547-566.
- ELLIS, D. I., MUHAMADALI, H., HAUGHEY, S. A., ELLIOTTB, C. T. & GOODACREA, R. 2015. Point-and-shoot: rapid quantitative detection methods for on-site food fraud analysis - moving out of the laboratory and into the food supply chain. *Analytical Methods*, 7, 9401-9414.
- ERICSON, R. V., ERICSON, R. V. & HAGGERTY, K. D. 1997. *Policing the risk society*, OUP Oxford.
- EUROMONITOR. 2017. E-Commerce is the Fastest Growing Global Retail Channel Through 2022. Available: <https://blog.euromonitor.com/e-commerce-is-the-fastest-growing-global-retail-channel-through-2022/> [Accessed 10 April 2019].
- EVERFRESH. 2019. *Welcome to Fitzroy Mural* [Online]. Available: <https://www.everfreshstudio.com/> [Accessed March 14, 2019].
- EVERSTINE, K., SPINK, J. & KENNEDY, S. 2013. Economically motivated adulteration (EMA) of food: common characteristics of EMA incidents. *Journal of Food Protection*, 76, 723-735.
- FAN, Z. & WANG, S.-G. 2003. *Anti-counterfeiting see-through moire security feature using frequency-varying patterns*. United States of America patent application.
- FEATHERMAN, M. S. & PAVLOU, P. A. 2003. Predicting e-services adoption: a perceived risk facets perspective. *International Journal of Human - Computer Studies*, 59, 451-474.
- FISCHHOFF, B. 1975. Attribution Theory and Judgment under Uncertainty. In: OREGON RESEARCH INST, E. (ed.).
- FISCHHOFF, B. 2003. Hindsight ≠ foresight: the effect of outcome knowledge on judgment under uncertainty. *Quality and Safety in Health Care*, 12, 304-311.
- FISHBEIN, M. & AJZEN, I. 1975. *Belief, attitude, intention, and behavior : an introduction to theory and research*, Reading, Mass. : Addison-Wesley Pub. Co., [1975].
- FONTANAZZA, M. 2016. *Food Fraud: Perps Two Steps Ahead, Innovation Needed to Keep Up* [Online]. Food Safety Tech. Available: https://foodsafetytech.com/news_article/food-fraud-perps-two-steps-ahead-innovation-needed-to-keep-up/ [Accessed 20/09/2016 2016].
- FONTE, M. 2002. Food systems, consumption models and risk perception in late modernity. *International Journal of Sociology of Agriculture and Food*, 10, 13-21.
- FORUM, W. E. 2004. Corporate Brand Reputation Outranks Financial Performance as Most Important Measure of Success. In: DAVOS, S. (ed.).
- FRANCIS, C. Designers Search Strategies Influenced by the Interaction with Information Retrieval Systems (IRS): Within the Early Stages of the Design Process. Asia-Pacific Conference on Computer Human Interaction, 2004. Springer, 646-650.
- FRANCIS, C. 2017. Packaging Innovation and Anti-Counterfeiting Research. University of Melbourne.
- FRANCIS, C. 2019a. Anti-Counterfeiting, Design-Driven Deterrents and Detection Strategies. In: PROTECTION, I. A. O. F. (ed.) *Emerging Food Categories - Food Fraud Series*. Online.
- FRANCIS, C. 2019b. Food Fraud and Counterfeiting Deterrents: Comparing Chinese and Australian appraisals of "Trust Security Elements" intended for export packaging. University of Melbourne.

- FRANCIS, C. M. 2006. *How Information Retrieval Systems Impact on Designers' Searching Strategies Within the Early Stages of the Design Process*. Queensland University of Technology.
- FRANKLIN, J. 2016. 'Counterfeiting is an art': Peruvian gang of master fabricators churns out \$100 bills. *The Guardian*, March 31, 2016.
- FREIRE, P., RAMOS, M. B. & MACEDO, D. P. 2012. *Pedagogy of the oppressed*, New York : Bloomsbury, 2012. 30th anniversary edition.
- FROG 2018. Designing for Digital Trust.
- FSA 2016. Food Crime: Annual Strategic Assessment. Food Standards Agency UK and Food Standards Scotland.
- FSAUK, N. 2015. Risk Modelling of Food Fraud Motivation - 'NSF fraud protection model' intelligent risk model scoping project. Food Standards Agency UK.
- FUNG, R. & LEE, M. EC-trust (trust in electronic commerce): exploring the antecedent factors. AMCIS 1999 Proceedings, 1999.
- GABRIEL, Y. & LANG, T. 1995. *The unmanageable consumer : contemporary consumption and its fragmentations*, London ; Thousand Oaks, Calif. : Sage Publications, 1995.
- GEFEN, D., KARAHANNA, E. & STRAUB, D. 2003. Trust and TAM in Online Shopping: An integrated model. *MIS Quarterly*, 27, 51-90.
- GEFEN, D. & STRAUB, D. 2004. Consumer trust in B2C e-Commerce and the importance of social presence: experiments in e-Products and e-Services. *Omega*, 32, 407-424.
- GENTRY, J. W., PUTREVU, S. & SHULTZ II, C. J. 2006. The effects of counterfeiting on consumer search. *Journal of Consumer Behaviour*, 5, 245-256.
- GEYSKENS, I., STEENKAMP, J.-B. E. M., SCHEER, L. K. & KUMAR, N. 1996. The effects of trust and interdependence on relationship commitment: A trans-Atlantic study. *International Journal of Research in Marketing*, 13, 303-317.
- GFSI 2014. Position on Mitigating the Public Health Risk of Food Fraud. Global Food Security Initiative.
- GIDDENS, A. 1999. Risk and responsibility. *The modern law review*, 62, 1-10.
- GINO, F., NORTON, M. I. & ARIELY, D. 2010. The counterfeit self: The deceptive costs of faking it. *Psychological science*, 21, 712-720.
- GORDON, I. 2018. *MAST90007 Statistics for Research Workers Book (Winter 2018)*, School of Mathematics and Statistics, University of Melbourne.
- GRABNER-KRAEUTER, S. 2002. The Role of Consumers' Trust in Online-Shopping. *Journal of Business Ethics*, 39, 43.
- GREEN, R., T. & SMITH, T. 2002. Countering Brand Counterfeiters. *Journal of International Marketing*, 10, 89.
- GROSSMAN, G. M. & SHAPIRO, C. 1988. Foreign Counterfeiting of Status Goods. *Quarterly Journal of Economics*, 103, 79-100.
- GUNARATNE, N. M., FUENTES, S., GUNARATNE, T. M., TORRICO, D. D., FRANCIS, C., ASHMAN, H., VIEJO, C. G. & DUNSHEA, F. R. 2019. Effects of packaging design on sensory liking and willingness to purchase: A study using novel chocolate packaging. *Heliyon*, 5, e01696.
- GUSEFF 2019. Modern painting wall art decor abstract drawing. DepositPhotos USA.
- HA, H. Y. 2002. The effects of consumer risk perception on pre-purchase information in online auctions: Brand, word-of-mouth, and customized information. *Journal of Computer-Mediated Communication*, 8, 0-0.
- HA, S. & LENNON, S. J. 2006. Purchase Intent for Fashion Counterfeit Products: Ethical Ideologies, Ethical Judgments, and Perceived Risks. 297.

- HACKBARTH, G., GROVER, V. & YI, M. Y. 2003. Computer playfulness and anxiety: positive and negative mediators of the system experience effect on perceived ease of use. *Information & Management*, 40, 221-232.
- HAGAN, F. E. 2010. *Crime types and criminals*, Thousand Oaks, Calif., Sage Publications.
- HARDEY, M. 2001. 'E-health': the internet and the transformation of patients into consumers and producers of health knowledge. *Information, Communication & Society*, 4, 388-405.
- HASSENZAH, M. 2010. Experience design: Technology for all the right reasons. *Synthesis Lectures on Human-Centered Informatics*, 3, 1-95.
- HEINONEN, J. A., HOLT, T. J. & WILSON, J. M. 2012. Product Counterfeits in the Online environment: An Empirical Assessment of Victimization and Reporting Characteristics. *International Criminal Justice Review*, 353.
- HEINONEN, J. A., WILSON, J. M. & SPINK, J. 2017. When crime events defy classification: The case of product counterfeiting as white-collar crime. *Security Journal*, 621.
- HERTENSTEIN, J. H., PLATT, M. B. & BROWN, D. R. 2001. Valuing design: Enhancing corporate performance through design effectiveness. *Design Management Journal (Former Series)*, 12, 10-19.
- HOCEVAR, R. 2018. Participatory Action Research (PAR). Salem Press.
- HOFFMAN, D. L. & NOVAK, T. P. 1997. A New Marketing Paradigm for Electronic Commerce. *Information Society*, 13, 43-54.
- HOFFMAN, D. L., NOVAK, T. P. & PERALTA, M. 1999. Building Consumer Trust Online. *Communications of the ACM*, 42, 80-85.
- HOLLIMAN, M. & MEMON, N. 2000. Counterfeiting attacks on oblivious block-wise independent invisible watermarking schemes. *IEEE Transactions on image processing*, 9, 432-441.
- HOLLIS, M. E. & WILSON, J. 2014. Who are the guardians in product counterfeiting? A theoretical application of routine activities theory. *Crime Prevention and Community Safety*, 16, 169-188.
- HOLMES, J. G. 1991. Trust and the appraisal process in close relationships. In W. H. Jones & D. Perlman (Eds.), *Advances in personal relationships*, 2.
- HOMANS, G. C. 1958. Social Behavior as Exchange. *American Journal of Sociology*, 63, 597-606.
- IACC. 2019. *International Anti-Counterfeiting Coalition* [Online]. Available: <https://www.iacc.org/> [Accessed April 15, 2019].
- IEP 2019. René Descartes. Internet Encyclopedia of Philosophy.
- IND, N., IGLESIAS, O. & MARKOVIC, S. 2017. The co-creation continuum: from tactical market research tool to strategic collaborative innovation method.
- IRWEB 2019. Writing a Case Study. *Learning Resources*. University of Bedfordshire.
- JANAL, D. S. 1995. *Online marketing handbook : how to sell, advertise, publicize, and promote your products and services on the Internet and commercial online systems*, Van Nostrand Reinhold.
- JARVENPAA, S. L., TRACTINSKY, N. & SAARINEN, L. 1999. Consumer Trust in an Internet Store: A Cross-Cultural Validation. *Journal of Computer-Mediated Communication*, 5, 0-0.
- JASPER, C. R. & OUELLETTE, S. J. 1994. Consumers' perception of risk and the purchase of apparel from catalogs. *Journal of Direct Marketing*, 8, 23-36.
- JEN, J. J. & CHEN, J. 2017. *Food Safety in China: Science, technology, management and regulation*, Chichester, West Sussex, UK, Hoboken, NJ, John Wiley & Sons, Inc.
- KASPERSON, R. E., RENN, O., SLOVIC, P., BROWN, H. S., EMEL, J., GOBLE, R., KASPERSON, J. X. & RATICK, S. 1988. The Social Amplification of Risk: A Conceptual Framework. *Risk Analysis*, 8, 177-187.

- KAUFMANN, D. 2019. *Invisible digital watermark opens consumer channels* [Online]. Active and Intelligent Packaging Industry Association. Available: <https://www.aipia.info/news-Invisible-digital-watermark-opens-consumer-channels-1005.php> [Accessed 05 February 2019].
- KAZADI, K., LIEVENS, A. & MAHR, D. 2016. Stakeholder co-creation during the innovation process: Identifying capabilities for knowledge creation among multiple stakeholders. *Journal of Business Research*, 69, 525-540.
- KENDALL, H., KUZNESOF, S., DEAN, M., MEI-YEN, C., CLARK, B., HOME, R., STOLZ, H., QIDING, Z., CHUANHE, L., BRERETON, P. & FREWER, L. 2019. Chinese consumer's attitudes, perceptions and behavioural responses towards food fraud. *Food Control*, 95, 339-351.
- KENG KAU, A., TANG, Y. E. & GHOSE, S. 2003. Typology of online shoppers. *Journal of Consumer Marketing*, 20, 139-156.
- KENNEDY, J. 2016. Proposed Solutions to the Brand Protection Challenges and Counterfeiting Risks Faced by Small and Medium Enterprises (SMEs). *Journal of Applied Security Research*, 11, 450-468.
- KERRY, J. & BUTLER, P. 2008. *Smart Packaging Technologies for Fast Moving Consumer Goods*, John Wiley Sons.
- KHAN, A. & TUROWSKI, K. A Survey of Current Challenges in Manufacturing Industry and Preparation for Industry 4.0. Proceedings of the First International Scientific Conference "Intelligent Information Technologies for Industry" (IITI'16), 2016. 15-26.
- KIM, J., JIN, B. & SWINNEY, J. L. 2009. The role of e-tail quality, e-satisfaction and e-trust in online loyalty development process. *Journal of Retailing and Consumer Services*, 16, 239-247.
- KORPORAAL, G. 2016. Chinese Consumers Set the Trend Online. *The Australian*, 11 July 2016.
- KRANACHER, M.-J., RILEY, R. & WELLS, J. T. 2011. *Forensic accounting and fraud examination*, Hoboken, N.J., John Wiley.
- LAI, K. & ZAICHKOWSKY, J. 1999. Brand Imitation: Do the Chinese Have Different Views? *Asia Pacific Journal of Management*, 16, 179-192.
- LEWICKI, R. J. & BUNKER, B. B. 1995. Trust in relationships: A model of trust development and decline. In B. B. Bunker & J. Z. Rubin (Eds.), *Conflict, cooperation and justice*, 133-173.
- LEWICKI, R. J., MCALLISTER, D. J. & BIES, R. J. 1998. Trust and Distrust: New relationships and realities. *Academy of Management Review*, 23, 438-458.
- LEWIS, J. D. & WEIGERT, A. 1985. Trust as a Social Reality. *Social Forces*, 63, 967-985.
- LI, H., DAUGHERTY, T. & BIOCCA, F. 2001. Characteristics of Virtual Experience in Electronic Commerce: A protocol analysis. *Journal of Interactive Marketing (John Wiley & Sons)*, 15, 13-30.
- LI, L. 2013. Technology designed to combat fakes in the global supply chain. *Business Horizons*, 56, 167-177.
- LI, Z. 2015. Effects of grating moire fringe on food packaging printing. *Food & Machinery*, 157.
- LIEN, C. H. & CAO, Y. C. 2014. Examining WeChat users' motivations, trust, attitudes, and positive word-of-mouth: Evidence from China. *Computers in Human Behavior*, 41, 104-111.
- LIEN, M. E. 1995. *Food products in the making: An ethnography of marketing practice*. Department and Museum of Anthropology.
- LIGHTNER, N. J. 2003. What users want in e-commerce design: effects of age, education and income. *Ergonomics*, 46, 153-168.
- LIU, Y., LI, H., PENG, G., LV, B. & ZHANG, C. 2015. Online purchaser segmentation and promotion strategy selection: evidence from Chinese E-commerce market. *Annals of Operations Research*, 233, 263-279.

- LOCKWOOD, T. 2007. Design Value: A Framework for Measurement. United States: DESIGN MANAGEMENT INSTITUTE.
- LOPETCHARAT, K. 2012. Tools for Up-Front Research on Consumer Triggers and Barriers. In: BECKLEY, J. (ed.) *Product Innovation Toolbox: A Field Guide to Consumer Understanding and Research*.
- LORA-WAINWRIGHT, A. 2013. Introduction. Dying for Development: Pollution, Illness and the Limits of Citizens' Agency in China. *The China Quarterly*, 214, 243-254.
- LORD, N., ELIZONDO, C. J. F. & SPENCER, J. 2017a. The dynamics of food fraud: The interactions between criminal opportunity and market (dys)functionality in legitimate business. *CRIMINOLOGY & CRIMINAL JUSTICE*, 17, 605-623.
- LORD, N., SPENCER, J., ALBANESE, J. & FLORES ELIZONDO, C. 2017b. In pursuit of food system integrity: the situational prevention of food fraud enterprise. *European Journal on Criminal Policy and Research*, 23, 483-501.
- LUHMANN, N. 1979. *Trust ; and, Power : two works / by Niklas Luhmann ; with introduction by Gianfranco Poggi ; [translated for the English edition by Howard Davis, John Raffan and Kathryn Rooney ; edited by Tom Burns and Gianfranco Poggi]*, Chichester ; New York : Wiley, c1979.
- MACKEY, T. K. & LIANG, B. A. 2011. The global counterfeit drug trade: patient safety and public health risks. *Journal Of Pharmaceutical Sciences*, 100, 4571-4579.
- MARTINSONS, M. G. M. C. E. H. 2008. Relationship-based e-commerce: theory and evidence from China. *Information Systems Journal*, 18, 331-356.
- MATHWICK, C., MALHOTRA, N. & RIGDON, E. 2001. Experiential value: conceptualization, measurement and application in the catalog and Internet shopping environment. *Journal of Retailing*, 77, 39.
- MAYER, R. C., DAVIS, J. H. & SCHOORMAN, F. D. 1995. An Integrative Model Of Organizational Trust. *Academy of Management Review*, 20, 709-734.
- MCKNIGHT, D., CHOUDHURY, V. & KACMAR, C. 2002. Developing and Validating Trust Measures for e-Commerce: An Integrative Typology. 334.
- MCKNIGHT, D., CUMMINGS, L. & CHERVANY, N. 1998. Initial Trust Formation In New Organizational Relationships *Academy of Management Review*, 23, 473-490.
- MCKNIGHT, D., KACMAR, C. & CHOUDHURY, V. 2004. Shifting Factors and the Ineffectiveness of Third Party Assurance Seals: A two-stage model of Initial Trust in a web business. *Electronic Markets*, 14, 252-266.
- MCLEOD, R. 2017. Counting the Cost: Lost Australian Food and Wine Export Sales due to Fraud. Food Innovation Australia Limited (FIAL).
- MCMILLAN, T. 2018. How China Plans to Feed 1.4 Billion Growing Appetites. *National Geographic*.
- MERCER, C. 2014. *Prosecutors race to identify more fake wines as Kurniawan sentencing looms* [Online]. Decanter. Available: <https://www.decanter.com/wine-news/prosecutors-race-to-identify-more-fake-wines-as-kurniawan-sentencing-looms-7955/> [Accessed May, 14 2018].
- MITCHELL, V. W. 1999. Consumer perceived risk: conceptualisations and models. *European Journal of Marketing*, 33, 163-195.
- MOHN, E. 2018. Fraud triangle. Salem Press.
- MOORE, J. GMA Science Forum. 2016 Washington DC.
- MOORE, J. C., SPINK, J. & LIPP, M. 2012. Development and application of a database of food ingredient fraud and economically motivated adulteration from 1980 to 2010. *Journal of Food Science*, 77, R118-R126.
- MORGAN, R. M. & HUNT, S. D. 1994. The Commitment-Trust Theory of Relationship Marketing. *Journal of Marketing*, 58, 20.

- NAÍM, M. 2006. *Illicit: How smugglers, traffickers and copycats are hijacking the global economy.*, London : Arrow, 2007, c2005.
- NASTU, P. 2009. *Newton's Eco-Friendly Packaging a Snug Fit* [Online]. Environmental Leader. Available: <https://www.environmentalleader.com/2009/01/newtons-eco-friendly-packaging-a-snug-fit/> [Accessed April 16, 2019].
- NEEDLEMAN, S. E. & CHU, K. 2014. Entrepreneurs Bemoan Counterfeit Goods. *Wall Street Journal (Online)*, 1-1.
- NESTLÉ. 2016. Food Fraud Prevention: Economically-motivated adulteration. Available: <https://www.nestle.com/asset-library/documents/library/documents/suppliers/food-fraud-prevention.pdf>.
- O'BRIEN, R. 1998. *An Overview of the Methodological Approach of Action Research* [Online]. Available: <http://web.net/~robrien/papers/xx%20ar%20final.htm> [Accessed].
- O'CALLAGHAN, K. A. M. & KERRY, J. P. 2016. Consumer attitudes towards the application of smart packaging technologies to cheese products. *Food Packaging and Shelf Life*, 9, 1-9.
- OECD 2007. The Economic Impact of Counterfeiting and Piracy: Executive Summary. Organisation for Economic Co-Operation and Development Publishing.
- PAVLOU, P. A. 2003. Consumer Acceptance of Electronic Commerce: Integrating Trust and Risk with the Technology Acceptance Model. M. E. Sharpe, Inc.
- PFRANG, T. 2011. *Smirnoff Caipiroska Peelable Bottle* [Online]. The Dieline Awards 2012. Available: <https://beta.thedieline.com/blog/2011/3/31/smirnoff-caipiroska-peelable-bottle.html> [Accessed April 16, 2019].
- PRASAD, P. & KOCHHAR, A. 2014. Active Packaging in Food Industry: A Review. *Journal of Environmental Science, Toxicology and Food Technology*, 8, 01-07.
- PRZEWORSKI, A. & TEUNE, H. 1970. *The logic of comparative social inquiry*, New York, Wiley-Interscience [c1970].
- PULLMAN, M. E. & GROSS, M. A. 2004. Ability of Experience Design Elements to Elicit Emotions and Loyalty Behaviors. *Decision Sciences*, 35, 551-578.
- PURAGROUP. 2019. *Security Printing* [Online]. Available: <https://www.puragroup.com/en/total-security-system/> [Accessed April 16, 2019].
- PUSTJENS, A. M., WEESEPOEL, Y. & VAN RUTH, S. M. 2016. Food Fraud and Authenticity: Emerging Issues and Future Trends. In: LEADLEY, C. E. (ed.) *Innovation and Future Trends in Food Manufacturing and Supply Chain Technologies*. Woodhead Publishing.
- PWC 2016a. The Disruptive Face of the Retail and Consumer Products Sector in China and Hong Kong. PWC.
- PWC 2016b. Food Fraud Vulnerability Assessment and Mitigation.
- PWC 2017. Mobile dominates the eCommerce ecosystem in China.
- RAMAMOORTI, S., MORRISON, D. & KOLETAR, J. W. 2009. Bringing Freud to Fraud.
- RANGE, L. M. 2018. Case study methodologies. Salem Press.
- RASINSKI, K. A., MINGAY, D. & BRADBURN, N. M. 1994. Do respondents really "mark all that apply" on self-administered questions? *Public Opinion Quarterly*, 58, 400-408.
- RBA 2018. Detected Australian Counterfeits by Denomination. Reserve Bank of Australia, Statistical Tables A7.
- RBA. 2019. *Next Generation Banknote Program* [Online]. Available: <https://banknotes.rba.gov.au/australias-banknotes/next-generation-banknotes-program/> [Accessed April 17, 2019].
- REASON, P. & BRADBURY, H. 2001. *Handbook of action research: Participative inquiry and practice*, Sage.
- RESERVE BANK OF AUSTRALIA. 2016. *Banknote Security Features: New \$5 Banknote* [Online]. Available: <http://banknotes.rba.gov.au/banknote-features/> [Accessed].

- ROUSSEAU, D. M., SITKIN, S. B., BURT, R. S. & CAMERER, C. 1998. Not So Different After All: A cross-discipline view of trust. *Academy of Management Review*, 23, 393-404.
- RUCHIR, Y. S., PRAJESH, N. P. & AGRAWAL, Y. K. 2010. Anticounterfeit packaging technologies. *Journal of Advanced Pharmaceutical Technology & Research*, Vol 1, Iss 4, Pp 368-373 (2010), 368.
- RURALBANK 2018. Australian Agricultural Trade Annual Review. *Rural Bank AG Answers*.
- SANDI, S., RADONJIC, S., DROBNJAK, J., SIMEUNOVIC, M., STAMATOVIC, B. & POPOVIC, T. 2018. Smart tags for brand protection and anti-counterfeiting in wine industry. IEEE 23rd International Scientific-Professional Conference on Information Technology.
- SCHAEFER, D. & CHEUNG, W. M. 2018. Smart Packaging: Opportunities and Challenges. *Procedia CIRP*, 72, 1022-1027.
- SCHULTZ, L., J., C. & SAPORITO, B. 1996. Protecting Intellectual Property: Strategies and Recommendations to Deter Counterfeiting and Brand Piracy in Global Markets. *Columbia Journal of World Business*, 31, 18-28.
- SHANKAR, V., URBAN, G. L. & SULTAN, F. 2002. Online trust: a stakeholder perspective, concepts, implications, and future directions. *The Journal of strategic information systems*, 11, 325-344.
- SHOBEIRI, S., LAROCHE, M. & MAZAHERI, E. 2013. Shaping e-retailer's website personality: The importance of experiential marketing. *Journal of Retailing and Consumer Services*, 20, 102-110.
- SHRIVASTAVA, P. 1995. Ecocentric management for a risk society. *Academy of management review*, 20, 118-137.
- SIAU, K. & SHEN, Z. 2003. Building customer trust in mobile commerce. *Communications of the ACM*, 46, 91-94.
- SINCERBOX, G. 1993. *Counterfeit deterrent features for the next-generation currency design*. [electronic resource], Washington, DC : National Academy Press, 1993.
- SIRDESHMUKH, D., SINGH, J. & SABOL, B. 2002. Consumer Trust, Value, and Loyalty in Relational Exchanges. *Journal of Marketing*, 66, 15-37.
- SLOVIC, P. 2000. *The perception of risk*, London : Earthscan Pub, 2000.
- SLOVIC, P. 2016. Understanding Perceived Risk: 1978-2015. *Environment: Science and Policy for Sustainable Development*, 58, 25-29.
- SLOVIC, P., FISCHHOFF, B. & LICHTENSTEIN, S. 1984. Behavioral decision theory perspectives on risk and safety. *Acta psychologica*, 56, 183-203.
- SOLOMON, R. C., HIGGINS, K. M. & MARTIN, C. W. 2012. *Introducing philosophy : a text with integrated readings*, Oxford ; New York : Oxford University Press, c2012. 10th ed.
- SPINK, J. Global Counterfeit Food & Beverage Packaging: Impacts on Food Safety. Association of Food and Drug Officials (AFDO) Annual Conference, 2007 San Antonio, Texas, USA.
- SPINK, J. 2010. Brand security in packaging. McGraw-Hill Education.
- SPINK, J., HELFERICH, O. K. & GRIGGS, J. E. 2010. Combating the impact of product counterfeiting. *Distribution Business Management Journal*, 10.
- SPINK, J., MOYER, D. & HEINONEN, J. 2012. Anti-counterfeiting countermeasures - tactics evolving to strategies. *Packaging World*, Trends and Issues.
- SPINK, J., MOYER, D., PARK, H. & HEINONEN, J. 2014. Development of a product-counterfeiting incident cluster tool. *Crime Science*, 3, 1-8.
- SPINK, J. & MOYER, D. C. 2011a. Background: Defining the Public Health Threat of Food Fraud. National Centre for Food Protection and Defence, A homeland security centre of excellence.
- SPINK, J. & MOYER, D. C. 2011b. Defining the public health threat of food fraud. *Journal of Food Science*, 76, R157-R163.

- SPINK, J., MOYER, D. C., PARK, H. & HEINONEN, J. A. 2013. Defining the types of counterfeiters, counterfeiting, and offender organizations. *Crime Science*, 2, 8.
- SPINK, J., MOYER, D. C. & SPEIER-PERO, C. 2016. Introducing the Food Fraud Initial Screening model (FFIS). *Food Control*, 69, 306-314.
- SPINK, J., ORTEGA, D. L., CHEN, C. & WU, F. 2017. Food fraud prevention shifts the food risk focus to vulnerability. *Trends in Food Science & Technology*, 62, 215-220.
- SPINK, J., SINGH, J. & SINGH, S. P. 2011. Review of Package Warning Labels and Their Effect on Consumer Behaviour with Insights to Future Anticounterfeit Strategy of Label and Communication Systems. *Packaging Technology and Science*, 24, 469-484.
- SPINK, J., VINCENT HEGARTY, P., FORTIN, N. D., ELLIOTT, C. T. & MOYER, D. C. 2019. The application of public policy theory to the emerging food fraud risk: Next steps. *Trends in Food Science & Technology*.
- STAAKE, T., MICHAHELLES, F., FLEISCH, E., WILLIAMS, J. R., MIN, H., COLE, P. H., LEE, S.-G., MCFARLANE, D. & MURAI, J. 2008. Anti-Counterfeiting and Supply Chain Security. In: COLE, P. H. & RANASINGHE, D. C. (eds.) *Networked RFID Systems and Lightweight Cryptography: Raising Barriers to Product Counterfeiting*. Berlin, Heidelberg: Springer Berlin Heidelberg.
- STAAKE, T., THIESSE, F. & FLEISCH, E. 2009. The emergence of counterfeit trade: a literature review. *EUROPEAN JOURNAL OF MARKETING*, 43, 320-349.
- SUN, C.-T., KUAN, P.-C., WANG, Y.-M., LU, C.-S. & WANG, H.-C. 2018. Integration of Graphic QR code and Identity Documents by Laser Perforation to Enhance Anti-Counterfeiting Features. IEEE 2018 International Conference on Multimedia & Expo Workshops (ICMEW).
- SUN, T., XU, B., CHEN, B., CHEN, X., LI, M., SHI, P. & WANG, F. 2017. Anti-counterfeiting patterns encrypted with multi-mode luminescent nanotaggants. Great Britain: Royal Society of Chemistry.
- TADDEO, M. 2009. Defining trust and e-trust: from old theories to new problems. *International Journal of Technology and Human Interaction*, 23.
- THIERS, P. 2003. Risk society comes to China: SARS, transparency and public accountability. *Asian Perspective*, 27, 241-251.
- VAN METER, A. 1941. The Function and Value of Aesthetics. *The Journal of Aesthetics and Art Criticism*, 1, 95-105.
- VILA, N. & KUSTER, I. 2011. Consumer feelings and behaviours towards well designed websites. *Information & Management*, 48, 166-177.
- WALL, D. S. & LARGE, J. 2010. Jailhouse Frocks: Locating the Public Interest in Policing Counterfeit Luxury Fashion Goods. *British Journal of Criminology*, 1094.
- WANG, Y. D. & EMURIAN, H. H. 2005. An overview of online trust: Concepts, elements, and implications. *Computers in Human Behavior*, 21, 105-125.
- WEBB, S. A. 2006. *Social work in a risk society: Social and political perspectives*, Palgrave Macmillan.
- WEBER, E. U. & HSEE, C. 1998. Cross-Cultural Differences in Risk Perception, but Cross-Cultural Similarities in Attitudes towards Perceived Risk. Institute for Operations Research and the Management Sciences.
- WEBSTER, J. & MARTOCCHIO, J. J. 1992. Microcomputer Playfulness: Development of a Measure With Workplace Implications. *MIS Quarterly*, 16, 201-226.
- WERWATH, T. 2006. The Culture and Politics fo Graffiti Art. Wilde Lake High School, Columbia, MD, USA.
- WHITING, B. B., EDWARDS, C. P., EDWARDS, C. P. & EMBER, C. R. 1992. *Children of different worlds: The formation of social behavior*, Harvard University Press.

- WIKE, R. & STOKES, B. 2016. Chinese Public Sees More Powerful Role in World, Names U.S as Top Threat: Domestic challenges persist: Corruption, consumer safety, pollution.
- WILCOCK, A. E. & BOYS, K. A. 2014. Reduce product counterfeiting: An integrated approach. *Business Horizons*, 57, 279-288.
- WILCOX, K., KIM, H. M. & SEN, S. 2009. Why do consumers buy counterfeit luxury brands? *Journal of Marketing Research*, 46, 247-259.
- WILKIE, D. 2018. Blockchain real chance to conquer counterfeits. *Australian China Business Review*.
- WILLIAMSON, O. E. 1993. Calculativeness, Trust, and Economic Organization. *The Journal of Law & Economics*, 36, 453-486.
- WILSON, J. M. 2015. Brand protection 2020. Technical reports, Michigan State University.
- WILSON, J. M. & KINGHORN, R. 2016. A total business approach to the global risk of product counterfeiting. *Glob. Edge Bus. Rev*, 10, 1-6.
- WISHNICK, E. 2005. *China as a risk society*, East-West Center Honolulu.
- WOLFE, D. T. & HERMANSON, D. R. 2004. The Fraud Diamond: Considering the Four Elements of Fraud. United States: NEW YORK STATE SOCIETY OF CERTIFIED PUBLIC ACCOUNTANTS.
- WOLFINBARGER, M. & GILLY, M. C. 2003. eTailQ: dimensionalizing, measuring and predicting retail quality. *Journal of Retailing*, 79, 183-198.
- WTO. 2019. *World Trade Organisation* [Online]. Available: <https://www.wto.org/> [Accessed April 15, 2019].
- WTR. 2019. *World Trademark Review* [Online]. Available: <https://www.worldtrademarkreview.com/> [Accessed April 15, 2019].
- WU, Y., MIAO, H., BING, S., JING, Z. & SPINK, J. 2016. Food Fraud. In: JEN, C. J. A. J. J.-S. (ed.) *Food Safety in China: Past, Present, and Future*. Beijing: Popular Science Press, China Science and Technology Press.
- XIAOMING, C. 2009. Coping with Risk Society: Criminal Law. *Chinese Journal of Law*, 6, 004.
- YAN, Y. 2012. Food safety and social risk in contemporary China. *The Journal of Asian Studies*, 71, 705-729.
- YANG, D. & FRYXELL, G. E. 2009. Brand Positioning and Anti-counterfeiting Effectiveness. *Management International Review*, 49, 759.
- YANG, D. & SONMEZ, M. M. 2017. Effectiveness against counterfeiting: four decades of strategic inquiry. In: CHAUDHRY, P. (ed.) *Handbook of Research on Counterfeiting and Illicit Trade*.
- YANG, G. 2010. Brokering Environment and Health in China: issue entrepreneurs of the public sphere. *Journal of Contemporary China*, 19, 101-118.
- YIANNAS, F. 2019. Speech: Remarks by Frank Yiannas to the International Association for Food Protection, Louisville, Deputy FDA Commissioner for Food Policy and Response. U.S. Regulatory Update at the Association's 2019 annual meeting: U.S Food and Drug Administration.
- YOU, M., LIN, M., WANG, S., WANG, X., ZHANG, G., HONG, Y., DONG, Y., JIN, G. & XU, F. 2016. Three-dimensional quick response code based on inkjet printing of upconversion fluorescent nanoparticles for drug anti-counterfeiting. *Nanoscale*, 8, 10096-10104.
- YOUNG, C., JOOWON, P., MIRI, C. & JUNGHOON, M. 2009. Effect of the food traceability system for building trust: Price premium and buying behavior. *Information Systems Frontiers*, 11, 167-179.
- ZHANG, L., MOL, A. P. & SONNENFELD, D. A. 2007. The interpretation of ecological modernisation in China. *Environmental politics*, 16, 659-668.

- ZHANG, X., PRYBUTOK, V. R., RYAN, S. & PAVUR, R. 2009. A Model of the Relationship among Consumer Trust, Web Design and User Attributes. *Journal of Organizational and End User Computing*, 21, 44-66.
- ZILJAK, V., PAP, K. & ZILJAK, I. 2010. Infrared hidden CMYK graphics. *Imaging Science Journal*, 58, 20-27.
- ZONCA, C. 2015. Selling the story of provenance key to Aussie farmers cracking the Chinese market. *ABC Online*.

Appendices

<i>Appendix A</i>	<i>Study 2 Workshop Proposal</i>	<i>xxi</i>
<i>Appendix B</i>	<i>Study 3 Online Survey Questionnaire</i>	<i>xxix</i>
<i>Appendix C</i>	<i>Ethics Summary Approval Form</i>	<i>xli</i>
<i>Appendix D</i>	<i>Plain Language Statement</i>	<i>xlvii</i>
<i>Appendix E</i>	<i>Participant Consent Form</i>	<i>xl ix</i>
<i>Appendix F</i>	<i>Study 1 QMA Plotted Elements</i>	<i>li</i>
<i>Appendix G</i>	<i>Study 3 Online Survey Statistical Analyses</i>	<i>liii</i>

Appendix A

Study 2 Workshop Proposal

Research Proposal

CLIENT | Undisclosed

PROJECT | Anti-Counterfeiting Strategies & Technologies Mapping
Workshop

PRODUCT | Undisclosed

DATE | 10th October 2017

VALID TO | 31st October 2017

REVISION | 1

PRIMARY RESEARCHER | Ms Caroline Francis

c.francis2@student.unimelb.edu.au

UNIVERSITY OF MELBOURNE

Faculty of Veterinary and Agricultural Sciences (FVAS),

Sensory Facility, Building 184,

Parkville, Victoria, Australia

| Terms

Industry Partner	An undisclosed Australian exporting food business willing to participate in the research study.
University of Melbourne	The research institute which is running the research study.
The Research Study	The study involving the pilot test of the Anti-Counterfeiting Workshop Model.
Stakeholders	The Industry Partner representatives from key decision platforms such as key managers throughout the supply chain.

| Purpose

The “Industry Partner” is looking to establish a strategic anti-counterfeiting yearly plan to navigate the threat of ongoing counterfeiting in China. The “University of Melbourne” has been consulted to plan and facilitate an all-day workshop with the “Industry Partner” team representatives identified as “Stakeholders” to strategize a roadmap of solutions across a multi-phase 2-year anti-counterfeiting plan.

This document sets out to detail the proposed next steps outlining the Workshops: pre-work; the schedule and agenda; and the post-workshop deliverables for the “Industry Partner” to review and approve.

Specific Project Considerations:

Products: Hero Product to be considered and family products as secondary considerations (details undisclosed).

Formats: Multiple formats considered (details undisclosed).

Delivery timeframe: Please see schedule options within the report

| Pre-Work (for the “Industry Partner”)

The following pre-work outlined below is recommended (yet optional) for the “Industry Partner” to provide to the “University of Melbourne” to establish the company’s position and their current issue with counterfeiting. This will equip the best decision making and forecasting process on the Workshop day:

Counterfeiting Examples

It is ideal if examples of counterfeited products can be acquired for the workshop so that an assessment of the counterfeiter’s capabilities can be deduced. Examples include:

- the purchased product and its packaging,
- records of the purchased price, and
- the online/offline channels it was sold through,
- how the counterfeited products were discovered by the original company.

Product Samples

Please bring 6 or more samples of your product for discussion and handling.

Online Channels

Please bring a list of your online / offline channels you currently sell through e.g. TaoBao, TMall, JingDong. If possible, try to identify if each channel has:

- a consumer return policy
(in the scenario that a consumer becomes aware that they have purchased a fake Nu-Lax product?)
- a delisting and blacklisting policy
(to shut down discovered illegal operations and report their operations)

Legal Work

If possible, please bring along your Chinese registrations and trademarks that have been breached (if any held).

Supply Chain

For this section, your company is not asked to identify your supply chain partners however it is ideal if you can share an A4 sheet that summaries a top-level map of your supply chain so that we can identify what strategies and technologies are appropriate for your needs (e.g. covert, overt, digital, remote, track&trace).

Budget

Please consider a range that you would consider to budget for investing into anti-counterfeiting strategies and technologies. By knowing how much you would be willing to invest will drive the decision making on the Workshop day.

This budget may change over the course of the workshop as you learn about the threats abroad and the value-add to your brand and customers with the right selection of security applications.

Additional SKU's

The workshop will focus on the Nu-Lax product currently being exported.

If you have other SKU's that you would consider exporting, or are exported, that could be targeted by counterfeiters, please bring a sample or a printout of these along to the workshop as this may alter the overall forecasted plan if you are considering repurposing the strategy for similar products offered by your company.

Questions to consider prior to the Workshop



| Workshop Agenda

The proposed Workshop agenda is outlined here:

Location: University of Melbourne FVAS Sensory facility, Building 184.
Parking will be advised in the calendar invite.

Date: Tuesday 31st October 2017

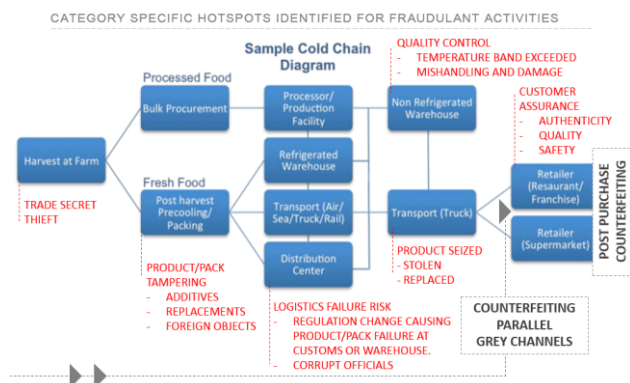
10am	start / welcome
10:15	empathise / knowledge map
11:00	define
12:00	<i>lunch review concept boards</i>
1:00	ideation / map benefits / time vs value chart
3:00	<i>break</i>
3:20	prototype / test / break the counterfeiting teams
4:30	wrap up

| Workshop Outline

EMPATHISE

1. What the Client already knows
2. What the Client does not already know (Alignment)
3. Assess business model weaknesses (where in the supply chain you lose control of the product/package?)
4. Deducing the Counterfeiters Capabilities (From Examples)

Business Model Weaknesses



Counterfeiting Capabilities

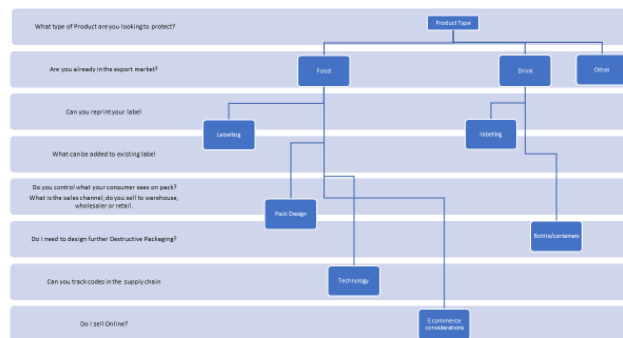


DEFINE

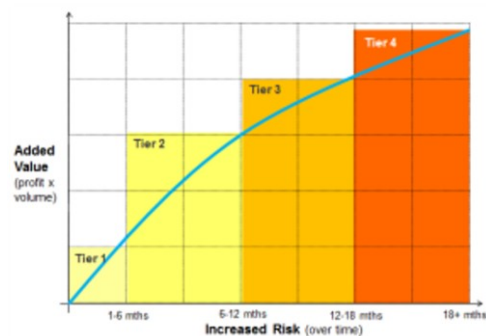
5. Defining the Problem
(The Statement)
6. Identifying What
Success Looks Like
(Aims)
7. Planning Actionable
Steps
(Objectives)
8. Mapping Out Phases
(Over 2 Years)

Defining the Steps to Success

What solutions should you be seeking

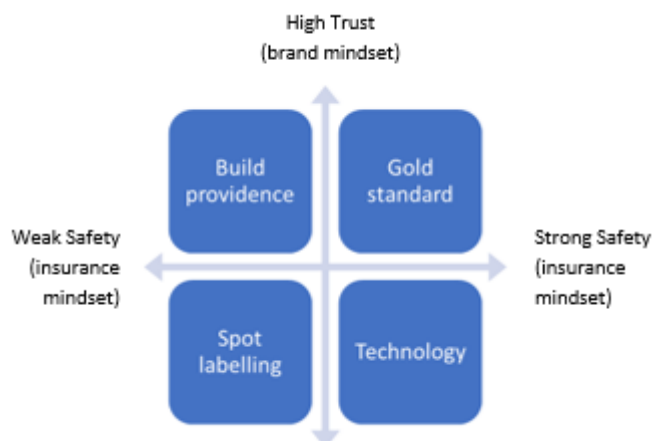


Mapping Strategic Phases



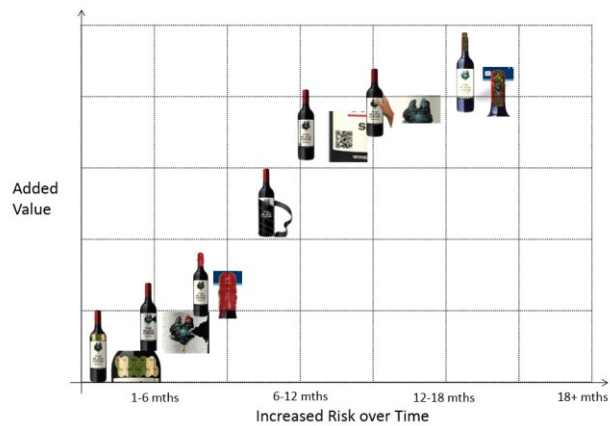
IDEATE

9. QMA - Anti-Counterfeiting Strategies and Technologies (ACSAT) with printouts.
10. Select Appropriate ACSATs per Dynamic Phases (over 2 years)
Voting System



PROTOTPE

11. Capture and Visualise Findings
(across identified Phases)



TEST

12. Someone is selected to be a counterfeit actor who uses the counterfeiting capabilities chart to test each phase to see if the selected strategies and technologies are sufficient for rollout.



| Post-Workshop Deliverables

The deliverables from the workshop include:

- The alignment of the “Industry Partner” “Stakeholders” on the current situation,
- Their contribution and agreement of the co-creation strategy, and
- A visual Report of the 2-year anti-counterfeiting plan presented to the “Industry Partner”, post-workshop. Date for presentation is to be confirmed.
-

| Facilitators

Recruitment of Professional Contractors from the University of Melbourne

The recruitment of professional facilitators will have the knowledge and experience of conducting a one-day workshop, facilitating the extraction of key insights and reporting on the best practice to be adopted. The primary research facilitator is a professional in design thinking methodology, co-creation strategies and anti-counterfeiting expertise and will present 30 summarised security elements for the “Industry Partner” to appraise.

Thank you for allowing us to provide you this Research Proposal.

We look forward to hearing from you soon.

Primary Researcher and Team

Industry Transformation Research Hub

University of Melbourne

Appendix B

Study 3 Online Survey Questionnaire

FINAL QUESTIONNAIRE: v09

Job number:	61273430
Job name:	Conjoint Study
Project Manager:	Sophia Gordon

AMENDMENTS: ADDITIONS / REMOVALS / TBC

(Version mgmt.: please maintain previous question IDs/coding and do not delete or overwrite text)

PROJECT SPECS

Speeder Setting: 30% of median (Default setting)	Flat-line QIDs / other QA measures: dFLAG1 / dFLAG2
Late Screen / Quota Reward (VOP AU / NZ ONLY): No	Project Contains PII: No
Scripting complexity: 4	Data file format: DASHBOARD
Device Information (select one, delete all others): PC and Tablet Only	

COUNTRY	LANGUAGE	SOURCE
AUSTRALIA	ENGLISH	VOP / EROP / PL
CHINA	SIMPLIFIED CHINESE	VOP / EROP / PL

IMPORTANT: Please note that **OMITTED QUESTIONS** are not relevant to this thesis research and therefore have not been included in the appendix.

[START SURVEY]

INSERT DUMMY TO RECORD RESPONDENT COUNTRY / SR / PUNCH ALL

dCountry.

1. Australia
2. China

[START OF SCREENER SECTION]

SHOW INFOSCREEN, D1 AND D2 ON THE SAME SCREEN AS SHOWN BELOW:

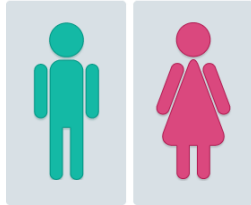
INFO SCREEN / SHOW ALL

INFOSCREEN. To begin with, please tell us a little about yourself:

ASK ALL / SR / AGE & GENDER IMAGE SELECT / QUOTA: GENDER (AUSTRALIA / CHINA)

D1. What is your gender?

1. Male
2. Female



ASK ALL / OE NUM / RANGE: 0-99

D2. What is your age?

INSERT DUMMY TO RECORD RESPONDENT AGE FROM D2 / SR / PUNCH IF dCountry=1 / QUOTA: AGE (AUSTRALIA)

dAgeAUS.

1. 0-17yrs TERMINATE
2. 18-24yrs
3. 25-34yrs
4. 35-44yrs
5. 45-54yrs
6. 55-64yrs
7. 65+yrs

INSERT DUMMY TO RECORD RESPONDENT AGE FROM D2 / SR / PUNCH IF dCountry=2 / QUOTA: AGE (CHINA)

dAgeCN.

1. 0-17yrs TERMINATE
2. 18-24yrs
3. 25-34yrs
4. 35-44yrs
5. 45-54yrs
6. 55-64yrs
7. 65+yrs

ASK IF dCountry=1 / SR

D3AUS. Which of the following state of territories do you currently live in?

1. Australian Capital Territory
2. New South Wales
3. Northern Territory
4. Queensland
5. South Australia
6. Tasmania
7. Victoria
8. Western Australia
9. None of the above

INSERT DUMMY TO RECORD RESPONDENT REGION FROM D3AUS / SR / PUNCH IF dCountry=1 / QUOTA: REGION (AUSTRALIA)

dRegionAUS.

1. Australian Capital Territory PUNCH IF D3AUS=1
2. New South Wales PUNCH IF D3AUS=2
3. Northern Territory PUNCH IF D3AUS=3
4. Queensland PUNCH IF D3AUS=4
5. South Australia PUNCH IF D3AUS=5

6. Tasmania **PUNCH IF D3AUS=6**
7. Victoria **PUNCH IF D3AUS=7**
8. Western Australia **PUNCH IF D3AUS=8**
9. None of the above **PUNCH IF D3AUS=9 / TERMINATE**

ASK IF dCountry=2 / SR

D3CN. Which of the following provinces do you currently live in?

1. Anhui
2. Beijing
3. Chongqing
4. Fujian
5. Gansu
6. Guangdong
7. Guangxi
8. Guizhou
9. Hainan
10. Hebei
11. Heilongjiang
12. Henan
13. Hubei
14. Hunan
15. Jiangsu
16. Jiangxi
17. Jilin
18. Liaoning
19. Neimenggu (Inner Mongolia)
20. Ningxia
21. Qinghai
22. Shaanxi
23. Shandong
24. Shanghai
25. Shanxi
26. Sichuan
27. Tianjin
28. Xinjiang
29. Xizang (Tibet)
30. Yunnan
31. Zhejiang
32. None of the above

INSERT DUMMY TO RECORD RESPONDENT REGION FROM D3CN / SR / PUNCH IF dCountry=2 / QUOTA:
REGION (CHINA)
dRegionCN.

1. Eastern China PUNCH IF D3CN=1,4,15,16,23,24,31
2. North-Eastern China PUNCH IF D3CN=11,17,18
3. Northern China PUNCH IF D3CN=2,10,19,25,27
4. South Central China PUNCH IF D3CN=6,7,9,12,13,14
5. Western China PUNCH IF D3CN=3,5,8,20,21,22,26,28,29,30
6. None of the above PUNCH IF D3CN=32 / TERMINATE

[END OF SCREENER SECTION]

[START OF MAIN QUESTIONNAIRE]

ASK ALL / MR

Q1. Which of the following food and beverage products have you ever consumed?

1. Wine
2. Coffee
3. Chocolate
4. Yoghurt
5. Milk drinks (e.g. ready to drink milk drinks)
6. Ice cream
7. Cheese
8. Baby formula (consumed by your child)
9. Capsicum
10. Pumpkin
11. Tomato
12. Banana
13. Melon
14. Tea
15. Grains (e.g. rice, oats, wheat, quinoa, etc.)
16. Beef
17. Pork
18. Olive Oil
19. None of these TERMINATE

ASK ALL / GRID SR PER ROW

Q2. On average, how often do you consume the following types of food and beverage?

MASK ROWS BASED ON Q1 SELECTION	At least once per day	At least once a week	At least once a month	Less than once a month	Never
1. Wine	1	2	3	4	5
2. Coffee	1	2	3	4	5
3. Chocolate	1	2	3	4	5
4. Yoghurt	1	2	3	4	5
5. Milk drinks (e.g. ready to drink milk drinks)	1	2	3	4	5
6. Ice cream	1	2	3	4	5
7. Cheese	1	2	3	4	5
8. Baby formula (consumed by your child)	1	2	3	4	5
9. Capsicum	1	2	3	4	5
10. Pumpkin	1	2	3	4	5
11. Tomato	1	2	3	4	5
12. Banana	1	2	3	4	5
13. Melon	1	2	3	4	5
14. Tea	1	2	3	4	5
15. Grains (e.g. rice, oats, wheat, quinoa, etc.)	1	2	3	4	5
16. Beef	1	2	3	4	5
17. Pork	1	2	3	4	5
18. Olive Oil	1	2	3	4	5

INSERT DUMMY TO FLAG COUNT FOOD COMSUPTION FREQUENCY 'AT LEAST ONCE PER DAY' FROM Q2 / SR / PUNCH ALL

dFlag1. dQ2COUNT.

1. COUNT 1 PUNCH IF Q2_1-18=1 COUNT 1
2. COUNT 2 PUNCH IF Q2_1-18=1 COUNT 2
3. COUNT 3 PUNCH IF Q2_1-18=1 COUNT 3
4. COUNT 4 PUNCH IF Q2_1-18=1 COUNT 4
5. COUNT 5 PUNCH IF Q2_1-18=1 COUNT 5
6. COUNT 6 PUNCH IF Q2_1-18=1 COUNT 6
7. COUNT 7 PUNCH IF Q2_1-18=1 COUNT 7
8. COUNT 8 PUNCH IF Q2_1-18=1 COUNT 8
9. COUNT 9 PUNCH IF Q2_1-18=1 COUNT 9
10. COUNT 10 PUNCH IF Q2_1-18=1 COUNT 10 / TERMINATE
11. COUNT 11 PUNCH IF Q2_1-18=1 COUNT 11 / TERMINATE
12. COUNT 12 PUNCH IF Q2_1-18=1 COUNT 12 / TERMINATE
13. COUNT 13 PUNCH IF Q2_1-18=1 COUNT 13 / TERMINATE
14. COUNT 14 PUNCH IF Q2_1-18=1 COUNT 14 / TERMINATE
15. COUNT 15 PUNCH IF Q2_1-18=1 COUNT 15 / TERMINATE
16. COUNT 16 PUNCH IF Q2_1-18=1 COUNT 16 / TERMINATE
17. COUNT 17 PUNCH IF Q2_1-18=1 COUNT 17 / TERMINATE

18. COUNT 18 PUNCH IF Q2_1-18=1 COUNT 18 / **TERMINATE**

INSERT DUMMY TO FLAG FOOD CONSUMPTION FREQUENCY 'AT LEAST ONCE PER DAY' FROM Q2COUNT / SR / PUNCH ALL

dFLAG1.

1. Q2 Flag (Count 15) PUNCH IF dQ2COUNT=15

2. Q2 Flag (Count 16) PUNCH IF dQ2COUNT=16

3. Q2 Flag (Count 17) PUNCH IF dQ2COUNT=17

4. Q2 Flag (Count 18) PUNCH IF dQ2COUNT=18

INSERT DUMMY TO RECORD FOOD CONSUMPTION FREQUENCY 'AT LEAST ONCE A MONTH' FROM Q2 / MR / PUNCH ALL

dCategory.

1. Wine PUNCH IF Q2_1=1,2,3
2. Coffee PUNCH IF Q2_2=1,2,3
3. Chocolate PUNCH IF Q2_3= 1,2,3
4. Yoghurt PUNCH IF Q2_4=1,2,3
5. Milk drinks PUNCH IF Q2_5=1,2,3
6. Ice cream PUNCH IF Q2_6=1,2,3
7. Cheese PUNCH IF Q2_7=1,2,3
8. Baby formula PUNCH IF Q2_8=1,2,3
9. Capsicum PUNCH IF Q2_9=1,2,3
10. Pumpkin PUNCH IF Q2_10=1,2,3
11. Tomato PUNCH IF Q2_11=1,2,3
12. Banana PUNCH IF Q2_12=1,2,3
13. Melon PUNCH IF Q2_13=1,2,3
14. Tea PUNCH IF Q2_14=1,2,3
15. Grains PUNCH IF Q2_15=1,2,3
16. Beef PUNCH IF Q2_16=1,2,3
17. Pork PUNCH IF Q2_17=1,2,3
18. Olive Oil PUNCH IF Q2_18=1,2,3

19. None PUNCH IF Q2_1-18=4,5 (IN ALL INSTANCES) / TERMINATE

INSERT DUMMY TO ALLOCATE RESPONDENT INTO ONE CATEGORY ON A LEAST FULL BASIS FROM dCategory / SR / PUNCH IF dCountry=1

dLeastFullAUS.

1. Wine
2. Coffee
3. Chocolate
4. Yoghurt
5. Milk drinks
6. Ice cream

7. Cheese
8. Baby formula
9. Capsicum
10. Pumpkin
11. Tomato
12. Banana
13. Melon
14. Tea
15. Grains
16. Beef
17. Pork
18. Olive Oil

INSERT DUMMY TO ALLOCATE RESPONDENT INTO ONE CATEGORY ON A LEAST FULL BASIS FROM
dCategory / SR / PUNCH IF dCountry=2

dLeastFullCN.

1. Wine
2. Coffee
3. Chocolate
4. Yoghurt
5. Milk drinks
6. Ice cream
7. Cheese
8. Baby formula
9. Capsicum
10. Pumpkin
11. Tomato
12. Banana
13. Melon
14. Tea
15. Grains
16. Beef
17. Pork
18. Olive Oil

Q3. Omitted Question

[REPEAT Q4_Xa / Q4_Xb SCRIPT FOR EACH OF THE 18 CATEGORY PPT. SLIDES 2 / 3, AND AS PER THE CATEGORY ALLOCATION AT dLeastFullAUS OR dLeastFullCN / FOR EXAMPLE: Q4_1a IS PPT. 1 (WINE), SLIDE 2 (BOX), Q4_1b IS PPT. 1 (WINE), SLIDE 3 (BOTTLE), AND BOTH Q4_1a AND Q4_1b ARE TO BE SHOWN TO ALL dLeastFullAUS=1 OR dLeastFullCN=1 RESPONDENTS, ONLY / SEE BOX BELOW FOR VISUAL EXAMPLE OF Q4_Xa / Q4_Xb REPEATED LOGIC]

ASK IF dLeastFullAUS=1 OR dLeastFullCN=1 / MR / SHOW IMAGES SAVED PPT. 1 (WINE), SLIDE 2 (BOX) **ROTATE**

Q4_1a. How **de** would you know if this product is Australian-made? What features would you expect to see on this style of packaging that builds your trust?

Please select from the list below all that apply.

1. Australian made logos and awards **SHOW 'AUSTRALIAN MADE' IMAGE**
2. Security features similar to that found on currency notes **SHOW '\$5 MONEY NOTE' IMAGE**
3. Packaging that can only be used once (tear open spout) **SHOW 'PACKAGING' IMAGE**
4. Scan with a smart phone feature to receive rewards or more information **SHOW 'MOBILE SCAN' IMAGE**
5. Premium branding and materials **SHOW 'PREMIUM BRANDING' IMAGE**
6. Other (please specify) **OE CHA / FD**
7. None of these **EXCLUSIVE / FX**

EXAMPLE OF HOW Q4_1a SHOULD LOOK LIKE ON SCREEN:

How do you know if this product is Australian-made? What features would you expect to see on this style of packaging that builds your trust?

Please select from the list below all that apply.

☐	Australian made logos and awards	
☐	Security features similar to that found on currency notes	
☐	Packaging that can only be used once (tear open spout)	
☐	Scan with a smart phone feature to receive rewards or more information	
☐	Premium design and materials	
☐	None of these	
☐	Other	



ASK IF dLeastFullAUS=1 OR dLeastFullCN=1 / MR / SHOW IMAGES SAVED PPT. 1 (WINE), SLIDE 3 (BOTTLE) **ROTATE**

Q4_1b. How **de** would you know if this product is Australian-made? What features would you expect to see on this style of packaging that builds your trust?

Please select from the list below all that apply.

1. Australian made logos and awards **SHOW 'AUSTRALIAN MADE' IMAGE**
2. Security features similar to that found on currency notes **SHOW '\$5 MONEY NOTE' IMAGE**
3. Packaging that can only be used once (wine cork) **SHOW 'PACKAGING' IMAGE**
4. Scan with a smart phone feature to receive rewards or more information **SHOW 'MOBILE SCAN' IMAGE**
5. Premium branding and materials **SHOW 'PREMIUM BRANDING' IMAGE**
6. Other (please specify) **OE CHA / FD**
7. None of these **EXCLUSIVE / FX**

EXAMPLE OF HOW Q4_1b SHOULD LOOK LIKE ON SCREEN:

How do you know if this product is Australian-made? What features would you expect to see on this style of packaging that builds your trust?

Please select from the list below all that apply.

☐	Australian made logos and awards	
☐	Security features similar to that found on currency notes	
☐	Packaging that can only be used once (wine cork)	
☐	Scan with a smart phone feature to receive rewards or more information	
☐	Premium design and materials	
☐	None of these	
☐	Other	



ASK IF dLeastFullAUS=2 OR dLeastFullCN=2 / MR / SHOW IMAGES SAVED PPT. 2 (COFFEE), SLIDE 2 (JAR) **ROTATE**

Q4_2a. How **de** would you know if this product is Australian-made? What features would you expect to see on this style of packaging that builds your trust?

Please select from the list below all that apply.

1. Australian made logos and awards **SHOW 'AUSTRALIAN MADE' IMAGE**
2. Security features similar to that found on currency notes **SHOW '\$5 MONEY NOTE' IMAGE**

3. Packaging that can only be used once (Seal Sticker) [SHOW 'PACKAGING' IMAGE](#)
4. Scan with a smart phone feature to receive rewards or more information [SHOW 'MOBILE SCAN' IMAGE](#)
5. Premium branding and materials [SHOW 'PREMIUM BRANDING' IMAGE](#)
6. Other (please specify) [OE CHA](#) [PK](#)
7. None of these [EXCLUSIVE](#) [PK](#)

EXAMPLE OF HOW Q4_2a SHOULD LOOK LIKE ON SCREEN:

How do you know if this product is Australian-made? What features would you expect to see on this style of packaging that builds your trust?

Please select from the list below all that apply.

☐ Australian made logos and awards

☐ Security features similar to that found on currency notes

☐ Packaging that can only be used once (foil cover)

☐ Scan with a smart phone feature to receive rewards or more information

☐ Premium design and materials

☐ Name of brand

☐ Other



ASK IF dLeastFullAUS=2 OR dLeastFullCN=2 / MR / SHOW IMAGES SAVED PPT. 2 (COFFEE), SLIDE 3 (CAN) [ROTATE](#)

Q4_2b. How [36](#) would you know if this product is Australian-made? What features would you expect to see on this style of packaging that builds your trust?

[Please select from the list below all that apply.](#)

1. Australian made logos and awards [SHOW 'AUSTRALIAN MADE' IMAGE](#)
2. Security features similar to that found on currency notes [SHOW '\\$5 MONEY NOTE' IMAGE](#)
3. Packaging that can only be used once (foil cover) [SHOW 'PACKAGING' IMAGE](#)
4. Scan with a smart phone feature to receive rewards or more information [SHOW 'MOBILE SCAN' IMAGE](#)
5. Premium branding and materials [SHOW 'PREMIUM BRANDING' IMAGE](#)
6. Other (please specify) [OE CHA](#) [PK](#)
7. None of these [EXCLUSIVE](#) [PK](#)

EXAMPLE OF HOW Q4_2b SHOULD LOOK LIKE ON SCREEN:

How do you know if this product is Australian-made? What features would you expect to see on this style of packaging that builds your trust?

Please select from the list below all that apply.

☐ Australian made logos and awards

☐ Security features similar to that found on currency notes

☐ Packaging that can only be used once (foil cover)

☐ Scan with a smart phone feature to receive rewards or more information

☐ Premium design and materials

☐ Name of brand

☐ Other



[REPEAT ABOVE Q4_Xa / Q4_Xb LOGIC UP TO Q4_18a / Q4_18b]

Q5. Omitted Question

ASK ALL / [GAIN](#) [CAROUSEL WITH COUNTER](#) SR PER ROW

Q6. Please indicate the extent to which you agree or disagree that you trust each of the following (1=strongly disagree, 7=strongly agree).

COLUMNS **SCALE**

1. Strongly disagree
- 2.
- 3.
- 4.
- 5.
- 6.
7. Strongly agree

ROWS **STATEMENTS** / ROTATE

1. People I buy products from
2. Online retailers
3. Local producers
4. Foreign producers
5. Officials in my country who regulate the production of goods
6. Officials in foreign countries who regulate the production of goods

Q7. Omitted Question

Q8. Omitted Question

Q9. Omitted Question

Q10. Omitted Question

[END OF MAIN QUESTIONNAIRE]

[START DEMOGRAPHIC SECTION]

INFO NODE / SHOW ALL / SEPARATE SCREEN

INFODEMO. Finally, we have a few questions for classification purposes only.

ASK ALL / SR

D4. Which of the following best describes your current living arrangements?

1. Living with parents
2. Living on my own or with housemates/boarders
3. Living with a partner/spouse, never had kids
4. Parent/guardian, with youngest child aged under 3 years living with me
5. Parent/guardian, with youngest child aged 3-12 years living with me
6. Parent/guardian, with youngest child aged 13-18 years living with me
7. Retiree

8. Other (please specify) **OE CHA**

INSERT DUMMY TO RECORD RESPONDENT LIFE STAGE FROM D4 AND dLifeStageAge / MR / PUNCH ALL dLifeStage.

1. New families **PUNCH IF D4=4**
2. Young families **PUNCH IF D4=5**
3. Older families **PUNCH IF D4=6**
4. Young singles/couples **PUNCH IF (D4=1,2,3) AND (dLifeStageAge=2,3,4)**
5. Mid-age singles/couples **PUNCH IF (D4=1,2,3) AND (dLifeStageAge=5,6,7)**
6. Older singles/couples **PUNCH IF (D4=1,2,3) AND (dLifeStageAge=8,9,10,11)**
7. Retirees **PUNCH IF (D4=7) AND (dLifeStageAge=12)**
8. Other **PUNCH IF D4=8**

ASK IF dCountry=1 / SR

D5AUS. What is your annual gross (i.e. before tax) household income range?

1. Less than \$15,000 AUD
2. \$15,000 – \$29,999 AUD
3. \$30,000 – \$44,999 AUD
4. \$45,000 – \$59,999 AUD
5. \$60,000 – \$74,999 AUD
6. \$75,000 – \$99,999 AUD
7. \$100,000 – \$149,999 AUD
8. \$150,000 – \$199,999 AUD
9. \$200,000 – \$499,999 AUD
10. \$500,000 – \$999,999 AUD
11. \$1 million + AUD
12. Prefer not to answer

ASK IF dCountry=2 / SR

D5CN. What is your annual gross (i.e. before tax) household income range?

1. Less than ¥15,000 CNY
2. ¥15,000 CNY – ¥24,999 CNY
3. ¥25,000 CNY – ¥34,999 CNY
4. ¥35,000 CNY – ¥44,999 CNY
5. ¥45,000 CNY – ¥54,999 CNY
6. ¥55,000 CNY – ¥64,999 CNY
7. ¥65,000 CNY – ¥74,999 CNY
8. ¥75,000 CNY – ¥84,999 CNY
9. ¥85,000 CNY – ¥94,999 CNY
10. ¥95,000 CNY – ¥99,999 CNY
11. ¥100,000 CNY – ¥149,999 CNY
12. ¥150,000 CNY – ¥199,999 CNY
13. ¥200,000 CNY – ¥249,999 CNY
14. More than ¥250,000 CNY
15. Prefer not to answer

ASK ALL / SR

D6. Which of the following best describes your employment status?

1. Full-time (30 or more hours per week)
2. Part-time
3. Contract, Freelance or Temporary Employee
4. Full-time Student
5. Part-time Student (working MORE than 30 hours per week)
6. Part-time Student (working LESS than 30 hours per week)
7. Homemaker
8. Self-employed
9. Stay-at-Home Parent
10. Retired
11. Semi-retired

12. Unemployed
13. None of the above

[END DEMOGRAPHIC SECTION]

ASK ALL / SR

RECON. Lastly, please may you indicate if you would be happy to be contacted for a very short follow-up survey?

1. Yes
2. No

[END OF SURVEY – RESPONDENT REDIRECTED TO RN END-PAGES]

Appendix C

Ethics Summary Approval Form

THE UNIVERSITY OF MELBOURNE
HUMAN RESEARCH ETHICS COMMITTEE

APPLICATION SUMMARY FOR APPROVAL OF HUMAN RESEARCH

1. ADMINISTRATION DETAILS

ETHICS ID:	1646413.2		
TITLE:	Sensory analysis of meat products and packaging		
APPLICATION TYPE:	Minimal Risk	RESPONSIBLE RESEARCHER :	DUNSHEA, PROF FRANK ROWLAND
RESPONSIBLE HEAG:	Veterinary and Agricultural Sciences	HESC:	Behavioural and Social Sciences
ADMINISTERING DEPARTMENT:	2080 - Agriculture and Food Systems	ADMINISTERING CENTRE: (if applicable)	

2. REQUEST FOR AMENDMENT DETAILS

DATE OF SUBMISSION: 17-Aug-2016

1.1 Nature of and Reason for Amendment

The reason for amendment is to add two student researchers:

Caroline Francis: PhD student - Supporting the QMA's studies and developing the stimulus and facilitation of the research.
Emily Ross: MS student - Supporting the QMA's studies and gathering stimulus and developing of meat categories for the research.

There will be no changes in the application, consent form, PLS or surveys.

1.2 Impact on Documentation

No changes

1.3 Possible Inconvenience or Risks to Participants

None

1.4 Actions to be taken by Researchers to Reduce Risks

Refer to original application

1.5 Expected Date of Implementation of Amendment to Research

29-Aug-2016

1.6 Possible Effect on Funding Arrangements

None

3. MINIMAL RISK CHECKLIST REVIEW

The responses to the Minimal Risk Checklist are summarised below.

Risk Assessment Topics	None identified
Risk Assessment Procedures	None identified

Risks to Researchers	None identified
Vulnerability Assessment	None identified
Overseas Research	None identified

4. PROJECT DETAILS

PROJECT TYPE:	Supervised Student Research Project - Masters by Research Supervised Student Research Project - Honours Supervised Student Research Project - PhD
RESEARCH INVOLVES:	Locations other than/in addition to Uni of Melbourne Funded Research (internal or external funding)
BRIEF DESCRIPTION:	This project will investigate the sensory responses of consumers (participants) to a ranges of stimulus samples that include meat products and packages. Sensory sessions in this project will consist in groups of eight participants gathered in a conference-type room. In each session, participants will assess different sensory and quality characteristics of products and their responses will be recorded. Additionally, each participant will have a tablet PC with a customised App for recording their responses. Questions will be asked through the app one by one related to visual, aroma, taste, texture and sound descriptors. Moreover, product acceptability and perceived quality will be asked using a Quantitative Multivariate Analysis (QMA) which consists in allowing participants to place products into a two-dimensional preference map (Reference: QMA methodology Product Innovation Toolbox: A Field Guide to Consumer Understanding and Research; Authors: Jacqueline Beckley, Dulce Paredes Ph.D., Kannapon Lopetcharats Ph.D.; Chapter 6.3.; Qualitative Multivariate Analysis; Authors: Kannapon Lopetcharat Ph.D. and Jacqueline Beckley).
PROPOSED DURATION OF WHOLE RESEARCH PROJECT:	From: MAR-2016 To: DEC-2019
PROPOSED DATE TO COMMENCE DATA COLLECTION:	01-Apr-2016

5. PERSON DETAILS

Responsible Researcher

Name	Dunshea, Prof Frank	Department	2080 - Agriculture and Food Systems
Person Type	Staff	Centre	
Phone Number	83447124	Email Address	fdunshea@unimelb.edu.au
Qualifications	Bachelors Degree (Honours), La Trobe University Doctorate (Research), La Trobe University		
Experience & Skills Relevant to the Project	Frank is the head of the ARC-ITRP project entitled "Unlocking the Food Value Chain: Australian food industry transformation for ASEAN markets"		
Additional Training Required	N/A		
Ethics Training Already Undertaken			

Student Researcher

Name	Francis, Caroline Maree	Department	2510 - Veterinary and Agricultural Sciences
Person Type	Student	Centre	
Phone Number	/Alt: +61 435 295 892	Email Address	c.francis2@student.unimelb.edu.au
Qualifications	Master of Applied Science (Industrial Design)		
Experience & Skills Relevant to the Project	Food Design Manager from Food Innovation Centre		
Additional Training Required			
Ethics Training Already Undertaken	Completed Ethics training at Queensland University of Technology 2002		
Student Supervisor (if applicable)	Frank Dunshea		

Student Researcher

Name	Bittner, Evan Paul	Department	2080 - Agriculture and Food Systems
Person Type	Student	Centre	
Phone Number		Email Address	e.bittner@student.unimelb.edu.au
Qualifications	Bachelor's Degree in Animal Science and Management (Hons) from the University of Melbourne Master of Animal Science from the University of Melbourne		
Experience & Skills Relevant to the Project	As a student researcher on this project Evan has minimal experience to date.		
Additional Training Required	I am working with another research group who have carried out this research method extensively and have offered me their guidance		
Ethics Training Already Undertaken			
Student Supervisor (if applicable)	Frank Dunshea, Robert van Barneveld		

Student Researcher

Name	Ross, Emily	Department	2510 - Veterinary and Agricultural Sciences
Person Type	Student	Centre	
Phone Number	98593150	Email Address	e.ross4@student.unimelb.edu.au
Qualifications	Master of Food Sciences		
Experience & Skills Relevant to the Project	Quality control and product innovation and food science		
Additional Training Required	None		
Ethics Training Already Undertaken	None		
Student Supervisor (if applicable)	Robyn Warner		

Co researcher

Name	Fuentes, Dr Sigfredo	Department	2080 - Agriculture and Food Systems
Person Type	Staff	Centre	
Phone Number	(03) 9035 9670	Email Address	sigfredo.fuentes@unimelb.edu.au
Qualifications	Bachelors Degree, University of Talca Bachelors Degree, University of Talca Doctorate (Research), University of Western Sydney		
Experience & Skills Relevant to the Project	Senior Lecturer of Sensory Analysis and Practice course at The University of Melbourne (2014-2015) FOOD90028 CI for Sensory Analysis component of the ARC - ITRP ""Unlocking the Food Value Chain: Australian food industry transformation for ASEAN markets" (2014 - 2017)		
Additional Training Required	N/A		
Ethics Training Already Undertaken			

Co researcher

Name	Ashman, Ms Hollis	Department	2510 - Veterinary and Agricultural Sciences
Person Type	Staff	Centre	
Phone Number	Work telephone number not found in HR System	Email Address	hollis.ashman@unimelb.edu.au
Qualifications	BSChE from Purdue University MBA from the University of Pittsburgh		
Experience & Skills Relevant to the Project	Mondelez Food Innovation Centre ANZ: Best Practices Manager Develop knowledge base, innovation practices/ training for SME export to Asia. Including: Management of Research Hubs with University of Melbourne and University of South Australia, Development and implementation of Innovation Training program for Graduates, Development and implementation of Innovation Training program for export to Asia for SME's, Training and mentoring of consumer science team in front end processes, Development of strategy and		

	opportunity space in premium and luxury market for Mondelez.
Additional Training Required	N/A
Ethics Training Already Undertaken	

Co researcher

Name	Torrico, Mr. Damir	Department	2080 - Agriculture and Food Systems
Person Type	Staff	Centre	
Phone Number	+61383449698	Email Address	damir.torrico@unimelb.edu.au
Qualifications	Bachelors Degree, NOT IN LIST - Use free text field instead Masters (Research), Louisiana State University PhD, Louisiana State University - Member of the Institute of Food Technologists (IFT) - Member of the Society of Sensory Professionals (SSP) - Member of the honour society Phi Kappa Phi USA - Member of the agricultural honour society Gama Sigma Delta (GSD) USA		
Experience & Skills Relevant to the Project	Louisiana State University A&M, Food Science Department (USA, January 2009–present) - Extensive experience conducting sensory evaluation of food products including consumer tests and descriptive analyses - Collaboration with research projects related to new food product development and innovation - Assisting with the preparation of laboratory sessions for the Sensory Evaluation of Foods and New Product Development classes at Louisiana State University Kellogg's (USA, January 2014–June 2014) Product and Consumer Understanding Intern: - Participation in the cross functional product development teams, including product development, marketing, marketing research, quality assurance, manufacturing and sensory science to focus on the project objective, developing research plans to meet the objective, and conducting research to meet the project goals - Designing, executing, interpreting data, and reporting results of all types of sensory tests including descriptive analysis, discrimination testing and consumer research		
Additional Training Required	N/A		
Ethics Training Already Undertaken			

Co researcher

Name	Van Barneveld, Prof Robert	Department	0000 No name found for this department code
Person Type	Staff	Centre	
Phone Number	Work telephone number not found in HR System	Email Address	robert.vanbarneveld@sunporkfarms.com.au
Qualifications	Bachelor of Agricultural Science PhD R.An.Nutr.		
Experience & Skills Relevant to the Project	As managing director of SunPork farms, Rob has extensive industry experience and access which will be vital to this projects success.		
Additional Training Required	N/A		
Ethics Training Already Undertaken			

Co researcher

Name	Hastie, Ms Melindee	Department	2080 - Agriculture and Food Systems
Person Type	Staff	Centre	
Phone Number	Work telephone number not found in HR System	Email Address	melindee.hastie@unimelb.edu.au
Qualifications	Bachelor of Applied Science (Biology major) Queensland University of Technology 1991 Professional member of the Australian Institute of Food science and Technology		
Experience & Skills Relevant to the Project	Over 20 years of experience in food industry technical management roles; Including 20 years of managing analytical laboratories servicing the food and		

	Pharma industries Project relevant capabilities include: • The development and maintenance of quality systems and accreditation for GMP and ISO standards for Food laboratory practice • Preparation of risk assessments and SOPs for laboratory activities, • As a technical manger have held accountability for OH&S compliance for the department. • Experienced in supervising and training of staff including postgraduate student interns • Experienced in the facilitation of QMA sessions • Experienced in scoping client project requirements and establishing costing and contracts for delivery of client projects
Additional Training Required	
Ethics Training Already Undertaken	Some training received in the UK around managing the confidentiality of clinical trial volunteers and their personal information (as part of my role at Reading scientific services). Nothing from the University of Melbourne

6. ADDITIONAL QUESTIONS

6.1 Sponsored Projects

Source of Funding: External
Internal

External Sponsors Identified: Yes

Sponsors: PORK CRC
SunPork

Participants Informed of Funding Source: Yes - The funding bodies will be identified on the consent form issued to all participants prior to their involvement with the project.

6.2 Location of Research

Location Where Research Will Be Carried Out: University of Melbourne
External sites within Australia
Overseas

Category of External Location: Private Venues

6.3 Other Approvals Required (other than ethics clearances)

Approvals Required: Not required

6.4 Other Ethic Clearances/Details of Multicentre Research

Other Clearances Required: Not required

Category	Description	Attached Via Themis	Hard Copy Only
Application	Minimal Risk Application	Yes	No
Consent Form	Consent form	Yes	No
Miscellaneous	Allergy statement for participants in sensory sessions	Yes	No
Miscellaneous	Risk assessment for participants consuming food during sensory panels	Yes	No
Miscellaneous	Standard operating procedure for controlling time and temperature of food provided during sensory panels.	Yes	No
Miscellaneous	Standard operating procedure for sample and stimulus traceability.	Yes	No
Miscellaneous	Standard operating procedure for temperature calibration of food used in sensory panels.	Yes	No
Plain Language Statement	PLS	Yes	No

Responsible HREC:

Comments:

7. ATTACHMENTS

PLEASE ENSURE YOU ATTACH A PAPER COPY OF EACH OF THE FOLLOWING ATTACHMENTS:

Category	Description	Attached Via Themis	Hard Copy Only
Additional Module	signed by HEAG chair	Yes	No
Additional Module		Yes	No

Page 5

Date: 17-AUG-2016 11:43:37

8. SIGNATURE**RESPONSIBLE RESEARCHER**

Name	Signature	Date
Prof Frank Dunshea		

HEAG/DEPARTMENT USE ONLY

Please tick ONE of the following:

The HEAG/Head of Department recommends the amendment for approval by the HESC.	
The HEAG approves this amendment as the project was previously approved as a minimal risk project or as a project within a program and the amendment presents no additional risks.	

Comments / provisos:

HEAG CHAIR

Name of HEAG Chair	Signature	Date
A/Prof Vernon Bowles		

[Note: If the HEAG Chair is also a researcher involved in this project, the Request for Amendment should be signed by another authorised member of the HEAG. If the Department does not have access to a HEAG the Request for Amendment should be signed by the Head of Department]

Page 6

Date: 17-AUG-2016 11:43:37

Appendix D

Plain Language Statement

Project Title: *Sensory Analysis of Food Products and Packaging*

Mr Caroline Francis, Faculty of Veterinary and Agricultural Sciences (francisc1@student.unimelb.edu.au)

Ms Hollis Ashman, Faculty of Veterinary and Agricultural Sciences (hollis.ashman@unimelb.edu.au)

Prof. Frank Dunshea, Faculty of Veterinary and Agricultural Sciences (fdunshea@unimelb.edu.au)

What are the aims of this project?

This student research project aims to collect data from a Qualitative Multivariate Analysis (QMA) and a survey in relation to food product packaging appraisals by assessing visual elements of packaging. We will be assessing consumer preferences of food products, packaging and security technologies using the QMA method which involves allowing participants to place products into a two-dimensional preference map, based on their evaluation of a food product, or the way it is packaged and presented to them in a supermarket. This new approach to market research is important for novel food packaging development, which is a very different exercise compared to sensory analysis applied to food product appreciation, acceptance and research on core design replacements to increase acceptance of food products in different markets and countries.

What will you be asked to do?

You will be asked to participate in a QMA session. During QMA, participants will be asked to place photos of different food product packaging represented by design visuals and anti-counterfeiting technology visuals onto a 2-dimensional preference map. Additional questions may be asked of individuals to gain more specific information to each choice they make. QMA sessions will last approximately 1.5 hours, with no invasive measures to be taken at any time, on any participant. Sessions may be filmed or photographed with written consent from all participants present during that session. The QMA session will be recruited for on an individual basis and run of separate occasions. Participants for all sessions will receive a small gift for attending each session with a maximum value of 50 AUD. The purpose of the incentive is to increase and maintain the number of participants in the studies. Participants may include students from the University, however participation is entirely voluntary, and a choice not to participate in the project will have no influence on grades for that student.

How will your confidentiality be protected?

Information gathered will be based on small groups, not individual participants. Participation in the study is entirely voluntary; you do not have to participate if you do not wish to. You are free to withdraw your consent at any time and your anonymity will be protected by the removal of any identifying details (names, location, etc.). Because the sensory analysis is done in a small group of 8-10 participants, this might have implications on protecting your identity. The confidentiality of information provided is subject to legal limitations. The data will be stored securely in a locked cabinet for five years from the date of collection before being destroyed. All computer files will be password protected. Any video footage recorded during sessions will only be available to participating researchers and will be stored securely on password protected hard drives, locked in cabinets within the University.

Research Results

Results from this research will not be made readily available to the public. Particular results will likely be available via publication of data in scientific journals, as well as Master and PhD Thesis completion by students attached to this project.

If you have any concerns about the conduct of the research, please contact the Human Research Ethics Committee:

Human Research Ethics Committee (Ethics Application 1646413.1)

Title: Sensory Analysis of Products and Packaging | The University of Melbourne | Phone: 03 8344 2073

Appendix E

Participant Consent Form

Faculty of Veterinary and Agricultural Sciences

PROJECT TITLE: Sensory analysis of products and packaging

Full Name of Participant: _____

Name of investigator(s): Ms Caroline Francis and Ms Hollis Ashman

1. I consent to participate in this project, the details of which have been explained to me, and I have been provided with a written plain language statement to keep.
2. I understand that after I sign and return this consent form it will be retained by the researcher.
3. I understand that my participation will involve photo recordings and I agree that the researcher may use the results as described in the plain language statement.
4. I understand that my answers and opinions given during the Quantitative Multivariate Analysis (QMA) are being recorded by researchers.
5. I acknowledge that:
 - a. the possible effects of participating in the QMA, survey and video recording have been explained to my satisfaction;
 - b. I have been informed that I am free to withdraw from the project at any time without explanation or prejudice and to withdraw any unprocessed data I have provided;
 - c. the project is for the purpose of research;
 - d. I have been informed that the confidentiality of the information I provide will be safeguarded subject to any legal requirements;
 - e. I have been informed that with my consent the sensory panel and QMA sessions will be recorded in sensory forms and photographed and I understand that sensory forms and photos will be stored at University of Melbourne and will be destroyed after five years;
 - f. my name will be referred to by a pseudonym in any publications arising from the research;

I consent to this interview being photographed yes or no (please circle one)

Participants Signature: _____ Date: _____

Appendix F

Study 1 QMA Plotted Elements (Design Session)

Session 1 Design



Session 2 Design



(Technology Session)

Session 1 Technology



Session 2 Technology



Appendix G

Study 3 Online Survey Statistical Analyses

Test 1 Multiple Correspondence Analysis for Australia

Analysis of Indicator Matrix

Axis	Inertia	Proportion	Cumulative	Histogram
1	0.3492	0.3492	0.3492	*****
2	0.1989	0.1989	0.5482	*****
3	0.1800	0.1800	0.7282	*****
4	0.1446	0.1446	0.8728	*****
5	0.1272	0.1272	1.0000	*****
Total	1.0000			

Column Contributions

ID	Name	Qual	Mass	Inert	Component 1			Component 2		
					Coord	Corr	Contr	Coord	Corr	Contr
1	AustMade	0.9984	0.0181	0.1819	0.6035	0.0363	0.0189	-3.0357	0.9191	0.8402
2	AX	0.9984	0.1819	0.0181	-0.0602	0.0363	0.0019	0.3028	0.9191	0.0838
3	Currency	0.9999	0.1720	0.0280	-0.2350	0.3396	0.0272	-0.0322	0.0064	0.0009
4	CX	0.9999	0.0280	0.1720	1.4450	0.3396	0.1673	0.1980	0.0064	0.0055
5	OncePack	0.6844	0.1531	0.0469	-0.3838	0.4806	0.0646	-0.0096	0.0003	0.0001
6	OX	0.6844	0.0469	0.1531	1.2524	0.4806	0.2107	0.0313	0.0003	0.0002
7	ScanQR	0.9997	0.1755	0.0245	-0.2378	0.4053	0.0284	-0.0958	0.0657	0.0081
8	SX	0.9997	0.0245	0.1755	1.7041	0.4053	0.2037	0.6864	0.0657	0.0580
9	Design	0.6817	0.1585	0.0415	-0.3564	0.4844	0.0576	0.0287	0.0032	0.0007
10	DX	0.6817	0.0415	0.1585	1.3593	0.4844	0.2198	-0.1096	0.0032	0.0025

ID	Name	Component 3			Component 4		
		Coord	Corr	Contr	Coord	Corr	Contr
1	AustMade	0.4986	0.0248	0.0250	-0.4272	0.0182	0.0229
2	AX	-0.0497	0.0248	0.0025	0.0426	0.0182	0.0023
3	Currency	-0.2511	0.3877	0.0602	-0.2081	0.2663	0.0515
4	CX	1.5440	0.3877	0.3704	1.2796	0.2663	0.3168
5	OncePack	0.2448	0.1956	0.0510	-0.0489	0.0078	0.0025
6	OX	-0.7990	0.1956	0.1664	0.1597	0.0078	0.0083
7	ScanQR	-0.1238	0.1098	0.0149	0.2418	0.4189	0.0710
8	SX	0.8870	0.1098	0.1070	-1.7325	0.4189	0.5084
9	Design	0.2186	0.1823	0.0421	-0.0557	0.0119	0.0034
10	DX	-0.8338	0.1823	0.1604	0.2126	0.0119	0.0130

Test 1 Multiple Correspondence Analysis for China

Analysis of Indicator Matrix

Axis	Inertia	Proportion	Cumulative	Histogram
1	0.2691	0.2691	0.2691	*****
2	0.2177	0.2177	0.4868	*****
3	0.1829	0.1829	0.6697	*****
4	0.1736	0.1736	0.8433	*****
5	0.1567	0.1567	1.0000	*****
Total	1.0000			

Column Contributions

					Component 1			Component 2		
ID	Name	Qual	Mass	Inert	Coord	Corr	Contr	Coord	Corr	Contr
1	AustMade	0.8256	0.0724	0.1276	-0.6886	0.2690	0.1275	-0.5997	0.2040	0.1196
2	AX	0.8256	0.1276	0.0724	0.3906	0.2690	0.0723	0.3401	0.2040	0.0678
3	Currency	0.9320	0.1125	0.0875	-0.5166	0.3429	0.1115	-0.2603	0.0870	0.0350
4	CX	0.9320	0.0875	0.1125	0.6637	0.3429	0.1433	0.3344	0.0870	0.0450
5	OncePack	0.7164	0.1148	0.0852	-0.4125	0.2292	0.0726	0.5332	0.3829	0.1499
6	OX	0.7164	0.0852	0.1148	0.5555	0.2292	0.0977	-0.7181	0.3829	0.2019
7	ScanQR	0.9774	0.0983	0.1017	-0.5114	0.2528	0.0955	-0.3367	0.1095	0.0512
8	SX	0.9774	0.1017	0.0983	0.4943	0.2528	0.0923	0.3254	0.1095	0.0495
9	Design	0.7651	0.0931	0.1069	-0.5379	0.2520	0.1001	0.5917	0.3049	0.1497
10	DX	0.7651	0.1069	0.0931	0.4684	0.2520	0.0871	-0.5152	0.3049	0.1304
					Component 3			Component 4		
ID	Name	Coord	Corr	Contr	Coord	Corr	Contr			
1	AustMade	-0.6979	0.2763	0.1928	-0.3669	0.0764	0.0561			
2	AX	0.3958	0.2763	0.1093	0.2081	0.0764	0.0318			
3	Currency	-0.0251	0.0008	0.0004	0.6246	0.5013	0.2528			
4	CX	0.0323	0.0008	0.0005	-0.8025	0.5013	0.3248			
5	OncePack	0.2323	0.0727	0.0339	0.1533	0.0316	0.0155			
6	OX	-0.3128	0.0727	0.0456	-0.2064	0.0316	0.0209			
7	ScanQR	0.6775	0.4436	0.2467	-0.4212	0.1714	0.1005			
8	SX	-0.6548	0.4436	0.2384	0.4070	0.1714	0.0971			
9	Design	-0.3729	0.1211	0.0708	-0.3165	0.0872	0.0537			
10	DX	0.3247	0.1211	0.0616	0.2756	0.0872	0.0468			

Test 2A General Linear Model testing differences between the 2 Populations, Food Categories, Demographics (LifeStage, Gender, Living Arrangements, Income Quintiles) and Trust Propensity.

General Linear Model

Method

Factor coding (-1, 0, +1)

Factor Information

Factor	Type	Levels	Values
Country	Fixed	2	Australia, China
Category	Fixed	10	Wine, Coffee Tea, Chocolate, Dairy, Baby Formula, Vegetables, Fruit, Grains, Meat, Olive Oil
LifeStage	Fixed	6	18 - 24 yrs, 25 - 34 yrs, 35 - 44 yrs, 45 - 54 yrs, 55 - 64 yrs, 65+ yrs
Gender	Fixed	2	Male, Female
LivArr(All)	Fixed	5	Adult no kids, Adult+Preteen, Adult+Teen, Adult+Postteen, Adult+Parent
IncomeQuintiles	Fixed	5	Quintile 1, Quintile 2, Quintile 3, Quintile 4, Quintile 5
TrustPropensityMean	Fixed	7	1, 2, 3, 4, 5, 6, 7

Analysis of Variance

Source	DF	Adj SS	Adj MS	F-Value	P-Value
Country	1	58.5	58.537	13.45	0.000
Category	9	357.0	39.670	9.12	0.000
LifeStage	5	137.4	27.474	6.31	0.000
Gender	1	1.5	1.547	0.36	0.551
LivArr(All)	4	69.7	17.435	4.01	0.003
IncomeQuintiles	4	359.1	89.783	20.63	0.000
TrustPropensityMean	6	2207.9	367.991	84.56	0.000
Country*Category	9	207.1	23.011	5.29	0.000
Country*LifeStage	5	305.6	61.124	14.05	0.000
Country*Gender	1	8.0	8.040	1.85	0.174
Country*LivArr(All)	4	62.5	15.637	3.59	0.006
Country*IncomeQuintiles	4	382.5	95.616	21.97	0.000
Country*TrustPropensityMean	6	329.4	54.906	12.62	0.000
Error	13398	58305.5	4.352		
Lack-of-Fit	5740	27881.8	4.857	1.22	0.000
Pure Error	7658	30423.7	3.973		
Total	13457	77157.0			

Model Summary

S	R-sq	R-sq(adj)	R-sq(pred)
2.08610	24.43%	24.10%	23.74%

Coefficients

Term	Coef	SE Coef	T-Value	P-Value	VIF
Constant	3.800	0.112	33.97	0.000	
Country					
Australia	-0.410	0.112	-3.67	0.000	38.53
Category					
Wine	0.0953	0.0721	1.32	0.186	1.76
Coffee Tea	-0.0531	0.0530	-1.00	0.316	1.40
Chocolate	-0.0625	0.0718	-0.87	0.384	1.75
Dairy	0.2474	0.0407	6.08	0.000	1.26
Baby Formula	-0.1077	0.0718	-1.50	0.133	1.75
Vegetables	-0.0860	0.0449	-1.91	0.056	1.29
Fruit	-0.0655	0.0502	-1.30	0.192	1.36
Grains	-0.0478	0.0722	-0.66	0.508	1.76
Meat	-0.2225	0.0527	-4.22	0.000	1.40
LifeStage					

18 - 24 yrs	0.434	0.179	2.43	0.015	5.21
25 - 34 yrs	0.1048	0.0558	1.88	0.061	2.71
35 - 44 yrs	-0.1120	0.0563	-1.99	0.047	2.61
45 - 54 yrs	-0.1330	0.0576	-2.31	0.021	2.42
55 - 64 yrs	-0.1939	0.0644	-3.01	0.003	2.48
Gender					
Male	-0.0110	0.0185	-0.60	0.551	1.06
LivArr(All)					
Adult no kids	0.0041	0.0441	0.09	0.926	2.43
Adult+Preteen	0.1682	0.0471	3.57	0.000	2.60
Adult+Teen	0.0847	0.0542	1.56	0.119	2.26
Adult+Postteen	-0.227	0.120	-1.89	0.059	5.29
IncomeQuintiles					
Quintile 1	-0.0829	0.0379	-2.19	0.029	1.65
Quintile 2	-0.2809	0.0355	-7.92	0.000	1.49
Quintile 3	0.1706	0.0366	4.66	0.000	1.59
Quintile 4	0.0479	0.0370	1.29	0.195	1.53
TrustPropensityMean					
1	-2.548	0.539	-4.73	0.000	38.87
2	-0.483	0.225	-2.15	0.032	8.37
3	-0.303	0.121	-2.50	0.012	5.46
4	-0.041	0.102	-0.40	0.687	9.51
5	0.311	0.102	3.04	0.002	9.58
6	0.855	0.109	7.82	0.000	7.29
Country*Category					
Australia Wine	0.0425	0.0721	0.59	0.556	1.76
Australia Coffee Tea	0.0867	0.0530	1.64	0.102	1.43
Australia Chocolate	0.3205	0.0718	4.47	0.000	1.75
Australia Dairy	0.0807	0.0407	1.98	0.047	1.39
Australia Baby Formula	-0.3110	0.0718	-4.33	0.000	1.75
Australia Vegetables	0.0042	0.0449	0.09	0.925	1.36
Australia Fruit	-0.0121	0.0502	-0.24	0.810	1.39
Australia Grains	-0.1083	0.0722	-1.50	0.134	1.76
Australia Meat	0.0645	0.0527	1.22	0.221	1.42
Country*LifeStage					
Australia 18 - 24 yrs	-0.686	0.179	-3.84	0.000	5.20
Australia 25 - 34 yrs	-0.1552	0.0558	-2.78	0.005	3.05
Australia 35 - 44 yrs	-0.0615	0.0563	-1.09	0.274	2.98
Australia 45 - 54 yrs	0.0786	0.0576	1.37	0.172	2.72
Australia 55 - 64 yrs	0.3433	0.0644	5.33	0.000	2.62
Country*Gender					
Australia Male	0.0251	0.0185	1.36	0.174	1.05
Country*LivArr(All)					
Australia Adult no kids	-0.1024	0.0441	-2.32	0.020	2.65
Australia Adult+Preteen	-0.1628	0.0471	-3.46	0.001	2.93
Australia Adult+Teen	-0.0260	0.0542	-0.48	0.631	2.28
Australia Adult+Postteen	0.241	0.120	2.01	0.045	5.30
Country*IncomeQuintiles					
Australia Quintile 1	0.1071	0.0379	2.83	0.005	1.65
Australia Quintile 2	0.2870	0.0355	8.09	0.000	1.49
Australia Quintile 3	-0.1604	0.0366	-4.38	0.000	1.59
Australia Quintile 4	-0.0954	0.0370	-2.58	0.010	1.53
Country*TrustPropensityMean					
Australia 1	1.253	0.539	2.32	0.020	39.32
Australia 2	0.180	0.225	0.80	0.423	8.27
Australia 3	-0.102	0.121	-0.84	0.400	5.23
Australia 4	-0.215	0.102	-2.10	0.035	11.97
Australia 5	-0.267	0.102	-2.61	0.009	12.52
Australia 6	0.085	0.109	0.78	0.438	7.70

Comparisons for Trusted Total Security**Tukey Pairwise Comparisons: Country****Grouping Information Using the Tukey Method and 95% Confidence**

Country	N	Mean	Grouping
China	7195	4.21085	A
Australia	6263	3.39013	B

Means that do not share a letter are significantly different.

Tukey Simultaneous Tests for Differences of Means

Difference of Country Levels	Difference of Means	SE of Difference	Simultaneous 95% CI	T-Value	Adjusted P-Value
China - Australia	0.821	0.224	(0.382, 1.259)	3.67	0.000

Individual confidence level = 95.00%

Tukey Simultaneous 95% CIs**Tukey Pairwise Comparisons: Country*Category****Grouping Information Using the Tukey Method and 95% Confidence**

Country*Category	N	Mean	Grouping
China Olive Oil	400	4.68094	A
China Baby Formula	399	4.41413	A B
China Dairy	1600	4.37758	A B
China Grains	402	4.27135	A B C
China Wine	400	4.26365	A B C
China Fruit	799	4.15749	B C D
China Vegetables	1198	4.12068	B C D E
China Coffee Tea	802	4.07103	B C D E F
China Meat	797	3.92378	C D E F
China Chocolate	398	3.82788	C D E F G
Australia Dairy	1328	3.71817	B C
Australia Chocolate	345	3.64819	B C D E F
Australia Wine	337	3.52799	B C D E F G
Australia Olive Oil	338	3.52465	B C D E F G
Australia Coffee Tea	673	3.42375	C D E F G
Australia Fruit	865	3.31257	D E F G
Australia Vegetables	1005	3.30837	D E F G
Australia Grains	334	3.23411	E F G
Australia Meat	694	3.23212	F G
Australia Baby Formula	344	2.97143	G

Means that do not share a letter are significantly different.

Tukey Pairwise Comparisons: Country*LifeStage**Grouping Information Using the Tukey Method and 95% Confidence**

Country*LifeStage	N	Mean	Grouping
China 18 - 24 yrs	60	5.33059	A
China 25 - 34 yrs	2845	4.47083	A B
China 35 - 44 yrs	2289	4.16039	C
China 45 - 54 yrs	1403	3.99926	C D E
Australia 65+ yrs	577	3.77097	B C D
China 55 - 64 yrs	548	3.67364	D E F
China 65+ yrs	50	3.63040	B C D E F
Australia 55 - 64 yrs	1597	3.53954	C D E
Australia 25 - 34 yrs	1151	3.33967	E F
Australia 45 - 54 yrs	1555	3.33573	E F
Australia 35 - 44 yrs	1340	3.21663	F
Australia 18 - 24 yrs	43	3.13826	C D E F

Means that do not share a letter are significantly different.

Tukey Pairwise Comparisons: Country*Gender**Grouping Information Using the Tukey Method and 95% Confidence**

Country*Gender	N	Mean	Grouping
China Female	3546	4.24703	A
China Male	3649	4.17467	A
Australia Male	2786	3.40425	B
Australia Female	3477	3.37602	B

Means that do not share a letter are significantly different.

Tukey Simultaneous 95% CIs

Tukey Pairwise Comparisons: Country*LivArr(All)

Grouping Information Using the Tukey Method and 95% Confidence

Country*LivArr(All)	N	Mean	Grouping
China Adult+Preteen	3206	4.54189	A
China Adult+Teen	1353	4.32152	A B
China Adult no kids	1522	4.31739	A B
China Adult+Parent	1051	4.12998	B C
China Adult+Postteen	63	3.74347	A B C D
Australia Adult+Teen	691	3.44878	C D
Australia Adult+Parent	284	3.41050	C D
Australia Adult+Postteen	278	3.40406	C D
Australia Adult+Preteen	1302	3.39550	D
Australia Adult no kids	3708	3.29182	D

Means that do not share a letter are significantly different.

Tukey Simultaneous 95% CIs

Tukey Pairwise Comparisons: Country*IncomeQuintiles

Grouping Information Using the Tukey Method and 95% Confidence

Country*IncomeQuintiles	N	Mean	Grouping
China Quintile 3	1872	4.54185	A
China Quintile 5	1351	4.49443	A
China Quintile 4	1292	4.35418	A
China Quintile 1	1251	4.02088	B
China Quintile 2	1429	3.64292	C
Australia Quintile 1	1508	3.41435	B C
Australia Quintile 3	1042	3.40040	B C
Australia Quintile 5	920	3.39707	B C
Australia Quintile 2	1471	3.39625	B C
Australia Quintile 4	1322	3.34260	B C

Means that do not share a letter are significantly different.

Tukey Simultaneous 95% CIs

Tukey Pairwise Comparisons: Country*TrustPropensityMean

Grouping Information Using the Tukey Method and 95% Confidence

Country*TrustPropensityMean	N	Mean	Grouping
China 7	479	7.35268	A
China 6	1864	4.98112	B
China 5	2931	4.78900	B C
Australia 7	84	4.66505	B C D
China 4	1700	4.38491	D E
Australia 6	452	4.32998	C D E
China 3	196	4.01005	D E F
China 2	22	3.54787	B C D E F G H
Australia 5	1761	3.43379	F H
Australia 4	2900	3.13352	G
Australia 2	146	3.08800	G H
Australia 3	883	2.98576	G
Australia 1	37	2.09484	G
China 1	3	0.41034	E F G H

Means that do not share a letter are significantly different.

Test 2B General Linear Model testing differences within Australia, Food Categories, Demographics (LifeStage, Gender, Living Arrangements, Income Quintiles) and Trust Propensity.

General Linear Model: Trusted Total Security versus ... PropensityMean

Method

Factor coding (-1, 0, +1)

Factor Information

Factor	Type	Levels	Values
Category	Fixed	10	Wine, Coffee Tea, Chocolate, Dairy, Baby Formula, Vegetables, Fruit, Grains, Meat, Olive Oil
LifeStage	Fixed	6	18 - 24 yrs, 25 - 34 yrs, 35 - 44 yrs, 45 - 54 yrs, 55 - 64 yrs, 65+ yrs
LivArr(All)	Fixed	5	Adult no kids, Adult+Preteen, Adult+Teen, Adult+Postteen, Adult+Parent
IncomeQuintiles	Fixed	5	Quintile 1, Quintile 2, Quintile 3, Quintile 4, Quintile 5
HomeStateAUS	Fixed	8	ACT, NSW, NT, QLD, SA, TAS, VIC, WA
TrustPropensityMean	Fixed	7	1, 2, 3, 4, 5, 6, 7

Analysis of Variance

Source	DF	Adj SS	Adj MS	F-Value	P-Value
Category	9	267.3	29.704	8.50	0.000
LifeStage	5	131.0	26.194	7.50	0.000
LivArr(All)	4	20.9	5.221	1.49	0.201
IncomeQuintiles	4	3.3	0.815	0.23	0.920
HomeStateAUS	7	14.6	2.081	0.60	0.760
TrustPropensityMean	6	838.9	139.818	40.02	0.000
Error	6227	21757.8	3.494		
Lack-of-Fit	4080	14050.3	3.444	0.96	0.866
Pure Error	2147	7707.6	3.590		
Total	6262	23099.8			

Model Summary

S	R-sq	R-sq(adj)	R-sq(pred)
1.86925	5.81%	5.28%	4.69%

Coefficients

Term	Coef	SE Coef	T-Value	P-Value	VIF
Constant	3.4071	0.0942	36.17	0.000	
Category					
Wine	0.1405	0.0953	1.47	0.140	1.75
Coffee Tea	0.0337	0.0699	0.48	0.630	1.39
Chocolate	0.2535	0.0941	2.69	0.007	1.73
Dairy	0.3308	0.0540	6.13	0.000	1.26
Baby Formula	-0.4229	0.0942	-4.49	0.000	1.73
Vegetables	-0.0828	0.0593	-1.40	0.163	1.28
Fruit	-0.0764	0.0630	-1.21	0.226	1.32
Grains	-0.1527	0.0956	-1.60	0.110	1.76
Meat	-0.1561	0.0691	-2.26	0.024	1.38
LifeStage					
18 - 24 yrs	-0.268	0.243	-1.10	0.270	9.71
25 - 34 yrs	-0.0487	0.0704	-0.69	0.489	2.38
35 - 44 yrs	-0.1715	0.0698	-2.46	0.014	2.54
45 - 54 yrs	-0.0527	0.0676	-0.78	0.436	2.59
55 - 64 yrs	0.1543	0.0681	2.27	0.023	2.67
LivArr(All)					
Adult no kids	-0.1004	0.0458	-2.19	0.029	1.27

Adult+Preteen	0.0045	0.0588	0.08	0.938	1.41
Adult+Teen	0.0605	0.0692	0.87	0.382	1.30
Adult+Postteen	0.0072	0.0985	0.07	0.942	1.56
IncomeQuintiles					
Quintile 1	0.0202	0.0471	0.43	0.668	1.51
Quintile 2	0.0033	0.0451	0.07	0.942	1.36
Quintile 3	0.0125	0.0512	0.25	0.806	1.47
Quintile 4	-0.0442	0.0472	-0.94	0.349	1.41
HomeStateAUS					
ACT	0.061	0.159	0.38	0.701	5.11
NSW	-0.0189	0.0639	-0.30	0.768	2.55
NT	-0.136	0.268	-0.51	0.613	12.67
QLD	-0.0100	0.0671	-0.15	0.882	2.46
SA	-0.0799	0.0884	-0.90	0.366	2.55
TAS	0.245	0.138	1.77	0.077	4.15
VIC	-0.0220	0.0642	-0.34	0.731	2.54
TrustPropensityMean					
1	-1.287	0.267	-4.82	0.000	2.46
2	-0.302	0.145	-2.09	0.037	1.38
3	-0.4079	0.0810	-5.03	0.000	1.63
4	-0.2603	0.0670	-3.89	0.000	2.20
5	0.0405	0.0708	0.57	0.568	2.00
6	0.9383	0.0963	9.74	0.000	1.37

Comparisons for Trusted Total Security
Tukey Pairwise Comparisons: Category
Grouping Information Using the Tukey Method and 95% Confidence

Category	N	Mean	Grouping
Dairy	1328	3.73788	A
Chocolate	345	3.66061	A B
Wine	337	3.54754	A B C
Olive Oil	338	3.53951	A B C
Coffee Tea	673	3.44078	B C
Fruit	865	3.33071	B C D
Vegetables	1005	3.32428	B C D
Grains	334	3.25434	B C D
Meat	694	3.25101	C D
Baby Formula	344	2.98417	D

Means that do not share a letter are significantly different.

Tukey Pairwise Comparisons: LifeStage
Grouping Information Using the Tukey Method and 95% Confidence

LifeStage	N	Mean	Grouping
65+ yrs	577	3.79393	A
55 - 64 yrs	1597	3.56142	A B
25 - 34 yrs	1151	3.35838	B C
45 - 54 yrs	1555	3.35437	C
35 - 44 yrs	1340	3.23560	C
18 - 24 yrs	43	3.13878	A B C

Means that do not share a letter are significantly different.

Tukey Pairwise Comparisons: LivArr(All)
Grouping Information Using the Tukey Method and 95% Confidence

LivArr(All)	N	Mean	Grouping
Adult+Teen	691	3.46754	A
Adult+Parent	284	3.43529	A
Adult+Postteen	278	3.41424	A
Adult+Preteen	1302	3.41163	A
Adult no kids	3708	3.30672	A

Means that do not share a letter are significantly different.

Tukey Pairwise Comparisons: IncomeQuintiles
Grouping Information Using the Tukey Method and 95% Confidence

IncomeQuintiles	N	Mean	Grouping
Quintile 1	1508	3.42731	A
Quintile 3	1042	3.41962	A
Quintile 5	920	3.41523	A
Quintile 2	1471	3.41034	A
Quintile 4	1322	3.36290	A

Means that do not share a letter are significantly different.

Tukey Pairwise Comparisons: HomeStateAUS
Grouping Information Using the Tukey Method and 95% Confidence

HomeStateAUS	N	Mean	Grouping
TAS	160	3.65200	A
ACT	117	3.46811	A
QLD	1356	3.39710	A
NSW	1748	3.38822	A
VIC	1703	3.38505	A
WA	635	3.36747	A
SA	506	3.32718	A
NT	38	3.27154	A

Means that do not share a letter are significantly different.

Tukey Pairwise Comparisons: TrustPropensityMean
Grouping Information Using the Tukey Method and 95% Confidence

TrustPropensityMean	N	Mean	Grouping
7	84	4.68524	A
6	452	4.34533	A
5	1761	3.44758	B
4	2900	3.14681	C
2	146	3.10500	B C D
3	883	2.99917	C D
1	37	2.12044	D

Means that do not share a letter are significantly different.

Test 2B General Linear Model testing differences within China, Food Categories, Demographics (LifeStage, Gender, Living Arrangements, Income Quintiles) and Trust Propensity.

General Linear Model: Trusted Total Security versus ... PropensityMean

Method

Factor coding (-1, 0, +1)

Factor Information

Factor	Type	Levels	Values
Category	Fixed	10	Wine, Coffee Tea, Chocolate, Dairy, Baby Formula, Vegetables, Fruit, Grains, Meat, Olive Oil
LifeStage	Fixed	6	18 - 24 yrs, 25 - 34 yrs, 35 - 44 yrs, 45 - 54 yrs, 55 - 64 yrs, 65+ yrs
LivArr(All)	Fixed	5	Adult no kids, Adult+Preteen, Adult+Teen, Adult+Postteen, Adult+Parent
IncomeQuintiles	Fixed	5	1, 2, 3, 4, 5
HomeStateCN	Fixed	5	Eastern China, North-Eastern China, Northern China, South Central China, Western China
TrustPropensityMean	Fixed	7	1, 2, 3, 4, 5, 6, 7

Analysis of Variance

Source	DF	Seq SS	Contribution	Adj SS	Adj MS	F-Value	P-Value
Category	9	551.2	1.27%	303.7	33.748	6.65	0.000
LifeStage	5	926.7	2.14%	384.2	76.846	15.13	0.000
LivArr(All)	4	628.2	1.45%	145.0	36.240	7.14	0.000
IncomeQuintiles	4	1257.0	2.91%	783.4	195.859	38.57	0.000
HomeStateCN	4	256.6	0.59%	177.6	44.392	8.74	0.000
TrustPropensityMean	6	3284.1	7.59%	3284.1	547.355	107.80	0.000
Error	7162	36365.8	84.04%	36365.8	5.078		
Lack-of-Fit	3874	22235.4	51.39%	22235.4	5.740	1.34	0.000
Pure Error	3288	14130.4	32.66%	14130.4	4.298		
Total	7194	43269.6	100.00%				

Model Summary

S	R-sq	R-sq(adj)	PRESS	R-sq(pred)
2.25335	15.96%	15.58%	36711.3	15.16%

Coefficients

Term	Coef	SE Coef	95% CI	T-Value	P-Value	VIF
Constant	4.151	0.221	(3.717, 4.584)	18.78	0.000	
Category						
Wine	0.048	0.105	(-0.158, 0.255)	0.46	0.648	1.75
Coffee Tea	-0.1365	0.0774	(-0.2883, 0.0153)	-1.76	0.078	1.39
Chocolate	-0.389	0.106	(-0.596, -0.182)	-3.68	0.000	1.75
Dairy	0.1675	0.0590	(0.0518, 0.2832)	2.84	0.005	1.23
Baby Formula	0.184	0.106	(-0.023, 0.391)	1.74	0.081	1.75
Vegetables	-0.0929	0.0657	(-0.2216, 0.0358)	-1.41	0.157	1.28
Fruit	-0.0544	0.0776	(-0.2065, 0.0976)	-0.70	0.483	1.39
Grains	0.065	0.105	(-0.141, 0.270)	0.61	0.539	1.74
Meat	-0.2830	0.0776	(-0.4351, -0.1308)	-3.65	0.000	1.39
Olive Oil	0.491	0.106	(0.285, 0.698)	4.66	0.000	*
LifeStage						
18 - 24 yrs	1.136	0.251	(0.643, 1.629)	4.52	0.000	1.37

25 - 34 yrs	0.2705	0.0864	(0.1011, 0.4399)	3.13	0.002	2.66
35 - 44 yrs	-0.0474	0.0880	(-0.2200, 0.1251)	-0.54	0.590	2.51
45 - 54 yrs	-0.2248	0.0944	(-0.4100, -0.0397)	-2.38	0.017	2.11
55 - 64 yrs	-0.540	0.113	(-0.762, -0.318)	-4.77	0.000	1.42
65+ yrs	-0.594	0.274	(-1.131, -0.057)	-2.17	0.030	*
LivArr(All)						
Adult no kids	0.0998	0.0778	(-0.0527, 0.2522)	1.28	0.200	3.03
Adult+Preteen	0.3095	0.0733	(0.1659, 0.4531)	4.22	0.000	3.82
Adult+Teen	0.0942	0.0825	(-0.0676, 0.2560)	1.14	0.254	3.21
Adult+Postteen	-0.419	0.230	(-0.870, 0.032)	-1.82	0.069	10.22
Adult+Parent	-0.0844	0.0852	(-0.2514, 0.0826)	-0.99	0.322	*
IncomeQuintiles						
1	-0.1924	0.0589	(-0.3078, -0.0770)	-3.27	0.001	1.77
2	-0.5615	0.0545	(-0.6683, -0.4548)	-10.31	0.000	1.62
3	0.3309	0.0496	(0.2337, 0.4281)	6.67	0.000	1.54
4	0.1443	0.0561	(0.0344, 0.2542)	2.57	0.010	1.64
5	0.2788	0.0558	(0.1695, 0.3881)	5.00	0.000	*
HomeStateCN						
Eastern China	0.0836	0.0503	(-0.0149, 0.1822)	1.66	0.096	1.82
North-Eastern China	-0.3401	0.0803	(-0.4974, -0.1827)	-4.24	0.000	2.56
Northern China	-0.1156	0.0680	(-0.2490, 0.0178)	-1.70	0.089	2.17
South Central China	0.2121	0.0491	(0.1159, 0.3083)	4.32	0.000	1.73
Western China	0.1599	0.0562	(0.0497, 0.2701)	2.84	0.004	*
TrustPropensityMean						
1	-3.70	1.12	(-5.90, -1.51)	-3.31	0.001	111.08
2	-0.704	0.454	(-1.593, 0.185)	-1.55	0.121	19.14
3	-0.187	0.242	(-0.663, 0.288)	-0.77	0.440	7.69
4	0.169	0.206	(-0.234, 0.573)	0.82	0.412	16.46
5	0.579	0.204	(0.180, 0.979)	2.84	0.004	21.06
6	0.750	0.206	(0.346, 1.154)	3.64	0.000	17.35
7	3.098	0.221	(2.665, 3.530)	14.04	0.000	*

Regression Equation

$$\begin{aligned}
\text{Trusted Total Security} = & 4.151 + 0.048 \text{ Category\_Wine} - 0.1365 \text{ Category\_Coffee Tea} \\
& - 0.389 \text{ Category\_Chocolate} + 0.1675 \text{ Category\_Dairy} \\
& + 0.184 \text{ Category\_Baby Formula} - 0.0929 \text{ Category\_Vegetables} \\
& - 0.0544 \text{ Category\_Fruit} + 0.065 \text{ Category\_Grains} \\
& - 0.2830 \text{ Category\_Meat} + 0.491 \text{ Category\_Olive Oil} \\
& + 1.136 \text{ LifeStage\_18 - 24 yrs} + 0.2705 \text{ LifeStage\_25 - 34 yrs} \\
& - 0.0474 \text{ LifeStage\_35 - 44 yrs} - 0.2248 \text{ LifeStage\_45 - 54 yrs} \\
& - 0.540 \text{ LifeStage\_55 - 64 yrs} - 0.594 \text{ LifeStage\_65+ yrs} \\
& + 0.0998 \text{ LivArr(All)\_Adult no kids} \\
& + 0.3095 \text{ LivArr(All)\_Adult+Preteen} + 0.0942 \text{ LivArr(All)\_Adult+Teen} \\
& - 0.419 \text{ LivArr(All)\_Adult+Postteen} - 0.0844 \text{ LivArr(All)\_Adult+Parent} \\
& - 0.1924 \text{ IncomeQuintiles\_1} - 0.5615 \text{ IncomeQuintiles\_2} \\
& + 0.3309 \text{ IncomeQuintiles\_3} + 0.1443 \text{ IncomeQuintiles\_4} \\
& + 0.2788 \text{ IncomeQuintiles\_5} + 0.0836 \text{ HomeStateCN\_Eastern China} \\
& - 0.3401 \text{ HomeStateCN\_North-Eastern China} \\
& - 0.1156 \text{ HomeStateCN\_Northern China} + 0.2121 \text{ HomeStateCN\_South} \\
& \text{Central China} + 0.1599 \text{ HomeStateCN\_Western China} \\
& - 3.70 \text{ TrustPropensityMean\_1} - 0.704 \text{ TrustPropensityMean\_2} \\
& - 0.187 \text{ TrustPropensityMean\_3} + 0.169 \text{ TrustPropensityMean\_4} \\
& + 0.579 \text{ TrustPropensityMean\_5} + 0.750 \text{ TrustPropensityMean\_6} \\
& + 3.098 \text{ TrustPropensityMean\_7}
\end{aligned}$$

Means

Term	Fitted Mean	SE Mean
Category		
Wine	4.199	0.247
Coffee Tea	4.014	0.234
Chocolate	3.762	0.246
Dairy	4.318	0.227
Baby Formula	4.334	0.248
Vegetables	4.058	0.228
Fruit	4.096	0.232
Grains	4.215	0.246
Meat	3.868	0.232
Olive Oil	4.642	0.247
LifeStage		
18 - 24 yrs	5.286	0.360
25 - 34 yrs	4.421	0.214
35 - 44 yrs	4.103	0.213
45 - 54 yrs	3.926	0.215
55 - 64 yrs	3.611	0.231
65+ yrs	3.556	0.385
LivArr(All)		
Adult no kids	4.250	0.219
Adult+Preteen	4.460	0.220
Adult+Teen	4.245	0.224
Adult+Postteen	3.731	0.355
Adult+Parent	4.066	0.224
IncomeQuintiles		
1	3.958	0.227
2	3.589	0.227
3	4.481	0.225
4	4.295	0.229
5	4.429	0.229
HomeStateCN		
Eastern China	4.234	0.224
North-Eastern China	3.810	0.238
Northern China	4.035	0.233
South Central China	4.363	0.226
Western China	4.310	0.227
TrustPropensityMean		
1	0.45	1.31
2	3.447	0.490
3	3.963	0.185
4	4.320	0.107
5	4.730	0.100
6	4.900	0.107
7	7.248	0.143

Comparisons for Trusted Total Security
Tukey Pairwise Comparisons: Category
Grouping Information Using the Tukey Method and 95% Confidence

Category	N	Mean	Grouping
Olive Oil	400	4.64194	A
Baby Formula	399	4.33449	A B
Dairy	1600	4.31804	A B
Grains	402	4.21505	A B C

Wine	400	4.19869	A	B	C
Fruit	799	4.09610		B	C
Vegetables	1198	4.05764		B	C
Coffee Tea	802	4.01403		B	C
Meat	797	3.86759			C
Chocolate	398	3.76185			C

Means that do not share a letter are significantly different.

Tukey Pairwise Comparisons: LifeStage
Grouping Information Using the Tukey Method and 95% Confidence

LifeStage	N	Mean	Grouping
18 - 24 yrs	60	5.28635	A
25 - 34 yrs	2845	4.42102	B
35 - 44 yrs	2289	4.10309	C
45 - 54 yrs	1403	3.92569	C D
55 - 64 yrs	548	3.61060	D
65+ yrs	50	3.55650	B C D

Means that do not share a letter are significantly different.

Tukey Pairwise Comparisons: LivArr(All)
Grouping Information Using the Tukey Method and 95% Confidence

LivArr(All)	N	Mean	Grouping
Adult+Preteen	3206	4.46003	A
Adult no kids	1522	4.25029	A B
Adult+Teen	1353	4.24475	A B
Adult+Parent	1051	4.06616	B
Adult+Postteen	63	3.73147	A B

Means that do not share a letter are significantly different.

Tukey Pairwise Comparisons: IncomeQuintiles
Grouping Information Using the Tukey Method and 95% Confidence

IncomeQuintiles	N	Mean	Grouping
3	1872	4.48142	A
5	1351	4.42933	A
4	1292	4.29481	A
1	1251	3.95816	B
2	1429	3.58899	C

Means that do not share a letter are significantly different.

Tukey Pairwise Comparisons: HomeStateCN
Grouping Information Using the Tukey Method and 95% Confidence

HomeStateCN	N	Mean	Grouping
South Central China	2080	4.36265	A
Western China	1592	4.31041	A
Eastern China	2087	4.23419	A B
Northern China	865	4.03497	B C
North-Eastern China	571	3.81049	C

Means that do not share a letter are significantly different.

Tukey Pairwise Comparisons: TrustPropensityMean
Grouping Information Using the Tukey Method and 95% Confidence

TrustPropensityMean	N	Mean	Grouping
7	479	7.24835	A
6	1864	4.90032	B
5	2931	4.72980	B C
4	1700	4.31961	D
3	196	3.96332	D E
2	22	3.44658	C D E
1	3	0.44581	E

Means that do not share a letter are significantly different.

Test 3 Binary Logistic Regression testing differences between the 2 Populations individual Trusted Security Elements.

Binary Logistic Regression: Recoded Ausmade_P versus Country

Method

Link function	Logit
Categorical predictor coding	(1, 0)
Rows used	13458

Response Information

Variable	Value	Count
Recoded Ausmade_P	Yes	10286 (Event)
	No	3172
	Total	13458

Deviance Table

Source	DF	Adj Dev	Adj Mean	Chi-Square	P-Value
Regression	1	1470	1469.93	1469.93	0.000
Country	1	1470	1469.93	1469.93	0.000
Error	13456	13228	0.98		
Total	13457	14698			

Model Summary

Deviance	Deviance	
R-Sq	R-Sq(adj)	AIC
10.00%	9.99%	13232.04

Coefficients

Term	Coef	SE Coef	VIF
Constant	2.3052	0.0440	
Country			
China	-1.7382	0.0504	1.00

Odds Ratios for Categorical Predictors

Level A	Level B	Odds Ratio	95% CI
Country			
China	Australia	0.1758	(0.1593, 0.1941)

Odds ratio for level A relative to level B

Regression Equation

$$P(\text{Yes}) = \exp(Y') / (1 + \exp(Y'))$$

$$Y' = 2.3052 + 0.0 \text{ Country\_Australia} - 1.7382 \text{ Country\_China}$$

Goodness-of-Fit Tests

Test	DF	Chi-Square	P-Value
Deviance	13456	13228.04	0.918
Pearson	13456	13458.00	0.494
Hosmer-Lemeshow	0	0.00	*

Binary Logistic Regression: Recoded Currency_P versus Country

Method

Link function	Logit
Categorical predictor coding	(1, 0)
Rows used	13458

Response Information

Variable	Value	Count
Recoded Currency_P	Yes	4025 (Event)
	No	9433
	Total	13458

Deviance Table

Source	DF	Adj Dev	Adj Mean	Chi-Square	P-Value
Regression	1	1489	1489.09	1489.09	0.000
Country	1	1489	1489.09	1489.09	0.000
Error	13456	14932	1.11		
Total	13457	16421			

Model Summary

Deviance	Deviance	
R-Sq	R-Sq(adj)	AIC
9.07%	9.06%	14935.86

Coefficients

Term	Coef	SE Coef	VIF
Constant	-1.8164	0.0364	
Country			
China	1.5657	0.0435	1.00

Odds Ratios for Categorical Predictors

Level A	Level B	Odds Ratio	95% CI
Country			
China	Australia	4.7862	(4.3951, 5.2121)

Odds ratio for level A relative to level B

Regression Equation

$$P(\text{Yes}) = \exp(Y') / (1 + \exp(Y'))$$

$$Y' = -1.8164 + 0.0 \text{ Country\_Australia} + 1.5657 \text{ Country\_China}$$

Goodness-of-Fit Tests

Test	DF	Chi-Square	P-Value
Deviance	13456	14931.86	0.000
Pearson	13456	13458.00	0.494
Hosmer-Lemeshow	0	0.00	*

Binary Logistic Regression: Recoded Packaging_P versus Country**Method**

Link function	Logit
Categorical predictor coding	(1, 0)
Rows used	13458

Response Information

Variable	Value	Count
Recoded Packaging_P	Yes	4535 (Event)
	No	8923
	Total	13458

Deviance Table

Source	DF	Adj Dev	Adj Mean	Chi-Square	P-Value
Regression	1	559.6	559.636	559.64	0.000
Country	1	559.6	559.636	559.64	0.000
Error	13456	16639.9	1.237		
Total	13457	17199.5			

Model Summary

Deviance	Deviance	
R-Sq	R-Sq(adj)	AIC
3.25%	3.25%	16643.91

Coefficients

Term	Coef	SE Coef	VIF
Constant	-1.1828	0.0298	
Country			
China	0.8851	0.0382	1.00

Odds Ratios for Categorical Predictors

Level A	Level B	Odds Ratio	95% CI
Country			
China	Australia	2.4233	(2.2486, 2.6116)

Odds ratio for level A relative to level B

Regression Equation

$$P(\text{Yes}) = \exp(Y') / (1 + \exp(Y'))$$

$$Y' = -1.1828 + 0.0 \text{ Country\_Australia} + 0.8851 \text{ Country\_China}$$

Goodness-of-Fit Tests

Test	DF	Chi-Square	P-Value
Deviance	13456	16639.91	0.000
Pearson	13456	13458.00	0.494
Hosmer-Lemeshow	0	0.00	*

Binary Logistic Regression: Recoded Scan_P versus Country

Method

Link function	Logit
Categorical predictor coding	(1, 0)
Rows used	13458

Response Information

Variable	Value	Count
Recoded Scan_P	Yes	4426 (Event)
	No	9032
	Total	13458

Deviance Table

Source	DF	Adj Dev	Adj Mean	Chi-Square	P-Value
Regression	1	2418	2418.48	2418.48	0.000
Country	1	2418	2418.48	2418.48	0.000
Error	13456	14630	1.09		
Total	13457	17048			

Model Summary

Deviance	Deviance	
R-Sq	R-Sq(adj)	AIC
14.19%	14.18%	14633.56

Coefficients

Term	Coef	SE Coef	VIF
Constant	-1.9693	0.0385	
Country			
China	2.0035	0.0452	1.00

Odds Ratios for Categorical Predictors

Level A	Level B	Odds Ratio	95% CI
Country			
China	Australia	7.4148	(6.7864, 8.1015)

Odds ratio for level A relative to level B

Regression Equation

$$P(\text{Yes}) = \exp(Y') / (1 + \exp(Y'))$$

$$Y' = -1.9693 + 0.0 \text{ Country\_Australia} + 2.0035 \text{ Country\_China}$$

Goodness-of-Fit Tests

Test	DF	Chi-Square	P-Value
Deviance	13456	14629.56	0.000
Pearson	13456	13458.00	0.494
Hosmer-Lemeshow	0	0.00	*

Binary Logistic Regression: Recoded Design_P versus Country**Method**

Link function	Logit
Categorical predictor coding	(1, 0)
Rows used	13458

Response Information

Variable	Value	Count
Recoded Design_P	Yes	5147 (Event)
	No	8311
	Total	13458

Deviance Table

Source	DF	Adj Dev	Adj Mean	Chi-Square	P-Value
Regression	1	1566	1565.93	1565.93	0.000
Country	1	1566	1565.93	1565.93	0.000
Error	13456	16340	1.21		
Total	13457	17906			

Model Summary

Deviance	Deviance	
R-Sq	R-Sq(adj)	AIC
8.75%	8.74%	16343.95

Coefficients

Term	Coef	SE Coef	VIF
Constant	-1.3387	0.0311	
Country			
China	1.4770	0.0391	1.00

Odds Ratios for Categorical Predictors

Level A	Level B	Odds Ratio	95% CI
Country			
China	Australia	4.3800	(4.0569, 4.7288)

Odds ratio for level A relative to level B

Regression Equation

$$P(\text{Yes}) = \exp(Y') / (1 + \exp(Y'))$$

$$Y' = -1.3387 + 0.0 \text{ Country\_Australia} + 1.4770 \text{ Country\_China}$$

Goodness-of-Fit Tests

Test	DF	Chi-Square	P-Value
Deviance	13456	16339.95	0.000
Pearson	13456	13458.00	0.494
Hosmer-Lemeshow	0	0.00	*

