Copyright is owned by the Author of the thesis. Permission is given for a copy to be downloaded by an individual for the purpose of research and private study only. The thesis may not be reproduced elsewhere without the permission of the Author.
TECHNICAL INFORMATION CAPTURE FOR FOOD PRODUCT INNOVATION IN THAILAND

A thesis presented in partial fulfilment of the requirements for the degree of

Doctor of Philosophy in Food Technology

at Massey University, Palmerston North, New Zealand

PRASONG SIRIWONGWILAICHAT

2001
Errata

- Page 15, paragraph 2, sentence 5: Statement "...makes technology applied more sophisticated." should read "...makes the applied technology more sophisticated."

- Page 108, paragraph 1, sentence 2: The phrase "contract manufactures" should read "contract manufacturers".

- Page 138, line 4: The word "descendent" should read "descending".

- Page 152, paragraph 1, line 6: The word "important" should read "importance".
ABSTRACT

Since rapidly effective product design and launch requires advanced technical skills and as new knowledge is expanding at an exponential rate, it is critical that food technologists keep up to date with international scientific developments. This is significant in Thailand in which the food market has been developed as a result of greater industrialisation, changes in consumer lifestyle and higher demand for processed foods. This study has identified the main technical knowledge sources used by Thai food manufacturing companies to support their development of new branded food products. Data were obtained from interviews with sixty two food processing companies, forty three potential providers of technical information and services, and from three focus groups held with technical food product developers. Internal technical staff in the food manufacturing companies were the major source of technical knowledge for food product development. Food ingredient suppliers were the most important outside providers of knowledge to these technical staff. The main technical information and services provided by the food ingredient suppliers included ingredient specifications, food recipes, consultancy, and product testing. Technical information was mostly required to support product formulations, food processing, shelf life studies, and quality control. New products that were radically innovative required more external technical knowledge sources, usually equipment suppliers, than those that were incrementally innovative.

The main barriers to technical knowledge absorption were foreign language difficulties, time limitation and business secrecy. To strengthen food product development activities in Thailand, it is recommended that a company enhance internal technical staff’s capabilities to absorb external technical knowledge more efficiently. In addition, the technical knowledge providers should also simplify technical information access to the food companies.
ACKNOWLEDGEMENTS

This thesis could not be achieved without financial support from the Royal Thai Government scholarship and cooperation from many people and organisations. The author would like to pay special gratitude to the following persons and organisations for their cooperation and contribution to his thesis production.

Prof. Ray J. Winger for his gratefully patient supervising throughout this research project;

Prof. Ken J. Kirkpatrick for his kind support and valuable comments;

Assoc. Prof. Vichai Haruthaithanasan for his suggestions and for facilitating industrial contacts in Thailand;

Prof. Mary D. Earle for her consistent support and suggestions on relevant literature from beginning to the end of the project;

Dr. Prisana Suwannaporn for her copy of Ph.D. thesis and suggested literature;

Staff from the Department of Food Technology, Silpakorn University, Thailand for their impressive assistance during data investigation in Thailand;

Mr. Thawat Theerawat from the Royal Thai Embassy in Wellington for the Thai food companies information;

Participating food companies in Thailand who took part in the surveys and the focus groups;

Assistant Prof. Hathairat Rimkiree and Dr. Thongchai Suwannsichon from the Department of Product Development, Kasetsart University; Mr. Thirawuth Pongprayoon from the Department of Chemical Engineering, KMITNB; Mr. Chaiyong Taechapairoj, and; Ms. Busarakorn Mahayothee from the Faculty of Industrial Technology, Silpakorn University for their assistance during focus groups in Bangkok.
Mr. Boonyarit Vichienpanthu for his help with transportation during interviews;

Mr. Wiwat Wangchareon, Ms. Wararat Ittiwibool, Mr. Wanchat Suwannakit, and Ms. Wanwadee Wongmongkol for their assistance in information search in Thailand;

Atawhai village friends for their companionship, joy and fun;

Finally, this thesis is profoundly dedicated to Siriwongwilaichat family for their moral support.
# TABLE OF CONTENTS

**ABSTRACT** .................................................................................................................. i

**ACKNOWLEDGEMENTS** ................................................................................................. ii

**TABLE OF CONTENTS** ................................................................................................... iv

**LIST OF FIGURES** ......................................................................................................... viii

**LIST OF TABLES** ............................................................................................................ ix

1  **KNOWLEDGE CREATION IN PRODUCT DEVELOPMENT** ................................. 1
   1.1  **INTRODUCTION** ................................................................................................. 1
   1.2  **DEFINITIONS OF “NEW” PRODUCTS** ................................................................. 1
   1.3  **PRODUCT INNOVATION MODELS** ................................................................. 4
   1.4  **TRANSITION IN THE PRODUCT DEVELOPMENT PROCESS** ......................... 6
   1.5  **THE RISK OF NEW PRODUCT DEVELOPMENT** ........................................... 7
   1.6  **THE ENVIRONMENT OF PRODUCT INNOVATION** ........................................ 9
   1.7  **KNOWLEDGE CREATION** ................................................................................ 11
   1.8  **CONCLUSION** .................................................................................................. 14

2  **INFORMATION CAPTURE FOR PRODUCT DEVELOPMENT** .................................. 15
   2.1  **INTRODUCTION** ................................................................................................ 15
   2.2  **CHARACTERISTICS OF FOOD PRODUCT DEVELOPMENT** ............................ 16
      2.2.1  Degree of product newness .............................................................................. 16
      2.2.2  Consumers ........................................................................................................ 16
      2.2.3  Market structure ............................................................................................... 17
      2.2.4  Technology and product development activities ............................................. 17
      2.2.5  Research and development (R&D) strategies .................................................. 18
      2.2.6  Product characteristics ................................................................................... 20
   2.3  **NPD PARADIGM IN DIFFERENT COUNTRIES** .................................................. 20
   2.4  **NPD OF MULTINATIONAL FOOD COMPANIES** ............................................ 21
   2.5  **COMPANY ACQUISITIONS** .............................................................................. 26
   2.6  **SOURCES OF TECHNICAL INNOVATION** ....................................................... 27
      2.6.1  Sources of new product ideas ........................................................................... 27
      2.6.2  Technological knowledge sources .................................................................. 28
      2.6.2.1  Role of suppliers to the food industry .......................................................... 31
      2.6.2.2  Academic and research institutes ................................................................. 33
      2.6.2.3  Consultants .................................................................................................. 35
      2.6.2.4  Food conferences, exhibitions and trade shows .......................................... 35
      2.6.2.5  Libraries ....................................................................................................... 35
   2.7  **FACTORS DETERMINING TECHNICAL INFORMATION SOURCES** ............ 36
      2.7.1  The pace of technology development .............................................................. 36
      2.7.2  The size of the company .................................................................................. 36
      2.7.3  The degree of familiarity with a problem ........................................................ 37
      2.7.4  Characteristics of information sources ............................................................ 37
      2.7.5  Innovation orientations ..................................................................................... 38
      2.7.6  Innovation strategies ....................................................................................... 39
   2.8  **BARRIERS TO TECHNICAL INFORMATION ACQUISITION** ............................ 40
6 TECHNICAL KNOWLEDGE SOURCES ........................................... 112
   6.1 INTRODUCTION .................................................................. 112
   6.2 TECHNICAL INFORMATION FOR NEW FOOD PRODUCTS .......... 112
       6.2.1 Technical information used for new food products .......... 112
       6.2.2 Sources of technical knowledge for product development .... 113
           6.2.2.1 The main technical sources ................................ 116
           6.2.2.2 Suppliers and other external sources ................. 119
       6.2.3 Advantages and disadvantages of technical knowledge sources 120
       6.2.4 Degree of product newness and technical knowledge sources 123
   6.3 CONCLUSION .................................................................. 129

7 TECHNICAL KNOWLEDGE PROVIDERS ......................................... 130
   7.1 INTRODUCTION .................................................................. 130
   7.2 TECHNICAL KNOWLEDGE PROVIDERS AND THEIR ACTIVITIES .... 130
   7.3 TYPES OF TECHNICAL INFORMATION PROVIDED TO THE FOOD MANUFACTURING AND PROCESSING INDUSTRY ............... 133
   7.4 TYPES OF TECHNICAL SERVICE PROVIDED TO THE FOOD MANUFACTURING AND PROCESSING INDUSTRY ............... 135
   7.5 CONTACT NETWORKS IN THE FOOD INDUSTRY .................... 137
   7.6 SOURCES OF TECHNICAL INFORMATION FOR TECHNICAL KNOWLEDGE PROVIDERS ....................................... 138
   7.7 CONCLUSION .................................................................. 140

8 TECHNICAL PRODUCT DEVELOPMENT STAFF .............................. 141
   8.1 INTRODUCTION .................................................................. 141
   8.2 FOCUS GROUPS .................................................................. 141
   8.3 FOCUS GROUP PERSPECTIVES OF RESULTS FROM INDUSTRY QUESTIONNAIRE .............................................. 142
   8.4 ROLE OF FOOD INGREDIENT SUPPLIERS ............................. 142
   8.5 UPDATED TECHNICAL INFORMATION FOR TECHNICAL STAFF ........................................................................ 143
   8.6 LIMITATION OF TECHNICAL INFORMATION AND SERVICES ...... 143
   8.7 PRODUCT DEVELOPMENT PROCESS AND RELEVANCE OF TECHNICAL INFORMATION ........................................... 143
   8.8 CONCLUSION .................................................................. 146

9 CONCLUSION AND DISCUSSION .................................................. 147
   9.1 INTRODUCTION .................................................................. 147
   9.2 NEW FOOD PRODUCTS INTRODUCTION IN THAILAND ............ 147
   9.3 SOURCES OF NEW PRODUCTS ............................................. 148
   9.4 SOURCES OF NEW PRODUCT IDEAS ...................................... 148
   9.5 MAIN TECHNICAL KNOWLEDGE SOURCES FOR FOOD PRODUCT DEVELOPMENT IN THE THAI FOOD INDUSTRY ........ 148
   9.6 FACTORS DETERMINING TECHNICAL INFORMATION SOURCES 149
   9.7 BARRIERS TO TECHNICAL INFORMATION ACQUISITION .......... 150
   9.8 INTERNATIONAL COMPANIES AS OPPOSED TO LOCAL THAI OWNED COMPANIES .............................................. 150
   9.9 INTER-INDUSTRY COMPARISON ........................................... 151
   9.10 INTER-COUNTRY COMPARISON ........................................... 152
   9.11 LIMITATIONS OF THE RESEARCH ....................................... 153
   9.12 IMPLICATIONS AND RECOMMENDATIONS ............................ 153
REFERENCES .......................................................... 156

APPENDIX 1 A LETTER OF INVITATION FOR SURVEY 1 ......................... 183
APPENDIX 2 QUESTIONNAIRE FOR SURVEY 1 .................................. 185
APPENDIX 3 A LETTER OF INVITATION FOR SURVEY 2 ...................... 188
APPENDIX 4 SUMMARY OF QUESTIONNAIRE FROM SURVEY 1 FOR PARTICIPATING FOOD COMPANIES .................................................. 189
APPENDIX 5 QUESTIONNAIRE FOR SURVEY 2 .................................. 190
APPENDIX 6 TELEPHONE CONTACT GUIDE FOR SCREENING TECHNICAL KNOWLEDGE PROVIDERS (SURVEY 3) .......................... 219
APPENDIX 7 A LETTER OF INVITATION FOR TECHNICAL KNOWLEDGE PROVIDERS (SURVEY 3) .................................................. 220
APPENDIX 8 QUESTIONNAIRE FOR TECHNICAL KNOWLEDGE PROVIDERS .......................................................... 221
APPENDIX 9 TELEPHONE CONTACT GUIDE FOR FOCUS GROUP .......... 228
APPENDIX 10 SUMMARY OF SURVEY 2 FOR PARTICIPATING COMPANIES .......................................................... 229
APPENDIX 11 PRODUCT DEVELOPMENT TECHNICAL STAFF FOCUS GROUP .......................................................... 231
APPENDIX 12 COMPANY OWNERSHIP AND USE OF TECHNICAL KNOWLEDGE SOURCES (ONLY FOR OWN MANUFACTURED PRODUCTS) .......................................................... 233
APPENDIX 13 ADVANTAGES AND DISADVANTAGES OF TECHNICAL KNOWLEDGE SOURCES .......................................................... 238
APPENDIX 14 ASSOCIATION BETWEEN COMPANY OWNERSHIP AND MOST IMPORTANT TECHNICAL KNOWLEDGE SOURCES WITHIN EACH NEW PRODUCT TYPE (ONLY FOR OWN MANUFACTURED PRODUCTS) .......................................................... 242
APPENDIX 15 ASSOCIATION BETWEEN NEW PRODUCT TYPES AND MOST IMPORTANT TECHNICAL KNOWLEDGE SOURCES WITHIN EACH NEW PRODUCT TYPE (ONLY FOR OWN MANUFACTURED PRODUCTS) .......................................................... 244
APPENDIX 16 FOCUS GROUP DISCUSSION ........................................... 246
LIST OF FIGURES

Figure 1.1 Stages and activities in product development process ........................................... 5
Figure 1.2 The coupling model of innovation .............................................................................. 7
Figure 1.3 Total technology and product development ................................................................. 10
Figure 1.4 Knowledge in the product development team ............................................................... 13

Figure 2.1 Model of sources of a firm’s technical knowledge ....................................................... 31
Figure 2.2 A two-dimensional representation of information sources ......................................... 38

Figure 3.1 Flow chart for agro-industry ......................................................................................... 44
Figure 3.2 Thailand’s urban and rural population ......................................................................... 53
Figure 3.3 Population age structure of Thailand .......................................................................... 54
Figure 3.4 Workforce in agricultural sector .................................................................................. 55
Figure 3.5 Household monthly expenditure in Thailand ................................................................. 58
Figure 3.6 Proportion of monthly household expenditure on food in Thailand .............................. 58
Figure 3.7 Gross Domestic Product per capita of some ASEAN countries .................................. 59
Figure 3.8 Accumulated number of food products registered in Thailand ................................. 63
Figure 3.9 Growth in market value of food products in Thailand ................................................ 63
Figure 3.10 The growth of dairy products registered in Thailand .................................................. 65
Figure 3.11 The growth of supermarkets in Thailand ................................................................. 76

Figure 8.1 Relevance of technical information to food product development process in Thailand ......................................................................................................................... 145
LIST OF TABLES

Table 1.1 Categories of new products .................................................................................2

Table 3.1 The impact of manufacturing on Thailand’s GDP .................................................45
Table 3.2 Production and export of selected foods in Asia in 1998 ..........................46
Table 3.3 Production of some food commodities in Thailand ............................................47
Table 3.4 Characteristics of manufacturing establishments in Thailand in 1996 ...........48
Table 3.5 Distribution of registered Thai food processing plants from 1990-1999 ......49
Table 3.6 Value of major imported food products to Thailand in 1998 .........................50
Table 3.7 Imports of dairy products to Thailand in 1998 ..................................................51
Table 3.8 Female labour force participation in Thailand ....................................................55
Table 3.9 Educational qualifications of employed population in Thailand ..................56
Table 3.10 Sales of newspapers and magazines in Thailand .............................................57
Table 3.11 Export: Import value ratio of main commodities of Thailand .........................60
Table 3.12 Sales of processed food products in Thailand: 2000 .........................................61
Table 3.13 Contribution of some food products to Thai diet .............................................61
Table 3.14 Governmental budget for promoting milk consumption at school ..................64
Table 3.15 Growth in market value of dairy products .........................................................65
Table 3.16 Growth in sales volume of dairy products .........................................................66
Table 3.17 Growth in market value of canned foods .........................................................67
Table 3.18 Growth in sales volume of canned foods .........................................................67
Table 3.19 Growth in market value of non-alcoholic beverages ........................................68
Table 3.20 Growth in sales volume of non-alcoholic beverages ........................................68
Table 3.21 Growth in market value of alcoholic beverages ...............................................69
Table 3.22 Growth in sales volume of alcoholic beverages ...............................................69
Table 3.23 Growth in market value and sales volume of bottled water ............................70
Table 3.24 Growth in market value of instant noodles and breakfast cereals ................70
Table 3.25 Growth in sales volume of instant noodles and breakfast cereals ................71
Table 3.26 Growth in market value of snack foods ...........................................................71
Table 3.27 Growth in sales volume of snack foods ...........................................................72
Table 3.28 Growth in market value of spreads and jams .....................................................72
Table 3.29 Growth in sales volume of spreads and jams .....................................................72
Table 3.30 Growth in market value of confectionery products .........................................73
Table 3.31 Growth in sales volume of confectionery products .........................................73
Table 3.32 Health food consumers in Thailand .................................................................74
Table 3.33 Market value of health foods in Thailand ........................................................74
Table 3.34 Growth in market value of chicken extract soup .............................................75

Table 4.1 Research designs and methods in organisational research ................................83
Table 4.2 Research approaches in innovation and information acquisition studies ..........85
Table 4.3 Comparisons between two survey methods .......................................................86

Table 5.1 Summary of number of food companies in Thailand and those that participated in the research .................................................................98
Table 5.2 Company ownership distribution for the main survey ....................................99
Table 5.3 Annual turnover of participating companies ....................................................100
Table 5.4 Number of employees in participating companies ..........................................100
Table 5.5 Distribution of number of employees across annual turnover of participating companies ................................................................. 101
Table 5.6 The length of time participating companies had been in business .......................................................... 101
Table 5.7 Age of respondents in Survey 2 ................................................................. 102
Table 5.8 Educational background of respondents in Survey 2 ................................................................. 102
Table 5.9 Educational background of respondents in Survey 2 ................................................................. 103
Table 5.10 Respondents’ working period in the current company ................................................................. 103
Table 5.11 Position of respondents in the company ................................................................. 104
Table 5.12 Number of food product categories sold by participating companies ................................................................. 105
Table 5.13 Categories of branded consumer food products sold by participating companies ................................................................. 105
Table 5.14 New branded consumer food product categories in the study ................................................................. 107
Table 5.15 Types of new food products identified in Survey 2 ................................................................. 107
Table 5.16 New product sources versus new product types ................................................................. 108
Table 5.17 Sources of new product ideas ................................................................. 109
Table 5.18 Company ownership versus new product type ................................................................. 110

Table 6.1 Uses of technical information in Thai food companies ................................................................. 113
Table 6.2 Technical knowledge sources for new food product introduction ................................................................. 114
Table 6.3 Technical knowledge sources versus company ownership ................................................................. 115
Table 6.4 Number of product development technical staff of food manufacturing companies ................................................................. 116
Table 6.5 Expectations of food companies from seminars ................................................................. 117
Table 6.6 Training sources for technical staff ................................................................. 118
Table 6.7 Product development marketing staff of food manufacturing companies ................................................................. 118
Table 6.8 Product development sales staff of food manufacturing companies ................................................................. 119
Table 6.9 Types of food ingredient suppliers providing technical information ................................................................. 120
Table 6.10 Advantages and disadvantages of main technical knowledge sources ................................................................. 122
Table 6.11 The most important technical knowledge sources for the Thai food industry ................................................................. 124
Table 6.12 The most important technical knowledge sources for each type of new product introduction ................................................................. 126
Table 6.13 Combined new product types versus technical knowledge sources ................................................................. 127
Table 6.14 Technical knowledge sources for different levels of product newness ................................................................. 128

Table 7.1 Activities performed for the Thai food industry by technical knowledge providers ................................................................. 131
Table 7.2 Food ingredient suppliers participating the survey ................................................................. 132
Table 7.3 Technical information types provided by technical knowledge providers and requested by food industry in Thailand ................................................................. 134
Table 7.4 Types technical service provided by technical knowledge providers and requested by food industry in Thailand ................................................................. 136
Table 7.5 Frequently contacted persons in food companies ................................................................. 138
Table 7.6 Sources of technical information used by technical knowledge providers ................................................................. 139

Table 8.1 Focus group components ........................................................................................................ 141