THE KEY CONSIDERATIONS TO ACHIEVE DESIGN EFFICIENCY FOR FUNCTIONAL USE OF DOMESTIC EARTHENWARE IN SRI LANKA

W.M.N.D Ranasinghe

09/8054

Degree of Master of Philosophy

Department of Integrated Design

University of Moratuwa

Sri Lanka

September 2012

THE KEY CONSIDERATIONS TO ACHIEVE DESIGN EFFICIENCY FOR FUNCTIONAL USE OF DOMESTIC EARTHENWARE IN SRI LANKA

Wasala Mudiyanselage Niwanthika Dilshani Ranasinghe

09/8054

Thesis submitted in partial fulfillment of the requirements for the degree Master of Philosophy

Degree of Master of Philosophy

Department of Integrated Design

University of Moratuwa

Sri Lanka

September 2012

Declaration

I declare that this is my own work and this thesis does not incorporate without acknowledgement any material previously submitted for a Degree or Diploma in any other University or institute of higher learning and to the best of my knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text.

Also, I hereby grant to University of Moratuwa the non-exclusive right to reproduce and distribute my thesis, in whole or in part in print, electronic or other medium. I retain the right to use this content in whole or part in future works (such as articles or books).

Signature: Date:

The above candidate has carried out research for the MPhil Dissertation under my supervision.

Signature of the supervisor: Date:

Acknowledgements

I feel it is my bounden duty to express my deep appreciation and gratitude to my supervisor, Senior Prof. Nimal de Silva for the valuable guidance and encouragement given to me at all stages of this research. I owe special thanks to my co-supervisor Prof. Harsha Munasinghe, Faculty of Architecture, for his valuable contributions which enabled me to carry out this study successfully.

I would like to take this opportunity to thank, Dr. Sepani Senarathne, Director of postgraduate, Faculty of Architecture, Dr. Upendra Rajapaksha, senior lecturer, Dept. of Architecture and Mrs. Sunethra Weerasinghe, University of Moratuwa for the cooperation and assistance extended to me to make this project a success. My sincere thanks are also due to Mr. AMS Attanayake Administrative & Technical coordinator, Faculty of Architecture, University of Moatuwa.

I am indeed grateful to people in kandy and Colombo for providing all the valuable data for my research. This research would never have been possible, without their support. I owe my thanks to the rural pottery manufacturers and their families too for their kind gesture.

My heartfelt thanks go to my beloved amma, appachchi & sister for their moral support and encouragement. Last but not least, I should thank my husband and son who have been the enduring sources of inspiration throughout this study.

Finally I would like to thank all those who helped me in numerous ways to make this project a success.

Abstract

Sri Lanka is famous for 'Clay Cooking Pots' from the historical days. Earthenware clay cooking pots have been used in each and every household as the main cooking utensil. However with the time these clay products became less popular. It has been found that they have not paid proper attention and concern during the process of manufacturing. This has resulted low quality clay products which make people dissatisfied of them. Therefore, it is obvious that clay cooking pots should be given due recognition, as they possess many good qualities which are unique to them only.

This study on 'Clay Cooking Products' reveals that these clay cooking utensils do not cater to the needs of present society, due to less design qualities. Although there are cooking utensils made out of other materials, they do not possess the qualities which belong only to the clay products. However it has been identified that people live in the present society are willing to use clay cooking pots, if they are up to standard with good design qualities which fulfill their needs.

Design Elements and Design Principles are very important factors which play a vital role in producing clay products. Other important factors that have to be considered are Shape, Form, Texture, Value and Balance of the products. Design elements and design principles are very important as they contribute a lot to produce a good designer product. Questionnaire survey was carried out with a view to finding out the effectiveness of those factors on present clay cooking pots. Main attempt was to collect information regarding the orifice, belly and base of the specific product which has been used in the study. The earthenware cooking pot *"Hattiya"* and the lid was used as sample objects in this study. Questionnaire survey was carried out in selected urban areas in the country (Kandy & Colombo). The data was studied and analyzed through the Chi-Square testing method in order to find out the most important factor.

According to the analysis of data, and other investigations it has now been found out that the specific clay cooking pot *("Hattiya")* which is in use presently has to be developed paying attention to the design development of the product. Through the data analysis it was proved that factors such as Shape, Form, Texture, Balance and Value are key considerations of making *"Hattiya"*. These factors are important to achieve design efficiency when product is functionally used. Those factors have to be considered according to the mentioned order and they are important to the other clay cooking pots as well, in the process of manufacturing them.

Keywords : Functional, Efficiency, Design Element, Design Principles

Table of Contents

Page

Declaration of the Candidate & Supervisor …….. I

Acknowledgements ……. II

Abstract ……. III

Table of Content ……... IV

List of Figures ……... XI

List of Tables ……. XVIII

List of Annexure …….. XX

List of Abbreviations …… XXI

Chapter One

IMPORTANCE OF CERAMIC PRODUCTS

0.1 Introduction …… 01

1.1 Identify ceramic as a valuable invention ……... 01

1.2 Problem Identification ……... 05

1.3 Problem Identification by Questionnaire Survey ……. 07

1.4 Importance of the study …….. 09

1.5 Limitations ……... 09

1.6 Methodology ……... 10

1.7 Summary …… 11

Chapter Two

DESIGN EFFICIENCY AND FUNCTIONAL USE OF CERAMIC PRODUCTS

0.2 Introduction ……. 12

2.1 Identify Designs, Design Efficiency and Product Functionality of Clay Vessels ……. 12

2.1.1 What is Design? …….. 13

2.1.2 Identification of Design Efficiency ……. 15

2.1.3 Identification of Product Functionality ……... 17

2.2 Product and Product Experience ……..... 18

2.3 Physical and Psychological Comfort of Design …….. 22

2.3.1 What is Physical Comfort? …….. 22

2.3.2 What is Psychological Comfort? ……. 23

2.3.3 The Effect of Physical and Psychological Comfort for Ceramic Design ……. 24

2.4 Principles and Elements of Design …….. 29

2.5 Classification of Design Principles and Elements …… 29

2.6 Use of Design Principles and Elements in Ceramic Design …… 31

2.6.1 Design Principles in Earthenware Ceramic Products ……..... 32

2.6.1.1 The Role of the Proportion of Earthenware Products….. 32

2.6.1.2 The Role of the Balance of Earthenware Products …….. 34

2.6.2 Design Elements in Earthenware Ceramic Products .,……. 36

2.6.2.1 The Role of the Shape of Earthenware Product ……....36

2.6.2.2 The Role of the Form of Earthenware Products ……... 40

2.6.2.3 The Role of the Texture of Earthenware Products ……... 42

2.6.2.4 The Role of the Value of Earthenware Products …….. 45

2.7 Structure of Clay Vessels …… 46

2.7.1 Structure of the Clay Pots and Its Importance ……. 52

2.7.1.1 Orifice of the Vessel …….. 52

2.7.1.2 Body of the Vessel ……. 55

2.7.1.3 Base of the Vessel ……..... 56

2.8 Summary ……..……. 58

Chapter Three

CERAMIC VARIETIES AND IMPORTANCE OF EARTHENWARE CULINARY PRODUCTS

3.0 Introduction ……..... 59

3.1 Evolution of ceramic ware in Sri Lanka ……. 59

3.2 About Earthenware Products ……..... 64

3.3 Variety of Earthenware Products and Product Usage ……. 67

3.3.1 Domestic Products ……... 67

3.3.2 Architectural Products ……. 68

3.3.3 Ritual Products /Ecclesiastical Products …….. 68

3.4 Functional Aspects of Domestic Earthenware Products ……. 68

3.4.1 The purpose of Earthenware Processing Products ……..… 69

3.4.2 The purpose of Earthenware Transport Products ……..… 71

3.4.3 The purpose of Earthenware Storage Products ……..... 73

3.5 Basic Cooking Methods in Sri Lanka …….. 75

3.5.1 Boiling …….. 76

3.5.2 Steaming ……... 77

3.5.3 Frying ……..... 78

3.5.4 Roasting …… 79

3.6 Identification of Earthenware Culinary Products ……. 80

3.6.1 Earthenware Culinary Products and it Function …….. 81

3.6.2 Identification of Earthenware Cleaning and Washing Objects …… 82

3.6.2.1 *"Nembiliya"* ……. 82

3.6.2.2 *"Koraha"* …… 83

3.6.2.3 *"Adi Walada"* …….. 84

3.6.3 Identification of Earthenware Auxiliary Objects ……. 84

3.6.3.1 *"Karamudiya"/"Wahantharawa"* ……..…. 84

3.6.3.2 *"Pittumudiya"* ……..…… 85

3.6.4 Identification of Earthenware Cooking Objects …….. 86

3.6.4.1 Cooking Pots …….. 88

3.6.4.1.1 Form Analysis …… 88

3.6.4.1.2 *"Muttiya"*……..…….. 89

3.6.4.2 Cooking Bowls ……..... 91

3.6.4.2.1 Form Analysis ……..…... 91

3.6.4.2.2 *"Athiliya"* ……..... 92

3.6.4.2.3 *"Hattiya"* ……94

3.6.4.3 Cooking Trays …… 94
3.6.4.3.1 Form Analysis …… 94
3.6.4.3.2 *"Thatiya"*……..… 95
3.6.4.3.3 *"Kabala"* ……. 97

3.7 Structural Analysis of *"Hattiya"* …… 98

3.7.1 Identification of "*Hattiya"* ……98

3.7.2 Manufacturing Processes of *"Hattiya"* …… 102
3.7.3 Structural Analysis of *"Hattiya"* ……. 106
3.7.3.1 Line Segment of *"Hattiya"* ……..…. 106
3.7.3.2 Structure of a *"Hattiya"* ……. 109

3.7.4 Orifice and Rim Varieties of *"Hattiya"* …….. 112
3.7.5 Importance of Body, Base and Stability of the *"Hattiya"*…. 115
3.7.6 Relationship Between *"Hattiya"* and Lid …… 121
3.7.7 Current situation of the *'Hattiya"* and Lid ……..……. 125
3.7.8 Size Varieties of Present *"Hattiya"* ……. 126
3.7.9 Size Varieties of Lid …… 136

3.8 Summary …….. 137

Chapter Four

METHODOLOGY

4.0 Introduction ……138
4.1 Research Method ……..... 138
4.2 Definition of Key factors ……..... 139
4.3 Research Model ……..… 142
4.4 Hypothesis Testing ……..… 144
4.5 Questionnaire Design & Questionnaire Survey Method …….. 145
4.6 Sample Selection ……147
4.7 Method of Data Measurement …….. 149
4.8 Questionnaire Development - (Question Type Two) ……..…179
4.9 Summary ……..……. 152

Chapter Five

DATA ANALYSIS

5.0 Introduction ……153
5.1 Sample Distribution …… 153
5.1.1 Sample Selection for Questionnaire ……..... 153
5.1.2 Sample Distribution of Gender ……..……... 154
5.1.3 Sample Distribution of Age Group ……..…… 156
5.1.4 Sample Distribution of Educational Qualifications ……..... 157
5.1.5 Sample Distribution of Occupation ……..…… 159
5.1.6 Sample Distribution of Monthly Income ……..……... 161
5.1.7 Sample Distribution of Number of Family Members ……...163
5.1.8 Sample Distribution of Energy Usage for Cooking Purpose ……....165

5.2 Data Records of the Survey ……... 166

5.2.1 Survey Data of Key Factors ……..166

5.2.2 Survey Data of Shape & Form ……..168

5.2.3 Survey Data of Texture ……169

5.2.4 Survey Data of Value ……170

5.2.5 Survey Data of Balance …… 171

5.2.6 Survey Data of Proportion ……..….. 172

5.3 Summary of Five selected Design Factors of *"Hattiya"* …….…….173

5.4 Hypothesis Testing ……174

5.5 Summary ……..176

CONCLUSION …… ... 177

REFERENCES ……. 180

LIST OF ANNEXURE …… 183

LIST OF FIGURES

Page

Chapter One

Figure 1.1: Problem Identification …… 08

Chapter Two

Figure 2.1: Relationship between Designer and Craftsman …… 15

Figure 2.2: Frame Work of Product Experience …… 20

Figure 2.3: Mug and the Way of Using Hand …… 26

Figure 2.4: Handling A Clay Pot (a-b) …… 28

Figure 2.5: Basic Design Principles and Elements …… 31

Figure 2.6: Structural Balance of Cooking Pots (a , b) …… 34

Figure 2.7: Vessel Stability …… 35

Figure 2.8: Positive Shape and Negative Space of Products …… 37

Figure 2.9: Basic Shapes of Clay Vessels…….. 39

Figure 2.10: Development of Cylinder Shape on the Wheel …… 39

Figure 2.11: Development of Flat Shape on the Wheel …… 39

Figure 2.12: Development of Sphere Shape on the Wheel …… 39

Figure 2.13: Use of Sphere Shape for Products (a , b) …… 39

Figure 2.14: Section of Embossed and Engraved Method …… 44

Figure 2.15: Use Engraving method for *"Nebiliya"*- Tactile Texture …… 44

Figure 2.16: Structure of a Clay Vessel …… 47

Figure 2.17: Major Subdivisions of Pottery Vessel……..... 48

Figure 2.18: Restricted and Unrestricted Shapes …… 50

Figure 2.19: Earthenware Cooking Pot……..……. 51

Figure 2.20: Position of Thickening with Relation to Vessel Wall …… 53

Figure 2.21: Junction of Thickened Part with Wall …… 53

Figure 2.22: Point of Greatest Thickness …… 53

Figure 2.23: Ratio of Rim Thickness to Wall Thickness …… 54

Figure 2.24: Relative Length of Thickened Part …….. 54

Figure 2.25: Shape of Thickened Part …… 54

Figure 2.26: Variety of Body Shapes of Clay Cooking Pots (a,b,c) …… 55

Figure 2.27: Flat Bases (a,b) …… 56

Figure 2.28: Round Bases (a,b) …… 56

Figure 2.29: Product Stability …… 57

Figure 2.30: Base with a Foot …… 57

Figure 2.31: Staking of Clay Pots …… 57

Chapter Three

Figure 3.1: Bowl- without Orifice …… 61

Figure 3.2: Development stage of *"Hattiya"* …… 61

Figure 3.3: Development stage of *"Muttiya"* …… 61

Figure 3.4: *"Muttiya"* with simple Decoration …… 62

Figure 3.5: Earthenware Cooking Pots …… 65

Figure 3.6: Decorated Water Pots …… 66

Figure 3.7: Decorated Water Pots …… 66

Figure 3.8: The Purpose of Processing and Use of Products …… 70

Figure 3.9: The Purpose of Transport and Use of Products …… 72

Figure 3.10: The Purpose of Storage and Use of Products …… 74

Figure 3.11 : Storage *"Muttiya"* and *"Nebiliya"* (a, b) …… 75

Figure 3.12: *"Muttiya"* covered with *"Nebiliya"* …… 76

Figure 3.13: Use of *"Kadawesma"* …… 78

Figure 3.14: Earthenware Culinary Products and their Functions …… 81

Figure 3.15: Variety of *"Nembiliya"*- Section …… 82

Figure 3.16: Variety of *"Koraha"*- Section …… 83

Figure 3.17: Variety of *"Adiwalada"* – Section …… 84

Figure 3.18: Variety of Lid- Section …… 84

Figure 3.19: A Lid …… 85

Figure 3.20: Section of *"Pittumudi"* (a , b)…… 85

Figure 3.21: Variety of *"Pittumudi"* (a , b) …… 85

Figure 3.22: Importance of *"Pittumudiya"* …… 86

Figure 3.23: Structural Development of Spherical Shape …… 87

Figure 3.24: Shape Varieties …… 87

Figure 3.25: Form Analysis of Pot Shape …… 88

Figure 3.26: Veddas Pot …… 89

Figure 3.27: Variety of *"Muttiya"*…… 89

Figure 3.28: Variety of *"Muttiya"* – Section …… 90

Figure 3.29: Form Analysis of Bowl Shape (a,b) …… 92

Figure 3.30: Variety of *"Athiliya"* – Section …… 92

Figure 3.31: *"Athiliya"* …… 92

Figure 3.32: *"Hattiya"* covered with *"Adiwalada"* …… 93

Figure 3.33: Form analysis of Tray Shape …… 94

Figure 3.34: Variety of *"Thatiya"* – Section 96

Figure 3.35: Side View of *"Thatiya"* 96

Figure 3.36: *"Kiri Roti Thatiya"* – Section..... 96

Figure 3.37: Variety of *"Kabala"* – Section 97

Figure 3.38: A *"Hattiya"* 99

Figure 3.39: A *"Kundahattiya"* 99

Figure 3.40: Wheel Thrown Curd Pots 99

Figure 3.41: Curd Pot making Machine 100

Figure 3.42: *"Kiri Hattiya"* (a ,b)..... 100

Figure 3.43: Importance of *"Hattiya"*..... 101

Figure 3.44: Steps of Manufacturing *"Hattiya", "Edikaranawa"* (a , b) 102

Figure 3.45: Leather hard Products – without Base 102

Figure 3.46: Making a Bottom part of the vessel (a , b) 103

Figure 3.47: Finishing Products 103

Figure 3.48: Green ware products 103

Figure 3.49: Tools 104

Figure 3.50: Variety of *"Athakoluwa"*..... 104

Figure 3.51: Variety of *"Athgala"* 104

Figure 3.52: Covered with *"Kabal"* (Damaged pots) 105

Figure 3.53: Covered with Clay 105

Figure 3.54: Firing 105

Figure 3.55: Line Segments of *"Hattiya"* (a,b)..... 107

Figure 3.56: Variety of *"Hattiya"* 108

Figure 3.57: Bend point Changes - *"Muttiya"* 109

Figure 3.58: Bend point Changes and structural development of the *"Hattiya"* ……. 109

Figure 3.59: Upper Part & Lower Part of the *"Hattiya"* ……. 110

Figure 3.60: Basic Structure of the Vessel *("Hattiya")* ……. 111

Figure 3.61: Identification of Lip Variations of the *"Hattiya"* ……. 112

Figure 3.62: Sections of Orifices *("Hattiya")* ……. 113

Figure 3.63: Variety of Orifices (*"Hattiya")* ……. 114

Figure 3.64: Variety of Surface Decorations used in *"Hattiya"*(a,b,c,d) ……. 116

Figure 3.65: Section of a clay body ……. 116

Figure 3.66: Stability of the *"Hattiya"* (a/b) ……. 117

Figure 3.67: Variety of Base Shapes and heat absorption …… 118

Figure 3.68: Spoons made out of coconut shells …… 119

Figure 3.69: Use of *"Daranuwa"* …… 119

Figure 3.70: Importance of the Base …… 120

Figure 3.71: Variety of Base Shapes of the *"Hattiya"* …… 120

Figure 3.72: Product Stacking …… 121

Figure 3.73: Product Stacking when Transporting ……..... 121

Figure 3.74: Structure of the Lid ……. 122

Figure 3.75: Importance of Lid …… 122

Figure 3.76: variety of Lids ……. 123

Figure 3.77: A Lid from Colombo museum collection …… 123

Figure 3.78: Lid varieties in present usage ……. 123

Figure 3.79: A Lid with decoration …… 124

Figure 3.80: A Lid with decoration ……. 124

Figure 3.81: Variety of Surface Decorations in Lids (a , b) …… 124

Figure 3.82: Size Variations of Present *"Hattiya"* …… 127

Figure 3.83: Section of the – *"Hattiya"* Type – 1 …… 129

Figure 3.84: Side View – *"Hattiya"* Type – 1 (a,b) …… 129

Figure 3.85: Section of the – *"Hattiya"* Type – 2 …… 130

Figure 3.86: Base of the *"Hattiya"* Type – 2 …… 130

Figure 3.87: Side View -*"Hattiya"* Type – 2 …… 130

Figure 3.88: Section of the – *"Hattiya"* Type – 3 …… 131

Figure 3.89: Side View -*"Hattiya"* Type – 3 (a,b) …… 131

Figure 3.90: Shape of the Base– *"Hattiya"* Type – 3 …… 132

Figure 3.91: Section of the – *"Hattiya"* Type – 4 …… 132

Figure 3.92: Side view -*"Hattiya"* Type – 4 (a,b) …… 133

Figure 3.93: Section of the – *"Hattiya"* Type – 5 …… 133

Figure 3.94: Base of the *"Hattiya"* Type – 5 …… 134

Figure 3.95: Side view of the *"Hattiya"* Type -5 (a,b) …… 134

Figure 3.96: Section Drawing – *"Hattiya"* Type – 6 …… 135

Figure 3.97: Side View of the *"Hattiya"* Type -6 (a , b) …… 135

Figure 3.98: Base of the *"Hattiya"* Type – 6 …… 136

Figure 3.99: Section of the – Lid …… 136

Figure 3.100: Variety of Lids …… 136

Chapter Five

Figure 5.1: Sample Selection …… 154

Figure 5.2: Sample Distribution of Gender …… 155

Figure 5.3: Sample Distribution of Age Group …… 156

Figure 5.4: Sample Distribution of Educational Qualifications 158

Figure 5.5: Sample Distribution of Occupation 160

Figure 5.6: Sample Distribution of Monthly Income 162

Figure 5.7: Sample Distribution of Number of Family Members 164

Figure 5.8: Sample Distribution of Energy Usage for Cooking Purpose 165

Figure 5.9: Data of Key Factors of the Survey 167

Figure 5.10: Summary of the Analysis of Five Selected Factors of *"Hattiya"* 173

Figure 5.11: Importance of the Design Facts of *"Hattiya"* 174

LIST OF TABLES

Page

Chapter One

Table 1.1: Problem Identification 08

Chapter Three

Table 3.1: Function Terms of the Local Household Pottery 80

Table 3.2: Price of Ordinary *"Hatties"* and Lids 125

Chapter Four

Table 4.1: Key Factors 139

Table 4.2: Definition of Key Factors 139

Table 4.3: Age Level Distribution 146

Table 4.4: Scale for Positive and Negative Questions 149

Table 4.5: Clarification of Questionnaire 150

Chapter Five

Table 5.1: Sample Selection 154

Table 5.2: Sample Distribution of Gender 154

Table 5.3: Sample Distribution of Age Group 156

Table 5.4: Sample Distribution of Educational Qualification 157

Table 5.5: Sample Distribution of Occupation 159

Table 5.6: Sample Distribution of Monthly Income 161

Table 5.7: Sample Distribution of Number of Family Members 163

Table 5.8: Sample Distribution of Energy Usage for Cooking Purpose 165

Table 5.9: Data of Key Factors of the Survey 167

Table 5.10: Survey Data of Shape & Form 168

Table 5.11: Survey Data of Texture 169

Table 5.12: Survey Data of Value 170

Table 5.13: Survey Data of Balance 171

Table 5.14: Survey Data of Proportion 172

Table 5.15: Summary of the Analysis 173

Table 5.16: Importance of the Design Facts of *"Hattiya"* 174

Table 5.17: Hypothesis Model 175

LIST OF ANNEXURE

Annexure 1 - Questionnaire Type - One …….…….. 183

Annexure 2 - Questionnaire Type – Two …….…….. 185

Annexure 3 - *"Hattiya"* Type - 1 …….. 192

Annexure 4 - *"Hattiya"* Type – 2 ……..…… 193

Annexure 5 - *"Hattiya"* Type – 3 ……..…… 194

Annexure 6 - A lid - Small Size ……... 195

LIST OF ABBREVIATIONS

BL- Balance

BRW - Black and Red Wares

BW - Black Ware

DE - Design Elements

DFM - Design for market

DP - Design Principles

GW - Graphite Ware

H- Height

MCW - Mica Coated Ware

N- Negative

P- Positive

PR- Proportion

Q- Question

RW - Red Wares

SH – Shape

TE – Texture

VA- Value

W- Width

Chapter One

IMPORTANCE OF CERAMIC PRODUCTS

0.1 Introduction

This is an introductory chapter and it discusses the importance of ceramic products particularly, low temperature earthenware products in Sri Lanka. This chapter includes the research problem, importance of the study, research limitations, and research methodology.

1.1 Identify ceramic as a valuable invention

Water, fire, air, earth and space are the basic natural elements in the planet. The world is controlled by these five basic elements. It can be described as; *"Pancha-mahabutha"* (Apo- water, Thejo- fire, Wayoo – air, Patavi - earth, Akasha- space. These basic natural elements have a great impact on human beings and their requirements.

Ceramic is a natural material formed with the combination of above mentioned elements. Earth means clay, which is flexible when mixed with water, and gets hardened by the effect of air and that shape will be made permanent by the effect of fire and also product volume will be created as a result of the way of handling the space. These are the basic steps of making clay ware objects. Sentence (2004) explained about the use of four types of basic elements for clay product manufacturing; "We are enthralled by the magic of a craft that involves all four of the elements: earth mixed with water cooked in a fire and coloured by the presence or absence of air. It feels as though, while molding the clay to our will, we could almost breathe life in to it" (p.9).

Origin of the clay industry is going back to the beginning of the civilization. As it is said by Jirousek (1995), “The art of ceramics is one of the oldest known, dating to prehistoric times. Clay is a special kind of earth, found all over the world that is easily worked when it is moistened, but can be hardened and made waterproof by exposing to heat. The earliest forms of construction were pinched that is, the clay is formed with the fingers to the desired shape”.

Clay was an ideal material for making cooking pots. People have identified clay as a flexible material which can be handled easily, when mixed with water. When comparing with other materials such as enamel, and stainless steel, clay can be used to create various types of clay objects for different purposes. Therefore manufacturing clay products can be seen as a structural and a systematic process. Finally a piece of clay can be turned in to a beautiful and useful clay product by adding life to it through this systematic process.

Manufacturing of the clay cooking pots has a long history and it dates back to the prehistoric time. “Clay, water, and fire over 10,000 years ago the world’s first ceramic combined these ingredients to produce one of the most significant innovations in all of human history the clay cooking pots” (Skibo, Walker, and Nielsen ,1995, p.80). It is believed that clay cooking pots had a good origination and conceited history. It is a known fact that Sri Lanka had a great history for the ceramic Industry. It is a wonderful craft created by people and goes back to five thousand years ago. Although people were engaged in this industry in larger numbers, it has been decreased with the passage of time. They used to produce products of good quality to cater the functionality. It has been proved by archeological excavations; which are evaluated constantly and these evidence help to get an idea about past society and their customs. “The study vessel shape can be form the standpoint of function, aesthetics, or taxonomy has the appeal of human interest, the purpose of vessels tell something of the activities and customs of the product who used them” (Anna,1980,p.26). It is believed that ceramic is one of the facts which say about society and it also reveals the behaviors of the people who used in that particular society. This can be explained vividly through archeological supportive information.

“The clay pots and jars from the most enduring record of human activity in this part of the world, during the prehistoric period to the present” (Gallery-2010).

As a result of the arrival of foreign technology and advanced mechanism to the Sri Lankan clay industry, porcelain industry showed a great development. Hence the earthenware industry in Sri Lanka was neglected to a certain extent. Porcelain material was immensely used to manufacture advanced products than the culinary items. Therefore the earthenware industry was badly affected as most of the people preferred to engage in the porcelain industry. This situation would have been created due to insufficient facilities, lack of techniques and primary manufacturing methods in earthenware industry. Since earthenware clay is a quality material which has a manufacturing capacity, it can be developed immensely to cater the present social needs. Past clay pots had correct shapes and forms for the usage and it had the stability, proper angles, body shapes to serve the purpose of functionality.

Although clay was a simple and a basic material, it was developed in various ways. At present, several types of ceramic varieties exist in Sri Lanka. According to the firing temperature and body composition, it can be categorized in to five different types as Terracotta ware, Earthenware, Stone ware, Porcelain and Bone China (Thakashima, 2004). This categorization is different from country to county and it also will be changed in accordance with body composition and firing temperature of clay products. From this classification; earthenware can be described as low temperature (red/brown colour) and high temperature body (red/brown and gray). The low temperature earthenware is used as a main material to manufacture culinary products.

By considering the product functionality and usage of ceramic products it can also be divided into three main categories. According to (Coomaraswamy, 1979), there are three main types of product variations which can be identified in Sri Lanka. They are Domestic ware, Ritual ware and Architectural ware. In addition, to these types toys and ornamental ware are produced in Sri Lanka presently. Earthenware clay is an ideal material to manufacture domestic products. According to the above

classification, domestic products are frequently used in each and every house in Sri Lanka and cooking pots play a huge role among the domestic products.

The domestic usage products can be classified in to three main parts with a view of product functionality. Rice (1987) explains about three varieties of “Domestic products; Storage products, Processing products, and Transferring products” (p.207). It is a known fact that most of the people in ancient Sri Lanka used clay pots as their kitchen utensils, because clay is a recyclable and eco-friendly material.

It is very important to note that, during the process of earthenware manufacturing the environment is not affected by any harmful effect. Materials like aluminum and the processes of aluminum casting release several types of dreadful things to the environment. (Mudalige,2010) said “They are turned out using an eco-friendly production processes (drain casting) in comparison to the aluminum casting processes that generates high heat and chemical fumes which adversely affect the working environment”. It is believed that the clay is a suitable and environment receptive material. Manufacturing and cooking in clay pots do not have any bad effect to the environment and human health. Not only that, it has also added an additional taste for the foods when cooking in clay pots. Clay pots have a quality of cooling and heating food and also have the special quality of absorbing excess fat to the clay body.

People have changed the usual fuel type in order to suit their busy life style. In the past, wood was used as the main fuel material. But it is understood that it takes a long time to prepare foods. Due to this reason gas has been used as a main fuel material in the present. Clay cooking pots also take time to get heated than the other cooking pots made of other materials like aluminum, stainless steel and non-stick etc. Despite the wastage of gas, by using clay utensils, people tend to use them more and more now, as it is good for their health.

The other specialty of earthenware product is that it has a simple and low cost production process when compared with other clay materials such as porcelain, stoneware and also the other materials like plastic and enamel. Sri Lanka is famous for earthenware clay manufacturers. It has a cultural identity, and social impression. As a material it has a quality of workability and the ability to control the wall thicknesses. Currently people are not aware of the importance of earthenware culinary products, and also the manufactures do not consider about the design, quality of the product and its functionality.

1.2 Problem Identification

In a fast moving world, life has become more competitive and busy. Therefore people are compelled to change their traditions in order to face new challenges in life. Hence they tend to use alternative products which are made from other materials such as Nonstick, Aluminum, Stain-less steel, and Enamel etc. Although these products make the life easy and comfortable, with the passage of time people understood certain disadvantages of these alternative products. It has been found that the materials like Nonstick, Aluminum, Stain-less steel, and Enamel would cause fatal diseases like cancer and kidney ailments, if they are used for a prolonged period. (Mudalige, 2010) explained about the disadvantages of the pots made out with other material as; “Traditional cookware found in Sri Lanka such as those made with aluminum, stainless steel and non-stick have been reported to cause health disorders in continuous use”.

Due to the urbanization, the kitchen arrangement also has changed. Most of the houses consist a place called pantry which is used for both cooking and dinning. There are houses which have both the pantry and the kitchen. In those houses clay products are used mainly in the kitchen because of the ill-effects which have been mentioned earlier. The utensils which are made from other materials are used in the

pantry because they have smooth attractive values. But these imitated products are good for short time usage and not good for long time usage.

Clay pots are more suitable to prepare foods in all aspects. But people hesitate to cook and serve food in clay products in the pantry, because of the less quality of product and unattractive designs. Therefore clay pots have to be developed in order to suite for the use in the pantry. “In the urban houses there are various vessels for various tasks. The kitchen is different in the urban context. However the kitchen has been subjected to change vastly. Since the ancient days and adjusted accordingly with the busy life style of man” (Markewita, 2005, p.1). It can be used as a serving object for a change; as clay has a quality of heating, cooling and good for hygienic matters. Therefore clay vessels can be identified as an ideal material for long time usage.

Hence it is obvious that using clay products is good for human lives. People hesitate to use them much in the present due to several disadvantages. Much attention is not paid to the functional usage and the attractive finish. It is proved that “Cleaning difficulty and low thermal expansion are the main draw backs of traditional red clay products” (Mudalige, 2010). The main disadvantages of clay pots are unattractive finish and improper functional usage.

Although all the clay vessels are not manufactured attractively, it is one of the factors that have to be paid much attention in pottery industry. Because people like to use good quality product combined with design efficiency and functional validity. “Purely decorative pots have total freedom of expression, while functional considerations impose compromise in both form and aesthetic development in pots that are made to be used. The various needs that domestic pottery servers predetermine to some extent the forms those were and are made. Within all of these basic forms there has usually been considerable room for invention, variation, and improvisation within a theme” (Hopper, 2000, p.29). Hence it is obvious that functional value of products is a key factor in domestic pottery. Generally clay pots in the current usage do not possess a good finish and surface quality, structural

quality, product appearance and aesthetical appearance. They also have defects like water leaking and less heat absorption.

Most of the clay cooking pots do not maintain a good standard, as they have less design qualities. This must be due to the result of less attention paid to the important aspects like material qualities and technical limitations of the product. If the manufactures pay their attention to those aspects, their end product would reach the required standard. Therefore, at the beginning of the process of manufacturing clay products the quality of the clay(to obtain rough and smooth surfaces, porosity) designs, shapes, forms and (bottom shape, orifice and belly), functionality (product stability, keeping on hearth) have to be taken in to consideration, as they are main aspects of the manufacturing clay cooking pots.

If more attention is paid for the design efficiency and functionality, the final product will undoubtedly be attractive and handy. Obviously these are the key factors in manufacturing clay products and they play a vital role in developing the domestic clay products. Therefore this research is carried out in order to identify the strength of design efficiency and how it can be developed to fulfill current social needs. It will also help to identify design errors, technical and manufacturing limitations, and design developments of earthenware clay cooking pots. This will also benefit the consumers and product manufactures, in order to re establish earthenware potter community in Sri Lanka.

1.3 Problem Identification by Questionnaire Survey

It has been identified that the clay cooking pots are not widely used by people in the current society. It is believed that most of these products do not cater to the needs of the people. Thus, a questionnaire was carried out to identify the present situation of clay pots (*"Hattiya"* and lid) clearly. The objective of the questionnaire is to identify the reasons for that situation and to identify the areas that have to be developed of the

product. The questionnaire will also be used to identify the problems of present *"Hattiya"* through the consumers' experiences and to obtain their valid opinions regarding the development of clay products.

The questionnaire type one is used for problem identification of clay pots. It is distributed among the people, especially to the people who live in urban places. It consists of 6 questions and will be given to 50 people to collect the data.

Question Type One- (See Annexure -1)

A- General information (Section-A) consists of basic information like; Name, age, education qualification, gender, occupation, monthly income, no of family members etc.

B- Problem Identification

Table 1.1: Problem Identification

Comments	No. of People	%
Need to Develop	44	88
No Need to Develop	6	12
Total	50	100

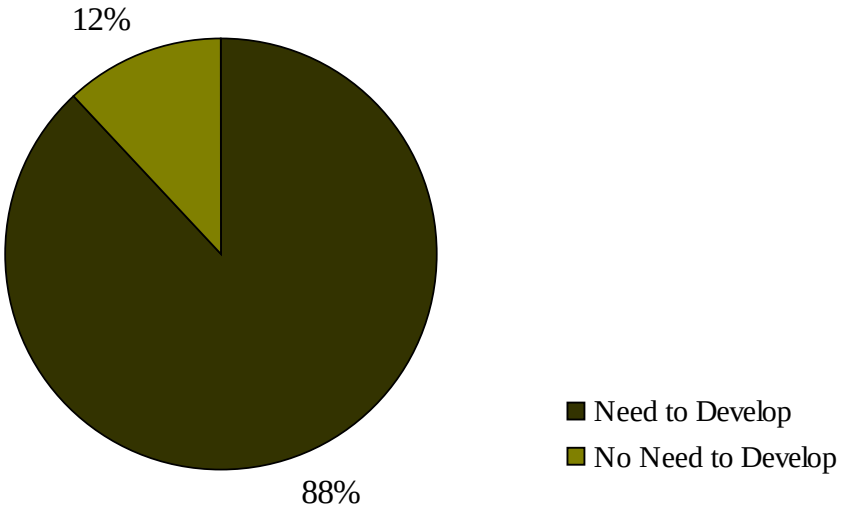


Figure 1.1: Problem Identification

The results of questionnaire survey shows that 88% people suggest that the clay cooking pots should be developed and 12% of people do not propose that idea. According to the results it is understood that the clay cooking pots are in a developmental stage.

1.4 Importance of the study

Although Sri Lanka had a great history for earthenware industry (See Section 1.1), there has been a significant decrease in it due to the foreign influence. Therefore this research will make an attempt to identify the importance of producing earthenware cooking pots and the drawbacks which arise in the industry. It will also help to identify the areas which have to be developed according to the needs of the present society. Here the attention is drawn to the main aspects such as design elements and design principals of products.

Further this research will be useful for product manufacturers and users, to upgrade their products to fulfill present social needs. As a result of that, consumer will be able to get an easy product which has a functional validity. This research will also help to build a new trend in pottery manufacturers by emphasizing the needs for improving design efficiency of cooking products. It will help to identify key factors and guidelines, in the industry in order to develop earthenware cooking pots which will absolutely suit present social requirements.

1.5 Limitations

Study of ceramic is a vast area that can be studied from several viewpoints due to its multi disciplinary complexity. Ceramic products have been existed since the early history of Sri Lanka. But this research focuses its attention only on domestic low temperature earthenware cooking pots, which are used for food processing. Several types of cooking pots have been used for the purpose of processing. But one type of product can be used for several purposes. It is one of the advantages of earthenware vessels. Presently there is a trend to use clay pots by the people who live in urban

areas. But they are not satisfied with the qualities of the product as they lack the certain important features. Therefore this research will consider only selected earthenware clay cooking pots which are mostly used in houses in urban areas. Due to the busy lifestyle it is very necessary to use convenient and different methods in preparing food. Colombo and Kandy are the main areas where the data is collected. These two places have been selected in order to show the various differences with regard to the people, the type of food they consume and also the different methods that they follow in cooking.

This research focuses on design considerations of the product. It will help to identify design problems, design developments and the characteristics which have to be considered, particularly. In this research the item *"Hattiya"* is taken as a sample object and lid is taken as a supportive object to collect data. Both these objects have raised much attention in this study. Design principles and design elements related to the ceramic ware are also considered with a view to achieve design efficiency of the clay cooking pots.

1.6 Methodology

The information and data which will be collected using the following methods will be analyzed under several key sections of the research.

Primary data

Questionnaire type Two (See Annexure - 2.) .Primary data will be collected from the primary source (original source) by using structured questionnaire and field visits. The questionnaire will be given to people who live in urban areas (Colombo and Kandy).The questionnaires mainly focus on the drawbacks of present *"Hattiya"* and the lid, in order to obtain their suggestions to develop those products to cater to their needs. The questionnaires will be developed in considering design elements and design principles of the products.

Secondary data

Secondary data will be collected from the previous and present earthenware cooking products, from the books, websites, research journals, research articles, museums artifact and archeological excavations etc.

1.7 Summary

This chapter has discussed about the importance of clay cooking pots and present condition of the clay cooking pots. It also includes the research problems, research limitations, methodology and importance of the research. Next chapter will describe the theoretical background and structural analysis of earthenware clay cooking pots. It will also explain the advantages and disadvantages of current clay cooking pots.

Chapter Two

DESIGN EFFICIENCY AND FUNCTIONAL USE OF CERAMIC PRODUCTS

0.2 Introduction

This chapter includes the literature review of the research. Although there were less documentary evidences and recorded data about ceramic products, available data has provided an immense support in this study. This chapter also discusses the design, design efficiency, product usage and functionality along with the physical and psychological use, of the product. Furthermore the basic theories and anatomy of the specific earthenware vessel *"Hattiya"* have also been included in this chapter. The main objective of this chapter is to identify the relative theory of design elements and design principles of clay cooking pots.

2.1 Identify Designs, Design Efficiency and Product Functionality of Clay Vessels.

Design and design efficiency have a great impact on the product functionality. The function and usage of the product is decided by the consumers and users.

"Other design objects such as furniture tools and appliances must be conceived in relation to function and often, the contours of human body that will use the object"

(Jirousek., 1995, p.3)

The role of the designer is to produce a new product which fulfills human needs. Product functionality, and design efficiency are the main factors that have to be considered much and if the product lacks any of these two it cannot be considered as a good product. Therefore design efficiency and functionality are identified as main features of a standard clay product.

2.1.1 What is Design?

Design origin dates back to the beginning of the civilizations. All the designs of earthenware products were created with a view to fulfilling human needs and requirements. At the beginning people did not consider the design value of a product. They only concerned about the purpose and the usage of the product.

Design cannot be explained in one word. It has been defined in several ways. It is an innovation of humans to fulfill some needs. Mayall (1979) stated that "Design conceives and defines all the means we employ to satisfy our many and increasing intricate needs" (p.9). Design is the process of taking something from its existing state and moving it to a preferred state. " every experience both takes up something from those which have one before and modifies in some way the quality of those which comes after" (Dewey, 1938, p. 34) . The prior experience and knowledge which possessed by the user, in relation to a product, might be especially relevant factors in their value assessment of product. Design is an experiment done with previous experiences.

"Design is that area of human experience, skill and knowledge which is concerned with mans ability to mould his environment to suit his material and spiritual needs"

(Archers, 1973)

Experience is used to; select a good product and to handle it properly. Designing is not a simple process. It can be identified as a well structured production process. "Designer product has a long designing process. It need to well planning and organizing. It has to exceed different steps, such as; Problem identification, Research, Analysis, Specification, Developing, Proposals, Planning, Making, Evolution" (Bull, 2000, p.3). To obtain a designer product one has to go through several stages in the process. The main issue of the final product is to accomplish the requirements of the user. If It does not meet the consumers' requirements, it cannot be considered as a convenient product.

Usually there is a selected target group for every product. If there is a target group it is easy to understand the consumers' needs and what they expect from the product. As an example when designing something for kids, it is needed to study children's behaviors and their physical and psychological aspects. This enables the manufacturer to design a good product which will achieve their needs and preferences. Design should be consumer oriented; basically it would meet the consumer's requirements.

Bull (2000) has pointed out, "When you start designing, there are some questions that you need to ask. You cannot begin if you don't know what you are to design or its context. You need to know who is for, what size it should be, its' cost, how it is to be made, the material or ingredients needed and any safety considerations. When you have started to design, you will have to make decisions and, probably, changers before you can start manufacture or production. You may still have to make changers, even while making, to produce a good final product. This constant improvement is an iterative process. Then you have to evaluate the product, does it satisfy the needs of the customer or client" (p.2).

"Design work cannot be undertaken effectively without establishing working relationships with all those activities concerned with the conception, manufacturing and marketing of products and, importantly, with the prospective user, together with all the services he may call upon to assist his judgment and protect his interest" (Mayall, 1997. p.137). Design product is a user centered product, it has a relationship with the user and makers in every way. Suri (2003) and Melican (2004) stated that, "The concept of user centered design has arguably given rise to one of the most fundamental changers in the field of design over the past few decades". It is obvious that every product should be a user centered product.

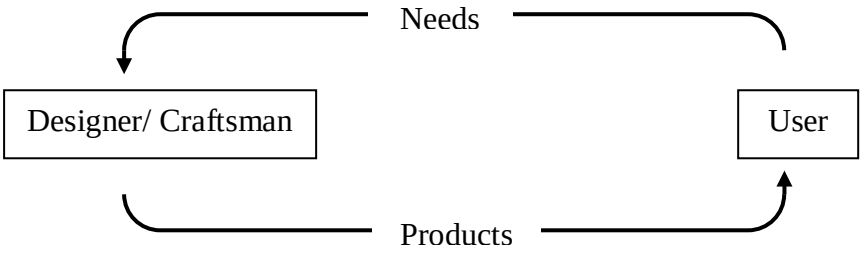


Figure 2.1: Relationship between Designer and Craftsman

Source: (Mayall, 1997, p.137)

Design can be explained as a response of social problems or people's requirements. Design can be identified as some kind of ideas expressed to others using materials. User and function are major aspects of the product. By this time it has turned to a norm of the society. "Designers often attempt to beyond the primary functional requirements of method, use, need, telesis, association and aesthetic; they strive for a more consign statement precision simplicity"

(Papanek,1972,p.20). According to these facts design can be identified as an advanced process of consisting with aesthetical, emotional, and functional values. Mayall (1979) explained as, "Design is concerned with how our needs are identified, related and, in some cases, stimulated. It affects the way in which our materials, energy and other resources are employed to satisfy these needs" (p.9). Therefore design should be an advanced well structured process.

2.1.2 Identification of Design Efficiency

Design efficiency can be identified as one of the main factors in the field of product design. Product comfortability, easy to use and fulfilling maximum consumer requirements are main necessities of design efficiency. Design efficiency also can be

identified as a main factor which accomplishes the purpose and the function of the product effectively. Basically it can be explained in several ways.

“The comparison of what is actually produced or performed with what can be achieved with the same consumption of resources (money, time, labor, etc.). It is an important factor in determination of productivity”.

www.businessdictionary.com

It is a basic idea of efficiency. There are various meanings which can be found in different disciplines.

“Efficiency in general describes the extent to which time or effort is well used for the intended task or purpose. It is often used with the specific gloss of relaying the capability of a specific application of effort to produce a specific outcome effectively with a minimum amount or quantity of waste, expense, or unnecessary effort. "Efficiency" has widely varying meanings in different disciplines”.

(www.wikipedia.com)

Design efficiency is varying with disciplines, because it depends on different types of human needs and product variability. The norm theory is; Scientists can invent technologies, manufacturers can make products, engineers can make them function and marketers can sell them. Designers can combine insight into all these things and turn a concept into something that's desirable, viable, commercially successful and adds value to people's lives. Product is a final result of a long process. Scientists, engineers, and manufactures evolve to produce functional products; nevertheless finally the designer is playing an effective role by adding design efficiency to the product. Efficiency is achieved through good standards, quality and providing effective products to the society. It is clearly seen in the ceramic products as most of the products have the functional value because of the aspect of design efficiency. It is one of the main aspects which should be considered in using domestic clay products. They should be easy to use, easy to hold, and easy to clean. When considering the usage of the product several types of attachments are used for easy handling. They

are a spout, a handle, foot, rims, and orifices which are attached to the body formation to achieve product efficiency. It also helps to intensify quality products to serve the functional purposes.

2.1.3 Identification of Product Functionality

Individual requirements are different from person to person and it is a basic norm of a human. They try to use easy and comfortable products to satisfy their needs. Therefore product functionality can be described as a major requirement of a good product. (Papanek, 1972) "The mode of action by which a design fulfills its purpose is its function" (p.5). Furthermore function can be identified as fulfilling some purpose. Function varies according to context and purposes. "The characteristics of all products have different relative values depending upon the different circumstances and times in which they may be used" (Mayall, 1979, p.67). Product functionality is different, because it is decided by, the way they are using product. Mayall (1979) sited that, "Function' what we want from a product, when we buy it is often based upon one or more functions without which what we are seeking could not exist" (p.72). Design, function, and need cannot be separated; as these are the main constituents of a functional product.

'Use value' and 'esteem value' are assessed adequately in a product. Usually one product caters more than one functional value. Traditional water pot can be explained as a good example for use value and esteem value; normally the vessel is lifted with a single hand; placing the thumb at the rim from the exterior and the other fingers are used to hold the vessel through the flared rim. The small mouth is kept covered with a coconut shell and the water is taken out by tilting the pot allowing pouring in to another vessel. This minimizes spilling water. This is a good example for identification of product functionality. Product should be appropriate for the function and its usability should suit the customers' needs.

There are varieties of key considerations which cater to functional use of product. When considering a ceramic object it is a user centered product. Because of that social position (target group), the way of using, type of user, method of cleaning, and method of storing can be identified as key considerations in ceramic (specially cooking and tableware) products. There is a rim to hold the pot, because with hot gravy it cannot be touched without, spilling the gravy. Therefore, rim is used for functional purposes. Some pots consist of a huge body, like *"Muttiya"*. It is used for the boiling purposes. Each and every product possesses individual characteristics to cater to the functionality. The shape and form of the product will be changed according to their personal characteristics. It is believed that the product functionality is one of the main features in a product life cycle. It will help to satisfy consumer needs and also to create a good designer product to society.

2.2 Product and Product Experience

Any product would be made to satisfy the needs of the people. The products would be differing from each other as the needs of people are different too. When a product is manufactured, one should ensure that it addresses the needs of many people. As mentioned earlier (2.1.2) the product efficiency would be high if the product as manufactured to be 'practical' as possible.

There are several things that one should consider in order to increase the product validity. One should consider the factors that increase the build quality, the technological sophistication and indeed the financial value of the product. In order to achieve this, manufacturer should consider criterion such as functionality, shape, form, durability and aesthetic elements. In the terms of technology and finance, the manufacturer should consider things such as the method of production, materials, social benefits and the use of advanced technology.

When a product is released to the market, and when people use it, the product will receive a lot of criticism, be it good or bad. This criticism is vital to improve the

product, to identify specific needs of users and it is important when developing new products.

> "When we buy products or when we design them we must therefore try to identify and value the reasons for buying or designing what we want. We would expect that one or more reasons will be related to the performance characteristic of our product and that, in general, this will be product's key characteristic.
>
> (Mayall ,1979, p.73)

Thus, the biggest concern of a manufacturer is to fulfill the needs of the user. When one observes domestic cooking pots through, one cannot see a huge development. They (cooking pot) should change to meet the requirements of today. Above all, the ease of use and the overall quality of cooking pots should be improved. A good product fulfills the needs of the user and it is of good quality. "Thus the life of objects cannot be understood in purely economical terms; we must refer to the dimension of desire or needs as well as that of demand" (Palmer & Dodson, 1996, 11p). By increasing the demand of a product, one can give a better service to the user and give a reasonable price.

When one uses a product, he might experience a variety of feelings. Those feeling depend on many factors; the build quality of the product, the way it is handled, the state of mind of the user etc. thus, the quality of the product and the consumer satisfaction affect the product experience directly. Desmet & Hekkert (2007) explained, "Experienced is shaped by the characteristics of the user (e.g., personality, skills, background, cultural values, and motives) and those of the product (e.g., shape, texture, colour and behaviors). All actions and processes that are involved, such as physical actions and perceptual and cognitive processes (e.g., perceiving, exploring, using, remembering, comparing and understanding) will contribute to the experience. In additionally, the experience is always influenced by the context (e.g., physical, social, economical) in which the interaction takes place" (p.58). In fact, three main factors affect the product experience;

1. Emotional Experience
2. Aesthetical Experience
3. Experience of Meaning

We thus define product experience as " The entire set of affects that is elicited by the interaction between a user and a product, including the degree to which all our senses are gratified (aesthetic experiences,) the meanings we attach to the product (experience of meaning) and the feelings and emotion that are elicited (emotional experience)".

(Hekkert,2006,p.160)

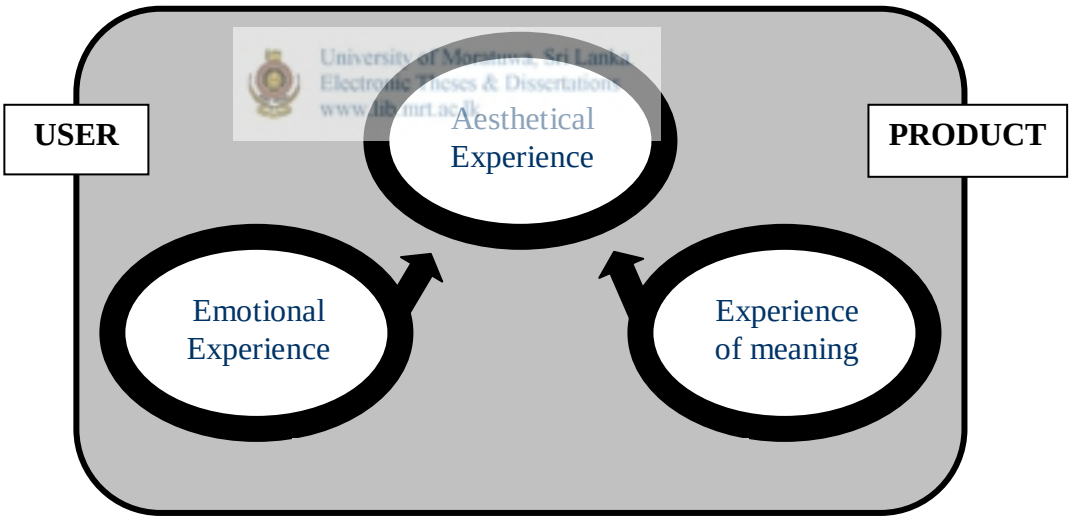


Figure 2.2: Framework of Product Experience

Source: (Desmet & Hekkert ,2007,p.60)

Therefore Emotional Experience, Aesthetical Experience, Experience of meaning can be identified as main components of product experiences. The aesthetical value directly affects the first impression that a product creates. It creates a desire to own

and use the product. The aesthetic element also creates certain awareness about the product and gives an idea about the build quality of the product.

"An aesthetic experience can give rise to an emotional experience, because aesthetic experiences involve pleasure and displeasure, and people are motivated to seek products that provide pleasure and avoid products that provide displeasure."

(Desmet& Hekkert, 2007, p.62)

The aesthetic appearance stems the shape, form, texture, colour, value and the materials of the product. Identify the characteristics of the product depends on product experience and the cultural and personal identification. When we consider human emotions, it is evident that they have a tendency to change rapidly. Elements within and outside man, brings such changes. Emotional values are very important when it comes to judging the pros and cons, and indeed the significance of a product. Frijda, (1986) "Emotions are functional, because they establish our position vis-à-vis our environment, pulling us toward certain people, objects, actions, and ideas, and pushing us away from others" (sited by Peter & Hekket, 2007, p.61). Therefore emotion can be identified as a vital fact in a product.

Emotional values can be decided in two ways; such as physical and mental value of the product. When a person uses a product he / she will receive a sense of experience from both faculties. Apart from this, the Experience of Meaning of a product also contributes to create awareness about it. According to Desmet & Hekkert (2007), at the level of meaning, cognition comes into play. Through cognitive processes, like interpretation, memory retrieval, and associations, we are able to recognize metaphors, assign personality or other expressive characteristics, and assess the personal or symbolic insignificance of products. Thus, it becomes clear that the Emotional Experience, the Experience of Meaning and the Aesthetic Experience together, create awareness about a product. These are very necessary to fulfill the human requirements and are very important to increase the physical and psychological comfortability of the people.

2.3 Physical and Psychological Comfort of Design

When a product ends up in the hand of the user, it is utilized according to his or her physical and mental code of conduct. A product is inextricably linked with its user and the life cycle of the product depends on how the user handles it. More than a lot of other products, Ceramic products come into contact with human hands and fingers. Hands and fingers are the most energetic parts of the body. Thus, a ceramic product should address two requirements: the Physical Comfort and the Psychological Comfort.

(Heskett, 2002a; Margolin, 1997; Redstrom, 2006) asserts, “Design has since shifted focus from giving form to subjects and information to enabling user experiences, and form physical and cognitive human factors for the emotional, social and cultural contexts in which products and communication take place”(Boztepe,2007,p.55). These two types will help to harmonize human physically and psychologically. Physical contentment and psychological contentment are vital components in human beings. Impression and satisfaction directly affect the performance and the usage of the product

2.3.1 What is Physical Comfort?

It is the build quality and the looks of a product that suggest or serve to bring comfort to the user. By the build quality and the looks the user can assume how comfortable the product will be to use. The Physical Comfort is a result of human satisfaction about the object or what they use. The “Feel; of an object probably depends on a combination of perceptual properties” (Chen, Shao, Barnes, Childs, & Henson, 2009, p.68).

Although one can get the feeling of a physical product by using it, the experience given is evaluated by the user’s psychological response. Thus, the physiology and the psychology are always linked. The user’s response towards the product or object depends on these two factors. Physical comfort can be identified as a combination of

the elements of visual, handling and performance. When we consider a ceramic cup, we can understand how it affects the user physically. The cup is handled by the hand. It comes into contact with hands and fingers which are sensitive parts of the body. Thus, the user gets the emotions and an understanding about the object quicker.

"The considerations of proportion in conjunction with the physical feel when holding the form can add immeasurably to the qualities that any object may have."

(Hopper R., 2000, p.101)

The product type, the material used, the method of use affect the Physical reaction of the user. Chen, Shao, Barnes, Childs, & Henson (2009) stated that, "there is growing interest among consumer goods manufacturers to be able to relate products' physical properties to a consumers' emotional experience when using a product, one aspect of which is touch" (p.67). A clay product should be made out with a suitable material, with correct shapes and forms, and with a facility of easy handling. It should be felt by the fingers by touching and handling it, as physical comfort is an important aspect of a product.

2.3.2 What is Psychological Comfort?

The identification or the science of the human mind and human behavior is Human Psychology. It can also be defined as;

"The science that deals with mental processes and behaviors".

(education.yahoo.com)

A product can be considered as a kind of treatment (given) to the Human Mind and the Human Need. As mentioned earlier, the Physical comfort and the Psychological Comfort are linked. Sometimes, the Psychological Reaction depends on the physical Comfort. The Psychological Comfort helps to treat the human mind and it is more important than the Physical Comfort. If a product offers a high level of Psychological Comfort, it (the product) remains in our memory for a long time. The Psychological Comfort is not an external attraction. The ability to offer a high level of Psychological Comfort is a good advantage for a product.

"The words 'affect' and 'experience' have been used interchangeably in the introduction, because we use 'product experience' to refer to an experience that is affective. In psychology, the term affect, or affective state, is generally used to refer to all types of subjective experiences that are valence, that is, experience that involve a perceived goodness or badness, pleasantness or unpleasantness."

(Chen, Shao, Barnes, Childs & Henson, 2009, p.58)

Although one can identify a product by its appearance, one must use it to get a proper understanding of the product. The quality (how good or bad it is) of a product will be judged by the level of mental and physical comfort it offers the user on a particular moment. When one uses a product, he/she feels the build quality, shape, form, texture and the weight of it and this affects the Physical comfort. The user's Psychological preference will decide whether these physical feedbacks are good or bad. Thus, it is difficult to draw a line separating Physical Comfort and Psychological Comfort. The liking for the product and the method of use is different from one another.

It is relatively easy to create a product for an individual, but when creating a product for a large community, one should understand the people's preferences and needs. If this is properly done, it will result in the creation of a successful generic product. And this product will be called a customer oriented product.

2.3.3 The Effect of Physical and Psychological Comfort for Ceramic Design

Appearance is very important to get the first impression of the product. However it is not the only fact to get a proper idea about the product. Both physical and psychological impression help to get a proper idea of the product and it also helps to clarify the functionality of the product and the way it can be used.

Ceramic always comes in to contact with the human body. The usage is different from person to person. It depends on the quality of the product and the behavior of the people and their environment.

"The way hands are used in the lifting and holding of objects varies from person to person, depending on the length and thickness of the fingers and wrist, and to some extent, the cultural background for the user".

(Hopper, 2000, p.104)

Ceramic can be identified as a product which can be handled by the human hand. So a ceramic product should be a 'comfortable' piece of art. Design elements, design principles and ergonomics can be explained as main aspects of a ceramic product. They help to observe the Physical and psychological comfort of a ceramic product.

The comfort that a product offers and the efficiency of the product depend on consumer satisfaction. As fingers are very sensitive, they send the message to the brain and immediately respond to the action. Consumer gets a correct opinion about the product and is able to hold the object safely, keeping the good balance. The center of gravity, the weight of the product, and the balance of the product are important factors of a ceramic product.

"If the handle of the pitcher juts out an excessive distance from the center of gravity, the apparent weight will be considerably more than the actual weight."

(Hopper , 2000, p.104)

The center of gravity helps to stabilize the product and to handle the product in the correct manner. Therefore the center of gravity can be considered as an essential aspect of the ceramic product. "The human wrist is one of the more fragile parts of our anatomy, being made up of a number of interlocking moveable bones. The angles it operates at and the weights it carries make it quite vulnerable in use and comparatively easy to damage. Pots, becoming excessively heavy with their contents, should be carefully balanced so that they can be made as easy as possible to pick up or to pour form" (Hopper,2000, p.104).

Therefore the human wrist is an important part of the human anatomy. It will help to hold and handle the product in the proper manner. How a mug, cup, goblet, or pots' rim profile can be felt by the fingers, hand and lips, and also how many fingers fit comfortably between the handle and the object, how many fingers are needed to

comfortably lift the object without any undue damage the importance of the hand and the way of hanging a mug can be explained as follows,

"The finger is made of three parts, with two joints within its length from the knuckle. The thumb has two parts and one joint within its length. . When the fingers of thumb are bent, the muscles on the inner part of the finger are compressed to half or less of their normal length. In many fine qualities, generally industrially products cups the handle is made in such a way as to make it impossible to get finger through, necessitating a pinching action between the four fingers the thumb, with the middle finger supporting beneath. Most potters usually make handles where at least one finger goes through the aperture between the handle and pot."

(Hopper, 2000, p.104)

Figure 2.3: Mug and the way of Using Hand

This picture explains how to handle a mug and which fingers are to be used for this purpose. The weight directly affects the hanging of the object. If it is too heavy it is difficult to handle and it will affect physical and physiological comfort. The weight of the product depends on the thickness of the product and on the quality of the clay. Besides, each and every product should have a standard weight, but they should differ according to the product category and brand. Hopper (2000) describes the thicknesses of a product as; "The thickness of the thickest part of an average fore finger is approximately 1". For a cup or mug to contain hot liquid and not burn the finger holding the handle, the space between the finger and the body of the pot need to be no more than ¼", or a total space of 1 ½" from the inside of the handle to the body of the vessel. This can be changed slightly depending on the object. (p.104).

The thickness of the product and the way it can be carried are the main concerns of a product. The thickness of an earthenware product can be in between 6 to 8 mm. But the up thickness 10mm can be even greater. This is because the products are hand made. Thus, the thickness of two (of the same type) products may also differ. The thickness of a clay cooling pot affects its level of thermal shock resistance directly. The thickness of a ceramic body should not be changed at once. It should be reduced gradually. If not, the product will crack when heating. The thickness may vary from product to product from brand to brand, according to the clay material. Whether the product is good or bad it depends on feelings and the physical and psychological comfort that of user experiences. As mentioned earlier, each product has some specifications; such as weight and thickness, etc. the product differs from country to country, from society to society but the main considerations are universal.

When, using a ceramic product one can experience various emotions. These emotions stem from the quality of the material and the stability of the product. For example, in a glaze product, the surface is smooth, non porous and comfortable, but non glaze products have a rough quality and a porous quality. A rough textured surface will help to create grip between the human hand and the ceramic body surface. It can help to hold and hang the object in a proper manner. The different materials (used), can be identified by touching and feeling the surface and the emotional experiences. “Most forms eating and drinking vessels come in touch with the mouth and lips. The lips are fleshy muscular tissues covered with a highly sensitive thin skin. They are particularly sensitive to objects being placed between them. The surface quality, thickness, curvature, and width of the object are all sensed very quickly, and an instant reaction of pleasure or displeasure is sent to the brain. Ultimately, the interpretation of this massage might mean the difference between a piece that is enjoyed or one that is enjoyed or one that is avoided” (Hopper, 2000, p.103).

The lack of concern for the quality of clay cooking pots has led to the unpopularity of the product. One can understand the quality of a product by using it. A lot of consideration must be given to the surface quality, thickness, curvature, shape, form

and the size of a ceramic product. But today, these essential specifications are not given due consideration. As an example a mug, the orifice and the handle come directly into contact with the human hand. Likewise, in a cooking pot, the orifice, the belly and the base are the most important parts. These parts determine the ease of use and control consumer satisfaction.

(a

(b)

Figure 2.4: Handling a Clay Pot (a-b)

"Functional pottery is made for people to use and many potters feel that the pot isn't complete until it is physically used for its job totally, it should be efficient, easy to use, comfortable in the hands, and give pleasure to the user at the same time. One should consider how it is to be used and what parts of the human anatomy will be in contact with it for optimum satisfaction on all counts."

(Hopper,2000, p.103)

Consumer satisfaction is a hallmark of a good product. One should consider how it should be used and what parts of the human anatomy will be touched and contacted by it and it must offer optimum satisfaction. In order to manufacture a proper product, pottery manufactures and designers should consider the anatomy of the product, and also the consumers who use these products. For the design efficiency and the functional value of a Ceramic product, physical and psychological comfort cannot be neglected as they are the main requirements of it.

2.4 Principles and Elements of Design

Design principles and elements can be identified as a basic tenet of a design product. There are many basic concepts that underlay the field of design. They are often categorized differently depending on philosophy or teaching method. The theory of design can be divided in to two categories; such as design principles and design elements. Genevese (2005) described, it can be grouped all of the basic tenets of design in to two categories: such as principles and elements of design.

Design principles and design elements were created by combining different elements. These are the main components of a product. Design principles and elements vary from product to product accordance with their product features and behaviors. It can be stated as a law behind the product design.

"Principles of design are the laws of designing anything! In other words, to have a good design, you should consider these principles for the best design possible. Elements of design on the other hand are things that are involved within making a design. The major difference between principles and elements is that principles are rules you have to follow and elements are things that will help you complete those rules for the best project outcome".

(Jiskha Homework,2011)

Design principles and design elements have become main considerations or main considerable points of every product. They are essential to achieve a good product with maximum quality.

2.5 Classification of Design Principles and Elements

Design principles and elements can be identified as basic fundamentals of design product. Therefore several types of design principles and elements are categorized in accordance with their product features. It depends on product category, material and variety of usage.

Considering the design principles and elements, products can be classified in different ways. According to Jiskha Homework (2011) Design principles consist of seven principles; such as contrast, emphasis, balance, unity, pattern, movement and

rhythm. And design elements also consist of seven elements such as colour, value, texture, shape, form, space and line. These can be identified as a law of designing any object. Park (2010) explained design principles and elements which are relevant to the field of multimedia and production in the following way; Elements of design described here are point, line, shape, form, space, colour and texture. And also he explained about various design principles, like the balance, proportion, perspective, emphasis, movement, pattern, repetition, rhythm, variety, harmony, and unity. These elements and principals can be the basic knowledge and analytical frame work for the designer. These basic categories are varying, according to the product variability.

Stout (2000) stated that, "everything you can see has a design. When we described some object or thing we have to use the words about, lines, shapes, colours, textures, and spaces. Line, shape, colour, texture, and space are the basic elements of design. The elements of design are important to everyone who works in textiles, and clothing, home interiors, wood working, photography, product design etc". Furthermore in according to the Stout (2000) rhythm, proportion, emphasis, balance, and unity can be identified as the principles of design. "Design elements can be explained as a tool of design something and the principles of design are how we organize or use the tools. When designing an art and craft product the relevant design elements and principles can be categorized as follows. Line, shape, form, space, colour, and texture are the design elements and the principles of design are balance, emphasis, movement, pattern, proportion, rhythm, variety and unity etc." (Idaho 4-H,2005).

Design principles and elements can be explained in several ways. In the field of ceramic, design elements and principles can be used to obtain a high quality product with design efficiency. Design is the organized arrangement of one or more elements and principles (e.g. shape, forms or texture) for a purpose. The elements and principles of design are important to everyone who works in the field of product design and industrial design.

The variety of design Principles and Elements can be identified in the field of product designing. These elements have differences according to product characteristics and it can be divided as follows,

Design Principles - Contrast, Emphasis, Balance, Unity, Pattern, Movement, Rhythm, Proportion, Repetition, Variety, Harmony

Design Elements- Shape, Form, Texture, Colour, Value, Space, Line

2.6 Use of Design Principles and Elements in Ceramic Design

Design Elements, and Design Principals are main aspects of the ceramic product. These two factors work together in combination and have an impact on the product manufacturing and product usage. It can be clearly seen when examining the products. Besides, these factors are important for efficiency of the product and make them more comfortable. When considering the relevance of design elements and principle in a ceramic product; it can be described as follows.

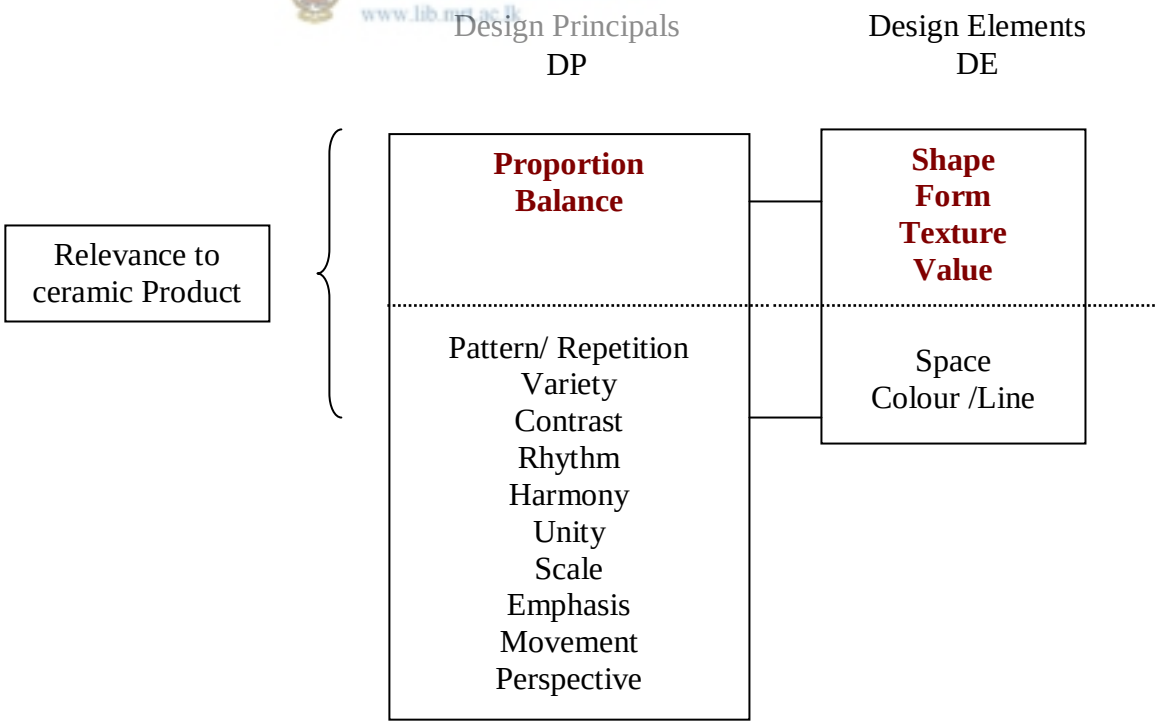


Figure 2.5: Basic Design Principles and Elements

There are several types of design principles and design elements which can be identified in the present. Selected design elements and principles have an effect on the field of ceramics. Proportion, Scale and balance can be identified as design principles and Shape, Form, Texture, colour and Value can be identified as design elements in the filed of ceramic. It will help to improve design value to achieve the design efficiency of the product.

2.6.1 Design Principles in Earthenware Ceramic Products

Design principle is an important key factor in a ceramic product. The principles of design govern the relationships of the elements used and organize the composition as a whole. Successful design incorporates the use of the principles and elements to serve the designer's purpose and visual goals. There are no rules for their use. The designer's purpose and intent drives the decisions made to achieve harmony between the elements.

Design principals can be identified in different ways. It is a necessary substance of the ceramic design. Few design principals can be identified as important for ceramic products. Proportion and balance are relevant for ceramic product. And also pattern, repetition, and variety cannot be identified as associate principles. The following sections discuss about the relationship between design principles and earthenware products.

2.6.1.1 **The Role of the Proportion of Earthenware Product**

Proportion can be identified as a compulsory aspect of the ceramic product. Proportion is the first principle of design. It helps to get the whole idea about the product, nevertheless to obtain aesthetical pleasing and impression about the product. “Proportion refers to the relative size and scale of the various elements in a design” (Park, 2010).

Stout (2000) stated that, Proportion refers to the relationship between one part of a design and another part or to the whole design. It is a comparison of sizes, shapes, and quantities. Proportion can be explained in several ways; “Proportion is the first principal of design. Proportion is the relationship of objects in space or the relationship of one part to another or the whole. The Greeks discovered many of the desirable rations of proportion; they discovered that a pleasing ratio is 2:3. This ratio is often called the golden rectangle. Another discovery by the Greek is that the division of a line between one-half and one third its length is the most desirable. They called this the golden mean. The golden mean is most often applied when planning the height for a mantel, trying back draperies, hanging pictures, mirrors, or wall cones. The least pleasing proportion is the square. The Greeks also discovered that odd numbers are more pleasing than even numbers; a group of 3 objects to 3 is more pleasing than 2 to 2”(www.uen.org). Golden ratio or Golden proportion is one of the standard ratios for designing products. It can be applied for designs and also for Architecture and Interior designs. Golden proportion is very much related to the ceramic design.

Proportion is a theory that can be used for every product. Every product has specific measurements of height, width, and volume. If any product completes these main elements it can achieve correct proportions. All proportions are originated with the nature. Nature is a good designer or a creator which introduces new theories in correct manner.

In domestic usage products, proportion can be identified as a main feature, which is very useful in handling of the product. Proportion of products like tea cups, mugs, plates, jars and cooking pots etc. have to be paid more attention in the manufacturing process.

2.6.1.2 The Role of the Balance of Earthenware Products

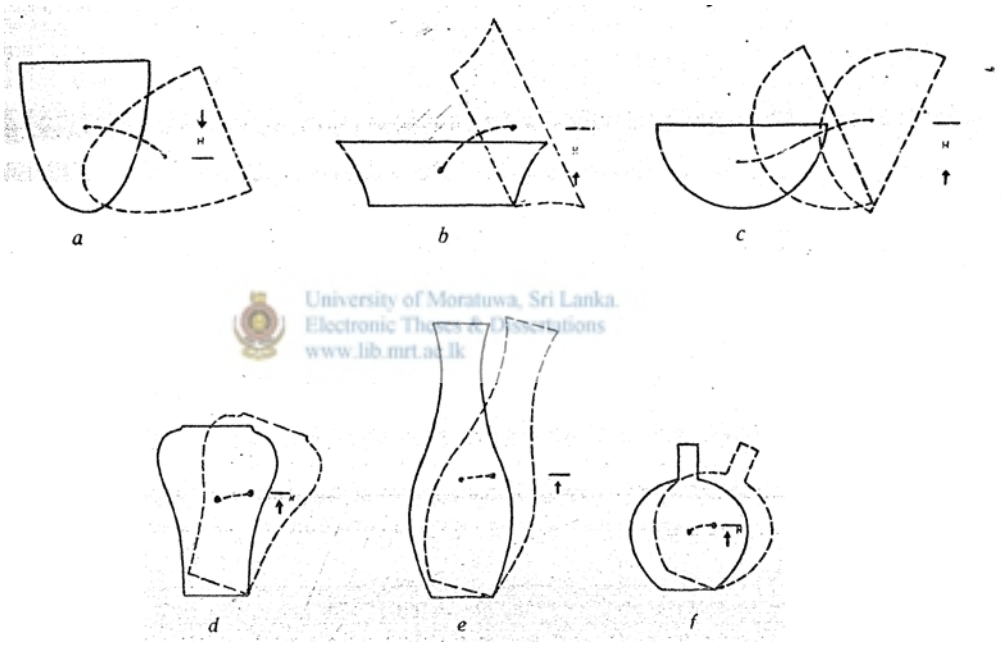
Balance is the state of equality when dealing with visual weight. Visual weight gives the first impression of the product. Visual balance is important for ceramic products. It can be enhanced using decorations. Glaze method or decoration method will help to control the visual balance. Objects of different sizes, shapes, and colours are used for the visual balance. Product balance is important for ceramic products. Because most of the ceramic products are used by one's hand, so that there should be specific weights and sizes. Balance can be identified as Symmetrical balance and Asymmetrical balance.

Most of the earthenware products are manufactured under the technical guidance to achieve the perfect balance. Firing cycle is one of the important facts to obtain correct balance of the product. Firing is a long technical process, which goes through several stages in order to get the proper shape and the form of the product. Balance depends on the shape and form of the product and it has an effect on the product stability. Center of gravity, foot/base types, shape of the body are important factors to keep the balance of the product. Balance gives a feeling of stability. Earthenware product has a radial balance and asymmetrical balance. Stout (2000) stated that; "designs that have a radial balance have a center points. Most of the earthenware product has a center points because most of product were created using with a potters wheel. All of cooking vessels have a radial balance. Asymmetrical balance creates a feeling of equal weight on both sides, even though the sides do not look the same. Asymmetrical designs also are called informal designs because they suggest movement and spontaneity".

a b

Figure 2.6: Structural Balance of Cooking Pots (a , b)

Product balance and base shapes have an effect on product stability. Earthenware product has different base shapes. Most of the cooking utensils have rounded base, which needs a *"Daranuwa"* to achieve balance on a flat surface (See Section 3.7.5- use of *"Daranuwa"*) and storage utensils have flat bases. *"Guruleththuwa"* is a good example for a flat base. The shape of the base has a good strength to hold big volume of water and it helps to turn object to pour water; though storage is the main purpose of this shape. The shapes of the base are designed in order to serve the purpose and functionality of a product.



Round base – a/b

Flat base – b/d/e/f

Figure 2.7: Vessel Stability

Source: (Shepard, 1974,p.237)

Figure 2.7 illustrates about the variation of base shapes. A designer ware handle is also used to obtain the product balance and a round base surface variety of foot types are used to fulfill the product balance. Product balance directly affects the usage and manufacturing clay cooking pots, because it is an important design principle in the field of ceramic design.

2.6.2 Design Elements in Earthenware Ceramic Products

Design elements are essential factors of the ceramic design. These elements are common for all product designs and also in the field of architecture. It is difficult to identify them separately, because all elements are combined with each other. Also It is a common theory for the ceramic design, as it includes more than one element. Shape, Form, Texture, and value are related design elements for a ceramic product. The following sections discuss about the relationship between design elements and earthenware products.

2.6.2.1 The Role of the Shape of Earthenware Product

Shape and form are the two main characteristics of ceramic products and they combine with each other. In this section it will be discussed separately but both are interrelated. Shape creates a form and form is developed by following the function. A shape can be defined as an area that stands out from the space next to or around it, due to a defined or implied boundary. Shapes can also show perspective by overlapping. Shape can be identified as the first impression, first appearance or identification of the product. It enhances first feeling of the product and form can be considered as second identification. Stout (2000) explained that, Shapes are made by connecting lines, circles, square, triangle, and freeform are words used to identify shapes. When describing basic shapes, it can be a one shape or a combination of many shapes. Line creates two dimensional or flat shapes. When shapes are three dimensional, it can be called as a form.

According to the Park (2010) there are two shapes and it is shown in the picture (Figure 2.8). The space around the shape is a negative space. It is important to consider the negative space as the positive shapes are shown in the picture. The positive spaces enhance the reaction and the effect of the negative space. When ceramic object becomes positive, the surrounding area or the background becomes a negative space.

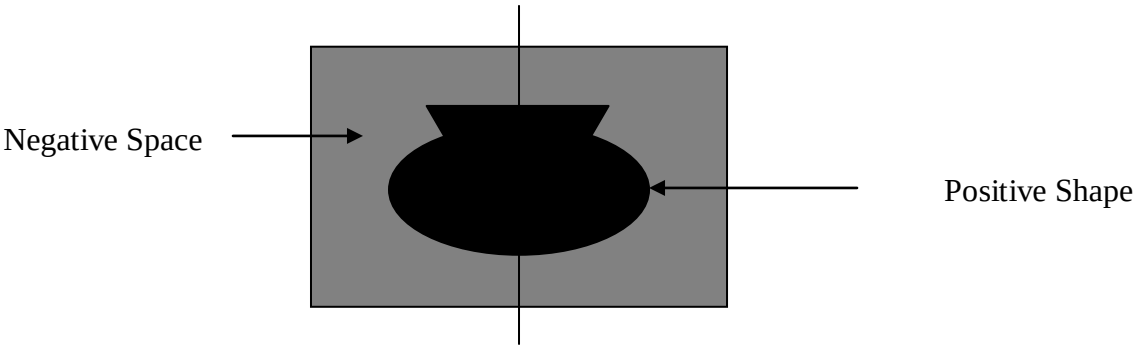


Figure 2.8: Positive Shape and Negative Space of product

Background helps to promote the shape and form of the object, decorations and colours. When displaying the objects these facts are really important to enhance the product quality.

All alone or in combination with other shapes or lines, they can convey universal meaning and also guide the eye or organize information. According to kyrnin (2011), stated that there are three basic types of shapes:

Geometric

Natural

Abstract

All designs are created according to those three basic types of shapes. All shapes are inspired by nature.

Geometric shapes are structured, often symmetrical shapes. These include shapes of squares, circles, triangles, diamond and rectangles, and also octagons, hexagons, and cones. Geometric shapes are rarely used in the ceramic design, due to the technical

and manufacturing limitations. There is a trend to use of abstract shapes for ceramic designs. Flower vases, ornaments, tableware items, tea sets are some of them.

Natural shapes are found in nature or they can be manmade shapes. Natural shapes are often irregular and fluid. Most of the earthenware cooking pots are developed using natural shapes. A drop of water provided inspiration for the shape of a goblet. As it has structured features, it is used as a storage object. Clay pots like *"Muttiya"* , *" Hattiya"* which are used as food storage and transport (water) objects are also further developments of the same inspiration. The shape of a pot was developed according to the product functionality. Practical usages are key factors to produce perfect products. Most of the clay products follow basic theories to achieve functionality. An examples *"Kalaya"* has a good quality for practical usage. It is an artistic object combined with functionality which is made to suit the women's hip. *"Kalaya"* with a long neck is more suitable for the hip. It has got the shape of a water drop; it has a center of gravity and also the volume. These concepts have enhanced the water pot. Natural shapes have been developed on basic theories to survive external reactions.

Basic Vessel shapes

Several types of clay pots can be identified in the world. The shapes and forms have different characteristics according to their usage. According to their shape and forms there are three types of vessel types as, cylinder shape, flat shape and sphere shapes. Sometimes they are merged together to create compound shapes.

"Pottery vessels are generally built using three basic container forms (cylinder, Flat, sphere) Although there are sculptural-style vessels that do not follow this pattern, nearly all pottery vessels do use the basic forms, either alone or in combination. When the basic forms are used together, the pot also has transitions from one shape to the next. Understanding these basic forms and transitional styles helps the potter create aesthetically pleasing pottery".

(Peterson,2011)

Figure 2.9: Basic shapes of Clay Vessels

The Cylinder

Figure 2.10: Development of Cylinder Shape on the Wheel

The Flat Shape

Figure 2.11: Development of Flat Shape on the Wheel

Figure 2.12: Development of Spherical Shape on the Wheel

a b

Figure 2.13: Use of Spherical for Vessels (a , b)

Shape identification is an important aspect of the ceramic design. Shapes give a basic idea of the product and shape is gradually converted in to a product. Shape is focused to gain a good functional value of the product. Sometimes shapes can not be developed according to consumers wish; it has much more technical and material limitations. Shapes have different meanings. According to Jirousek (1995) “Three dimensional shapes have an expressive vocabulary similar to that of line .this obviously follows, since line is always implied by the contours of shapes. For example, rectilinear shape suggests stability. Angular shapes placed diagonally in relation to gravity suggest instability and shapes that exhibit softly curving surfaces suggest quiet, comfort, and sensuality”. In general square shape denotes honesty and stability. Squares are familiar, trusted shapes and shapes of circles suggest infinity and it gives a feeling of protection. As an example most of the domestic products basically get circular shapes and finally they take a spherical form. Therefore cooking pots contain of a feeling of protection and infinity. In general, it can be described as shape has an individual meaning and it develops the form and creates a new product. Further, the meaning of the shape helps to develop an effective and efficiency product to the consumer.

2.6.2.2 The Role of the Form of Earthenware Products

Form is a development of the shape. It has a volume, which can be measured, from top to bottom (height), side to side (width), and from back to front (depth). The three dimensional shape and space of an object are the basic requirements of architecture and the most designed objects.

Idaho 4-H (2005) stated that, “Form is three dimensional shapes, expressing length, width, and depth. Balls, cylinders, boxes and triangles are forms”. Stout (2000) described, that “when shapes are three dimensional, we call them forms. A circle is a shape; a ball is a form. A square is a shape; a cube is a form. A drawing is a flat shape; a sculpture is a three- dimensional form. Ceramic vessels are a three dimensional form. It has a volume and mass”. Park (2010), explained as “Form

describes volume and mass, or the three dimensional aspects of objects that take up space. (Shape is two-dimensional) Forms can and should be viewed from any angles. When you hold a baseball, should or small sculpture, you are aware of their curves, angles, indentations, extensions, and edges- their forms" (p.4).

Besides the curves, angles of the product are also an important aspect in the form of a product. It has a rhythmical value and also an aesthetical value. Form can be described as one of the characteristics of the object. It helps to identify the quality of the product also. Form of a product is important in the process of manufacturing and in the usage.

Several types of materials are used to produce clay cooking pots. Compared to other materials like metal, aluminum, brass and stainless steels, clay is a very flexible material to convert in to three dimensional forms. Clay pots are interpreting form of the metal pot. Metal has a quality of overcoming manufacturing difficulties in different shapes and forms than the clay. When comparing metal and clay, it shows that metal has limited shapes, easy to clean and wash. Clay is flexible and some products are created to interpret the metal form. But all designs cannot be reproduced out of clay, as it also has material limitations. Although in the present *"Nebiliya", "Koraha", "Kalaya"* are made from metal. Cleaning these products are also difficult as their outer surface are very smooth, they are difficult to handle easily due to the heaviness and other disadvantages. Brass / metal *"Nebiliya"* is difficult to handle because of their heaviness and smoothness of the outside surface. Sometimes oxides would be formed on the metal surface. Presently most of the clay products try to resemble the metal forms and shapes, *("Thathchi", "Kalderama")* yet there are restrictions due to the material qualities. Metal and brass products are developed with rigid –straight lines, but clay product has smooth and curved shapes. The freshness and the smoothness of the clay cannot be found on metal, aluminum or stainless steel. There is a continuity of design and forms. Most of the products have their cultural identity which can be identified through material usage, shape and form of

the products. Basically shape and form can be identified as natural, arithmetical or synthesis. In a product, shapes and forms are developed to cater to functional needs.

2.6.2.3 The Role of the Texture of Earthenware Products

Texture is a surface condition of the product and it perceived surface quality. Surface quality is an essential part of the product. Texture can be identified in different ways, according to Idaho 4-H (2005), “Texture is the surface quality that can be seen and felt. Textures can be rough or smooth, soft or hard. Textures do not always feel the way they look” (p.2). Stout (2000) stated that “Texture is the surface quality of an item. It is how something feels when touched, or looks like it would feel it touched. Sandpaper is rough. Velvet is a smooth. A drawing of a tree stump could show rough outer bark and a smooth inner surface” (p.2).

Two types of textures can be identified in a ceramic piece:

Tactile / Real texture

Implied/perceptual /visual texture

The way the surface of an object is actually felt is known as tactile texture or real texture. This includes sandpaper, cotton balls, tree bark, clay surface, etc. Implied texture is the surface appearance of an object in the way that it is felt. The texture may look rough, fizzy, gritty, but cannot actually be felt. In ceramic there are two types of textures which enhance functional and aesthetical value. The surface quality is an important feature in a ceramic piece. Not only the inner surface but also the outer surface is important for the ceramic product. A smooth shiny surface can be obtained on a glazed surface. If it is not glazed it can be felt as rough because of the quality of the clay body. Non glaze body can be identified as a tactile or real texture and glazed surface can be identified as an implied or visual texture. The visual texture is not a real texture, as it is an effect of a quality of glazed, and it cannot be felt.

As mentioned above, surface quality is also an essential part of the clay product. it is understood that the inner surface and the outer surface have an effect on product functionality. Most of the earthenware and terracotta products are created with more texture effect. Earthenware cooking pots obtain a surface texture from the quality of the clay (size of the clay particles). The exterior surface texture is important to increase the quality of heat absorption. “Exterior texture improves a vessel’s heating effectiveness by increasing the exterior surface area and textured exterior surface also improve a pot’s resistance to thermal crack”(Skibo,Walker & Nielsen,1995,p.83).

Clay ware products can be identified as tactile texture, because clay ware texture feels to the hand. Smooth and rough surfaces can be developed from the clay material. Rough surface feel unfinished quality but it is a quality of physical component of the body. It helps to add porous quality and rough quality to the body. It is an advantage of clay ware (specially in earthenware) products. (Skibo,Walker & Nielsen,1995,p.83) stated that “But texturing does beneficially impact several other performance characteristic of cooking pots. In more recent replication experiments spalls formed on the smooth, un textured exterior surface of pots subjected to simulated cooking. This was caused by vaporized water passing through the vessel wall. Vessels with deeply textured exterior surfaces did not spall because the rough exterior, with its greater surface area, provided more escape routes for steam as it passed through the exterior surface. If the potter’s intent it to create a vessel that does not spall during cooking. One good solution is to leave it unsmoothed or to apply some form of exterior texturing”. Moreover texture is an essential quality for the clay cooking pots. It helps for the purpose of boiling, steaming, and frying foods. Earthenware clay body has a textured effect because of the particle size. If there are small particles, the surface gets a smooth surface. In certain stages texture becomes the decoration or decoration becomes the texture.

Ceramic texture can also be identified as a natural and artificial texture. Natural texture is produced from the clay quality and artificial texture is a result of manual

work. The textures are created as a result of engraving and emboss technique which can be categorized under the artificial textures. Embossed and engrave techniques are types of artificial texture.

Figure 2.14: Section of Embossed and Engraved Method

Functionality is an important feature of the product. Most of the clay products have textured surface to achieve grip for easy handling. A pot like *"Gas Muttiya"* is designed with outer texture with an engraving method, to have its functionality. There are several types of textured effects in the *"Gas Muttiya"*

Figure 2.15: Use Engraving method for
"Nebiliya"- Tactile Texture

"Nebiliya" and *"Koraha"* are another example for use tactile surfaces. It used engraving technique for decoration and also to obtain product functionality. The textured surface effected to achieve design efficiency of the object (See Section 3.6.2.1 & 3.6.2.2). *"Nebiliya"* has the textured effect on the inner surface and also has on the outer surface for functional purposes. The outer texture helps to create a grip between the thumb and clay surface when sifting the sand and grit from rice. Interior surface can be used for cleaning and smashing yams. *"Koraha"* is also an

example for a tactile texture object. The surface texture is used for functional purposes.

Implied texture can be created on a clay body by applying glazes. Glaze like a glass coat and it can be applied on top of the clay body. It helps to give a shiny effect to the surface and reduce the water absorption. The variety of texture effect can be achieved by the glaze surface but it cannot be touched as it is only to get a visual impression. Texture is an important feature for the ceramic products.

2.6.2.4 The Role of the Value of Earthenware Products

Value is the expressed quality of a product. It depends on the physical properties, structural properties and quality of the end product. It helps to express the product quality and to get the consumer's attraction. To have a clear and correct opinion of the product it is important the way of arranging, displaying and packing of products in a fascinating background.

The value of ceramic products can be classified as social value, cultural value, aesthetic value, and physical value. Ceramic products are more of eco-friendly and good for health. Colour, contrast, dark and light, decorations and attraction are associated aesthetical values of the product. Common value of the product is explained as; "Value is an element of art that refers to the relationship between light and dark on a surface or object and also helps with Form. It gives objects depth and perception"(www.wikipedia.com).

A quality of heating/ heat absorption, effect of cooling, water absorption (porosity), product weight and quality of thermal shock resistance are qualities of physical value of the ceramic product. Earthenware vessels have a special quality of giving good taste to food when they are cooked in them. That taste cannot be obtained using the

products manufactured with other materials. It is an advantage of the clay body. It can be described as a cultural value of the product. Therefore value is an important characteristic of the product.

Financial value is important for consumers; it depends on the quality of the product such as product size, structural appearance and it functionality. Prices of ceramic products cannot simply be ignored as price is really important when buying a product. In present, people try to buy quality products with concerning its functionality and efficiency with less concerning its price. Price of a clay product is less than the other cooking utensils made from other materials in the market.

Design principles are engaged in recreation in design. Sometimes all principles are used together and also they can be used separately. It depends on the product and its usage. However design principles and elements are basic fundamental of the design product.

2.7 Structure of Clay Vessels

Ceramic can be explained as an interesting, useful material in the world. Manufacturing ceramic product is a long process, which has diverse steps. In its appearance a clay pot looks like a simple object, but it is completed with advanced structural elements. Structural elements are important factors of clay vessels. Clay cooking pots can be used for several purposes. Structure of a clay pot consists of three main parts, Orifice, Body, and Base. These are main components of a vessels' structure. Variety of orifices, bodies and bases differ from vessel to vessel. It is defined by the usage and purpose of the pot.

Orifices (Rim) - Lips types
Body (Belly) - Body shapes and forms
Base (Foot) - Foot types

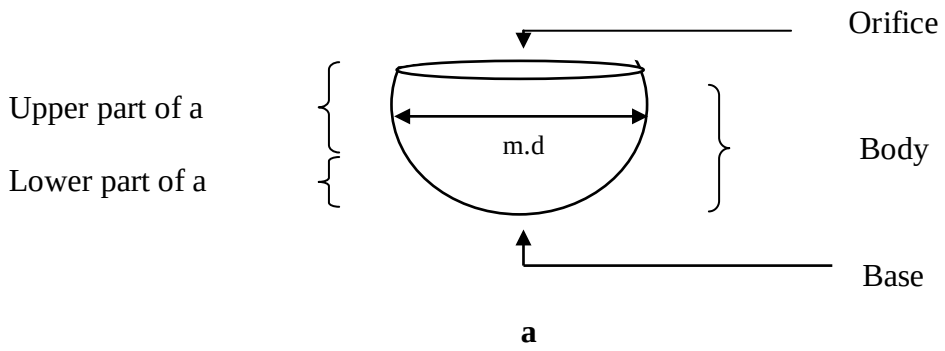


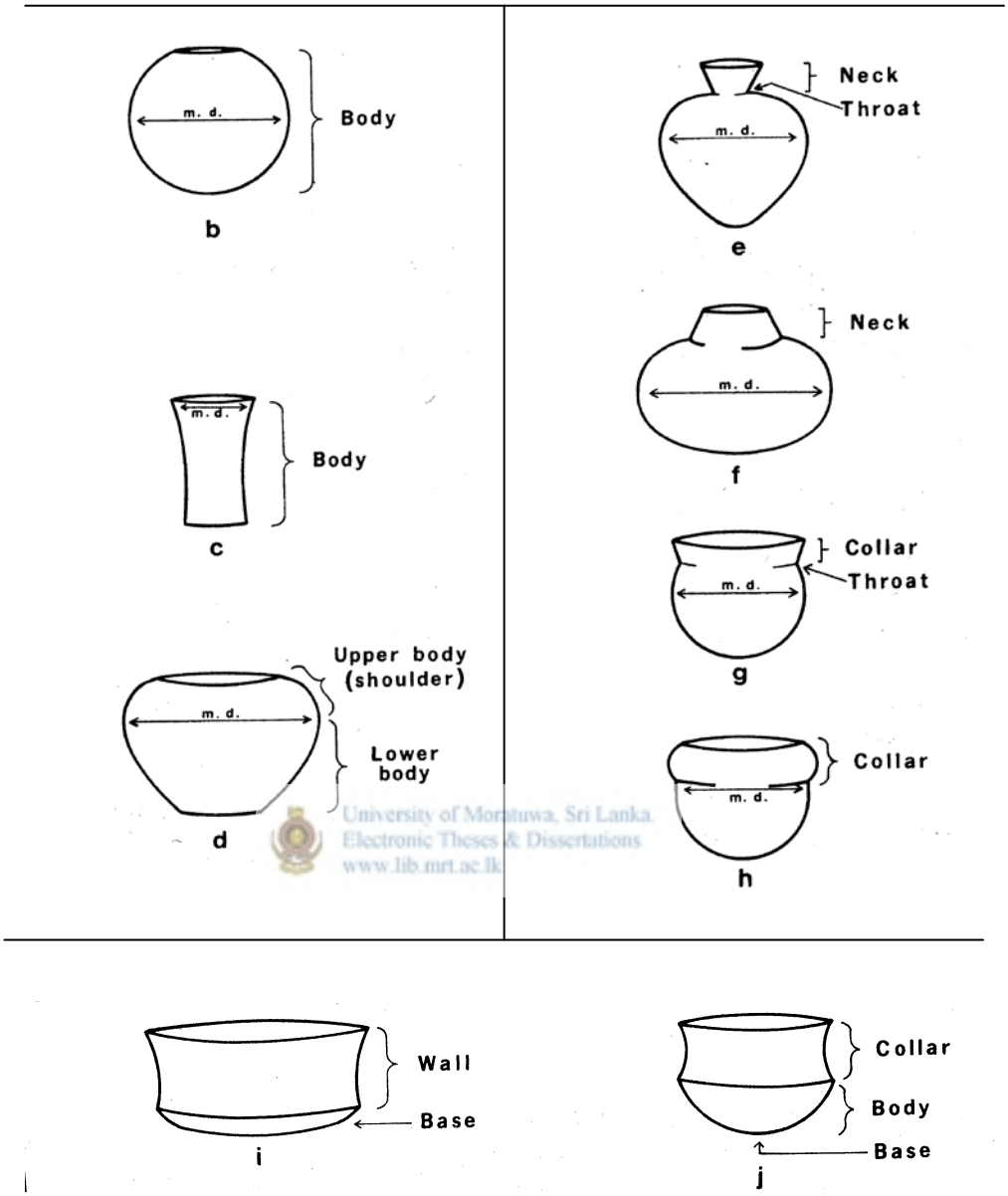
Figure 2.16: Structure of a Clay Vessel

The body of a vessel is identified as a belly, but generally it is known as the body. Area of a body can be defined as the area between the orifice and the base. It includes the maximum diameter of the pot (m.d.). It helps to generate volume of the pot. The maximum diameter of a vessel is found in the belly or body.

"The body of a vessel may be defined as the potion between the orifice and base that includes the maximum diameter of the vessel or the region of generate enclosed volume".

(Rice , 1987, p.212)

Vessels take different shapes according to the changes of orifice, belly and base.



a – Divisions of a simple vessel

b / d – Vessel body

e / h – Neck, collar, and throat

i / j – Base and body on composite form

m.**d**. = Maximum diameter

Figure 2.17: Major Subdivisions of Pottery Vessel

Source (Rice , 1987, p.213)

According to the Rice (1987) theory of shapes is described as follows, “The orifice, other mouth opening, of a vessel is subjected to a great deal of elaboration, mush of which is functional one is most important characteristics is its relation to the maximum diameter of the vessel. If it is equal to or greater than the maximum diameter, a, c. (Figure 2:16 & 2:17) it is described as an unrestricted orifice. If it is less than the maximum diameter, it is called the restricted orifice. On a restricted form, with the maximum diameter below the orifice of the vessel, the region between the point of maximum diameter and the orifice or neck is the shoulder or upper body of the vessel diameter. Sometimes the point of the maximum diameter alone may be called the shoulder. The area between the points of maximum diameter at the base is the lower body” (p.213).

The important characteristic of the orifice is the relationship with the maximum diameter of the vessel. If the orifice is greater or equal to the maximum diameter of the vessel it can be described as an ‘Unrestricted Orifice’. If it is less than the maximum diameter, it can be identified as a ‘Restricted orifice’.

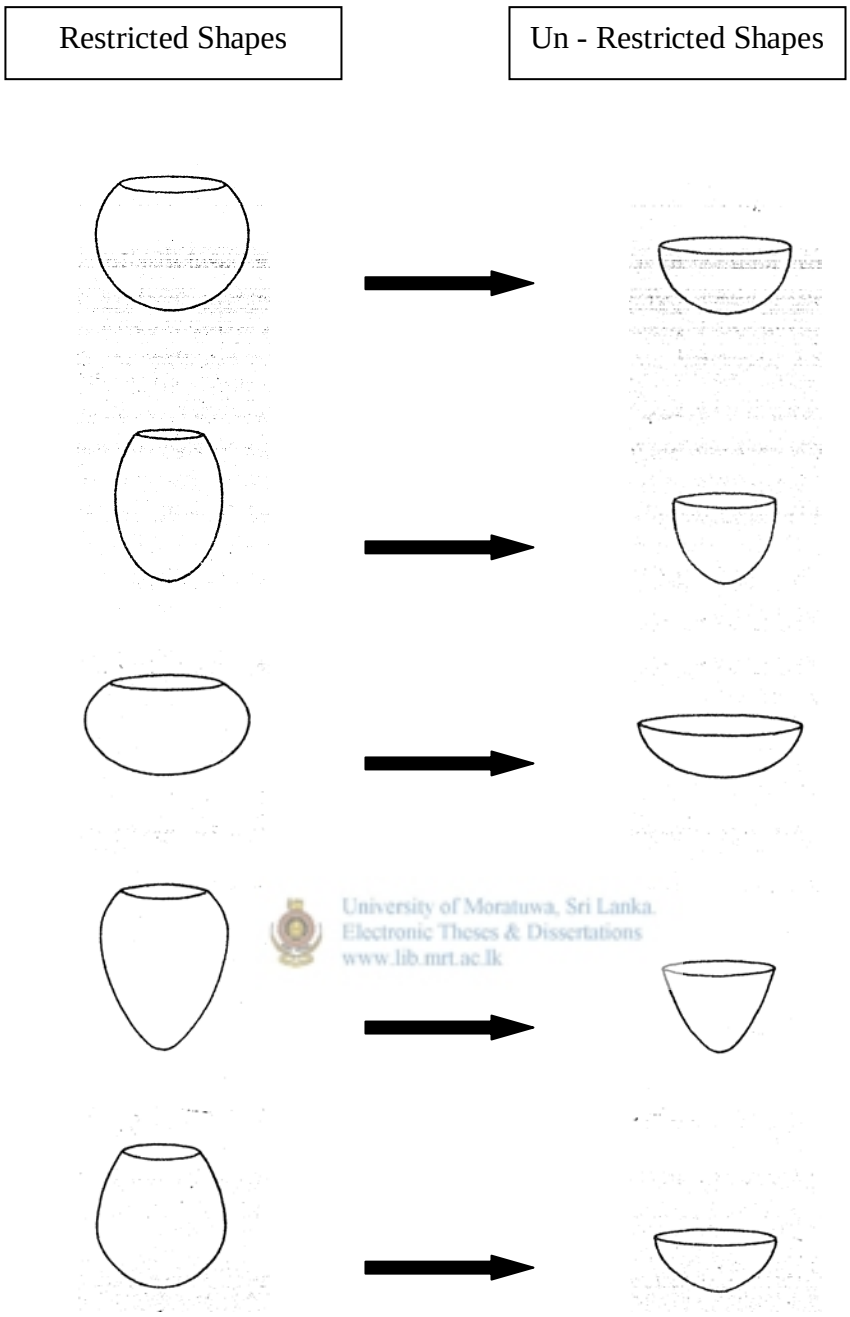


Figure 2.18: Restricted and Unrestricted Shapes

Restricted vessel provides the purpose of storage and it is preventive and safe. Restricted orifices are defined as having a diameter less than maximum vessel diameter. Unrestricted orifice has maximum vessel diameter. A neck provides prevention of a liquid from slopping. The unrestricted vessel is suited for all

purposes that require the use of the hands inside the vessel and also for display or drying of content.

Several types of unrestricted and restricted clay cooking pots are used for domestic purposes. By using the maximum diameter of the product, the body can be divided in to two parts as, upper part and the lower part. The upper part of the vessel consists of an orifice (lip, collar, and rim) neck and a part of body. The upper part of the vessel helps to cover the object and hang the object. The lower part of the body consists of a part of belly (body), and a base or foot. It helps to prepare curries and to keep the product stably. Most of earthenware cooking utensils have a round base and it needs a supportive element to keep it steady.

Most of the earthenware cooking pots have unrestricted orifices. From the bottom to belly of a cooking pot has a restricted form and gradually it takes an unrestricted shape when goes up to orifice area. It helps to prevent the spilling of gravy foods when cooking and transporting.

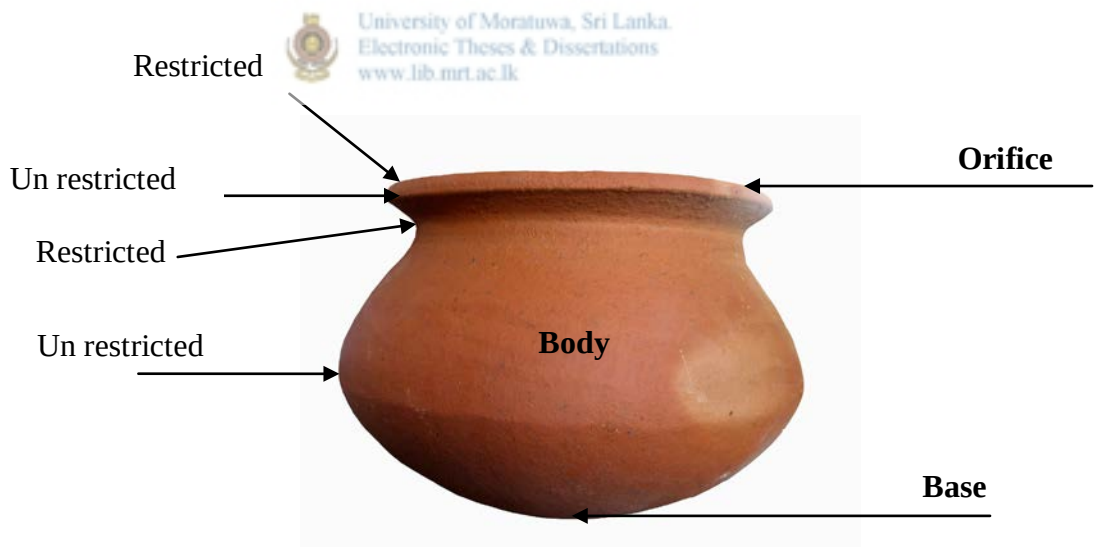


Figure 2.19: Earthenware Cooking Pot

Unrestricted orifices provide enough surface area to keep or hang the lid or other container on top of the pot. If it is an unrestricted orifice it provides wide open orifice

it did not provide safety, and easy to cool the foods. The angles of the orifices, body angles are changed according to the purpose of the product.

2.7.1 Structure of the Clay Pots and its Importance

Orifice, body and base are the main elements of a vessel. They have individual responsibilities and characteristics.

2.7.1.1 Orifice of the Vessel

The edge or margin of the vessel orifice is identified as the rim or lip of the vessel. It is the end point of the vessel or open upper edge of the pot. Lip is an important part in cooking pots. There are several types of orifices that can be identified from the clay cooking pots. It is an important part of the entire body, which helps to identify the finish and the quality of the product. The lip or rim of the vessel decides the restricted or unrestricted quality of the vessel.

"The orifice or examples, whether restricted, unrestricted, neck or collared may be described in terms of two secondary from characteristics, the lip and the rim. These two terms are often used interchangeably, because the point where one ended and the other begins is not always clear. The lip it self is easy to identify, beginning the edge or margin of mouth of the vessel, it may also be described as the edge of the rim of the vessel"

(Rice, 1987, p.214)

Not all vessels have simple contour however, often they have complex shapes consist with curves and angles. Specially an orifice or rim is known as a major part of a vessel. Orifice is a strengthening part or a modifier part of a vessel. It can be used for pouring, lifting, retaining liquids or of affording a decorative effect to carry the object, and important for staking the object. The sharp orifice is not suitable for cooking pots, because it is easy to damage and difficult to use. "Sharp openings are uncomfortable for drinking, and elaborate ones will make your beaker into a dribble glass. If the function is to hold flowers or some other object, think of how the rim area will help the viewer's eye makes the transition from the pot to the object it is holding".

(Peterson,2011)

Orifice is one of the functional areas of a product and it helps for staking the objects. Round or flat orifice surface helps for functional usage and also is used as a decorative area. The rim may be means of strengthening the orifice, of modifying form for functional purposes such as pouring, lifting and retaining liquids and affording a decorative effect. Several types of rim profiles are used for pottery manufacturing. The lip is finished by hand, the position of the thumb and fingers will determine whether it is rounded, tapered or squares. It helps to cater to the function. Orifice can be raised and extended up to the neck or collar. It serves the purpose of the body well.

Four basic types of orifices can be identified as Interior, Exterior, Interior and Exterior and Indeterminate. It depends on the shape and angle of the clay piece. Orifice is thicker than the body (wall thickness). It is an advantage for the usage of product.

a. Interior

b. Exterior

c. Interior and Exterior

d. Indeterminate

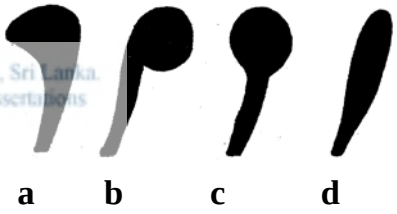


Figure 2.20: Position of Thickening with Relation to Vessel Wall

a. Abrupt

b. Gradual

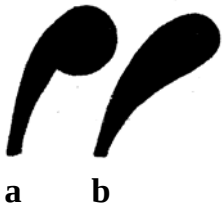


Figure 2.21: Junction of Thickened Part with Wall

a. Lip

b. Low

c. Medial

Figure 2.22: Point of Greatest Thickness

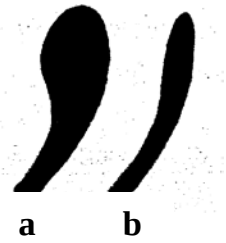


Figure 2.23: Ratio of Rim Thickness to Wall Thickness

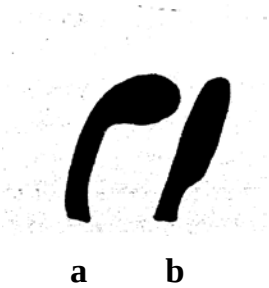


Figure 2.24: Relative Length of Thickened Part

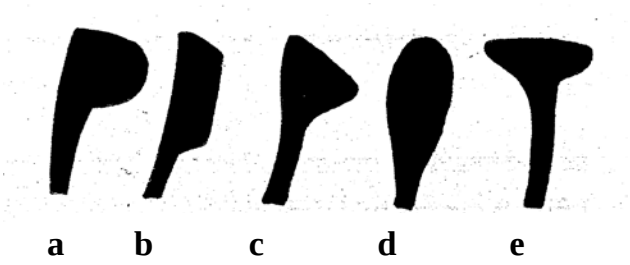


Figure 2.25: Shape of Thickened Part

Source (Shepard.,1980,p.216)

Lip or orifice is an important part of clay pots; it helps for hanging or carrying the object. It is a useful part of the body structure too. Grip is created as a result of shape or angle of the lip collar. Some products have necks, but clay cooking pots do not have necks. The neck of the pot, if there is one, also needs to follow its function. Certain necks are impractical for the purpose of storage, or for any other purpose that requires a hand to be able to reach its bottom. *"Guruleththuwa"* or goblet is a good example for the object which consisted with long neck .

The neck should also enhance the feeling you want to impart to your audience. For example, long thin necks tend to "read" as elegant, refined, and sometimes as prissy. Shorter, stout necks often give the user the feeling of sturdiness, stability, and strength.

2.7.1.2 Body of the Vessel

As mentioned above, the body of the clay pot can be identified as upper body and lower body. It is also named as a belly. The area between the point of maximum diameter and the orifice is identified as the upper body. The area between the maximum diameter and the base is identified as the lower body (See Figure 2.16) Upper part and the lower part of a body are important in body structure.

"The widest outwardly or convexly swelling area of a pot, especially if it is centered in the lower half of the form, is known as its belly. The belly, waist, and shoulder of a pot, taken together, are often known as the body of the pot".

(Peterson,2011)

There are several types of bodies which have been produced in pottery manufacturing. Most clay pots get a round body. The reason for that is most of the vessels are made out with pottery wheel. The shapes of body vary from product to product.

a b c

Figure 2.26: Variety of Body Shapes of Clay Cooking Pots

Varieties of body shapes can be found among the clay cooking pots in Sri Lanka. The body shapes depend on the purpose of the product and the way of cooking methods.

2.7.1.3 Base of the Vessel

The third region of the vessel is the base; sometimes it is called the foot. The base is underside of a vessel, touching the surface it rests on during normal use. There are two types of foots or bases which can be defined in a vessel, they are flat base and round base. Flat base is stable, and well fixed in to the basement.

a

b

Figure 2.27: Flat Bases

But curve base needs some foot basement. Most of the cooking pots have a round base. It needs some basement to keep it stable on the floor. *"Daranuwa"* is used as a supportive element to keep stability (See Section 3.7.5). Some vessels have small foot, like a collar. Pottery shape looks simple but it is combined with variety of shapes or combination of shapes. They can give a pot a strong tactile quality making it more comfortable in the hand.

a

b

Figure 2.28: Round Bases (a / b)

Figure 2.29: Product Stability

Clay cooking pot has a quality of heat absorption and heat transferring because it has a round base. When there is a foot for a cooking pot it cannot be kept on a hearth. It can be used as a cup, a plate or a lid. The base of a product is important for the stability and staking of the product. It is based on manufacturing and technical matters of the product. Base is a structure or a basement of the whole object. In a wheel thrown product basement is finished in the end of the product cycle.

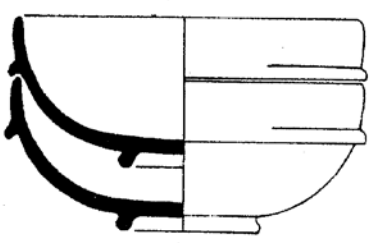


Figure 2.30: Base with a Foot

Figure 2.31: Staking of Clay Pots

These three basic elements are important for the products as the product structure is constructed according to these elements. Thus the more attention has to be paid to orifice, body and base in order to obtain an aesthetically and functional pleasing product.

2.8 Summary

This chapter has discussed about the design efficiency and functional use of ceramic products. It has briefly explained the relationship between physical and psychological comfort and how they can be increased by overcoming the certain drawbacks.

It has also included the basic theories of a ceramic product such as design principles and design elements as they have been identified as the main concerns in this industry. All these factors have been based on domestic earthenware cooking pots. The structure of the clay vessels and the importance of basic elements of the clay vessels (orifice, body and base) have been vividly described and explained in this chapter. Further it has also included the theory of a clay vessel, which has to be constantly used for the efficiency for the functional usage.

In next chapter origin of the domestic earthenware culinary products in Sri Lanka will be discussed taking the cooking pot *"Hattiya"* as a sample object. There the *"Hattiya"* and also the lid of it will be described vividly; considering all the important aspects of the products.

Chapter Three

CERAMIC VARIETIES AND IMPORTANCE OF EARTHENWARE CULINARY PRODUCTS

3.0 Introduction

Ceramic can be identified as a product which is made of clay by man. Ceramic has a long history. Several types of ceramic varieties can be identified according to their material compositions and firing conditions. Ceramic products can be used for several purposes and are mostly used for the cooking purpose. This chapter will describe ceramic varieties, origin of the clay cooking pots, and product categories according to the usage and their purposes in detail. Special reference has been made on earthenware culinary product concerning the factors like product structure, usage and functionality. "*Hattiya*" and lid are taken as sample objects for further discussions.

3.1 Evolution of ceramic ware in Sri Lanka

Man is a distinctive creation of nature. He has marvelous talents for creativity. They try out several materials to create new designs. When people became modern, their needs also got changed and complicated. They tried to find new techniques and new objects for a sophisticated life style. Most of the objects were produced considering functional usage and design aspects. Therefore new methods and new technologies were adapted to suit their life style. This was done by using their creative abilities and talents. New ways for producing objects for daily needs were developed through many experiments and experiences. As a result of their numerous experiments clay was identified as a quality and a flexible material which can be used to produce these objects.

The origin of the clay is known from the beginning of the earth and it was there during pre history of man as a useful material. It had been used as a material to make objects because of its' good plasticity.

"The art of ceramics is one of the oldest known, dating to prehistoric times. Clay is a special kind of earth, found all over the world that is easily worked when moist, but can be hardened and made waterproof by exposure to heat. The earliest forms of construction were pinched that is, the clay is formed with the fingers to the desired shape"

(Jirousek, 1995, p.1)

In the past there were several legends on invention of pottery. During the wet season man may have seen the foot print of animals in muddy places. Water was left in that foot print, even in the dry season. Most of the objects were discarded; some were burned in a wild fire during the dry season. During the rainy season people had seen that water gets collected in those objects. People learnt that clay can be hardened using fire. It was the invention of the pottery industry in the world. Clay is an available material on the earth, which is soft and flexible to the hand, when hold a lump of it. When it is pinched and pressed it takes shape; almost by it self. This piece of earth gets life of its own when you touch it with fingers. It changes the behaviors when mixed with water and fire. Using their experience, people tried to make different objects out of clay. Most of the designs were simple and creative. Functionality was the main aspect of the products which were designed by people.

"One is that most clay is plastic; it can be shaped and formed and will retain that from when dried. Another principle is that fire hardens clay. A third is that adding various substances to clay can improve its properties and usefulness"

(Rice 1987, p.8)

In order to understand the chronology of the local pottery production and usage, there are three areas such as the literary sources, archeological remains and the current usage of the prevailing tradition which can be explored. "As a result of the archeological investigation carried out in the country it has been reported that the pottery chronology from 900 BCE up to the present". (De Silva & Dissanayake , 2008,p.34) . (Somadewa, 2006) indicate a continuity of the pottery using cultural occupation of the area from 900 BCE to 1400 CE.

Pottery industry was established as an occupation in several places around Sri Lanka villages like Ranchagama in Rathnapura , Dorawaka Kanda in Kegalle are famous for clay products. The evidences have proved that most people had been engaged in pottery industry. According to the excavator; the first evidence of Sri Lanka crude earthenware (Red-Brown ware) association with stone tools (De Silva & Dissanayake, 2008, p.34) can be identified the origin of the local earthenware goes reverse towards period of hunter gathers of the Sri Lanka.

Before using clay objects people used different types of natural containers to fulfill their needs. *"Labu Kettaya", "Kolapatha", "Nelum kolaya" "Polkatuwa"*, animal skins, animal shells, and tree husks are some of them. People tried to make new utensils by doing experiments and using different types of materials. It was a case of trial and error. Natural resources could not fulfill their daily requirements. For example, they needed storage facilities to gather and to prepare foods. Clay was identified as a material to create utensils and objects. At the beginning people used less sophisticated pots to cater to their needs. "Vedda makes very rough pots" (Seligmann & Seligmann,1993, p.323). These pots has a small unfinished orifice, the special thing of it is they used a loop for hanging the pots. These were used to collect honey. They used simple decorations to make the product attractive.

Figure 3.1: Bowl- without Orifice

Added small Orifice

Figure 3.2: Development stage of *"Hattiya"*

Figure 3.3: Development stage of *"Muttiya"*

Figure 3.4: *"Muttiya"* with simple Decoration

Source: (Seligmann & Seligmann ,1993 p.328)

At the beginning, the designs were in a primary level as they only wanted to fulfill their basic requirements. Later on, aesthetic values also were considered in the industry. This led to new experiments and innovations widening the scope for multidisciplinary usage.

"The potter served the people and performed an important function in all period of the evolution of Sri Lankan society. Starting from the pre-historic time the use of pottery has been attested in the earliest stage of the appearance of our ancestors thousands of years before recorded history. Along with implements of hunting and food gathering earthenware had been used for storing, cooking and eating purposes"

(Tilakasiri, 1994,p.46)

Arrival of the clay cooking pots cooking methods, eating methods also changed. Wijesekara (1949) explained; "Cooking as it is practiced today was unknown to primitive men. Few foods were actually cooked in vessels. The meat may have been toasted or broiled over a fire. Roots and yams may have been baked under hot ash. The development of the culinary art was the direct result of the knowledge of pottery. Pottery helped to maintain a cleaner home. The clay vessels provided a surface of artistic expression and a mean of improving food by cooking" (p.29).

In the past people had directly used plastic clay as it was available. Later on they identified suitable clay materials with physical components. Although pottery craft was established in Sri Lanka after the arrival of Sangamitta Therani, pottery was known as a craft which dates back to prehistoric era.

"In 288 B.C. Sangamitta landed in Ceylon with a branch of the sacred Bo tree beneath which the Buddha had attained enlightenment. We are told that she brought with her eighteen personages of the royal blood, eighteen members of noble families, eight of the Brahman and eight of the setthi (trading) caste; and eight each of the herdsman, goldsmith and 'Kalinga' castes as, well as of weavers and potters".

(Coomaraswamy, 1979,p.3)

Other than clay metal, stainless steel and aluminum are used as materials to manufacture cooking pots. Clay pots are influenced from the format of metal cooking pots. Therefore people always try to get the same form of the metal cooking products for their clay cooking products too. However, this attempt is not very successful as the body shape and the appearance of the clay product would be different from the metal products due to limitations of the material (clay), technology and manufacturing process. Metal form can be used as, wire form, sheet form, and casting form. Clay product can get only solid and liquid format as it cannot have different thicknesses for the same object using casting processes. The physical quality of the clay body is important for cooking purpose than the material like metal for its body.

Earlier the product was manufactured to satisfy people's personal needs, or as a service, but with the passage of time objective of the manufacturers have changed and it has now become a paid work. The changes of the society, culture, and living pattern and people's needs, have become the concerning factors in this innovation. In the Sri Lankan pottery, all the designs, patterns, shapes, usage were changed due to the trades, exchangers and inoculation of other countries. Because of that, pottery industry had to bear many influences. Because Sri Lanka is in the middle of the Indian Ocean, Sri Lanka gets various influences by the trades.

Several types of clay deposits can be identified in Sri Lanka. Ceramics is a word that can be used to identify all types of clay compositions. Ceramic is an inorganic non metallic material in the world. It has a quality of flexibility and eco friendly. Ceramic has a much more limitations and barriers; technical and material limitations are mainly effected to product manufacturing.

At present several other good clay materials can also be identified. They can be classified according to the composition of body mixtures, firing temperature, body colour, and body effect. The classification of ceramics differs from one country to another. Five main types of ceramic bodies can be identified in Sri Lanka such as, Earthenware, Porcelain, Terracotta, stoneware and porcelain.

1. Terracotta
2. Earthenware – High Temperature Earthenware –
   (White or ash colour Reddish or Brown colour)
   Low Temperature Earthenware –
   (Reddish or Brown colour)
3. Stoneware - (Reddish or Brown colour , White or Ash colour)
4. Porcelain
5. Bone China

Most cooking pots are made of earthenware, because the material is available in many places. Areas such as Kelaniya, Menikhinna, Paduwasnuwara, Molagoda, Biyagama, , Nakandala, Dediyawala, Abagaswewa are famous for earthenware products since the early days. Pottery industry was developed in several ways. People tried to find new clay minerals. Variety of clay materials, variety of firing methods, fuel usage and product range also changed. In present there are several types of clay materials and large product ranges can be identified.

3.2. About Earthenware Products

Earthenware is the development stage of a terracotta (750 ^{0}C-850^{0}C) body. It can be grouped under two types such as, low temperature earthenware and high temperature earthenware. Low temperature earthenware is fired at around 750^{0}C -1000^{0}C, and exact type can be identified from the colour of the body and the strength. Most of the culinary items, water containers and pans can be categorized under the low temperature products. It has the quality of water absorption (porous body) and also less heat resistance. Firing can be done in normal wood kiln. Wood, coconut husks, saw dusts are used as fuel material. Tilakasiri (1994) stated that, “Earthenware clay is

the common red clay found in nature and mixed with sand and grit, mainly used for making bricks and tiles, the subsequent dirt –free layers of clay being used for making pottery" (p.48). Earthenware clay which contains stones and sand compounds is not good to produce clay cooking pots. It should be a fine and clean clay compound.

Figure 3.5: Earthenware Cooking Pots

According to De Silva & Dissanayake (2008) "The production of pots and pans in Sri Lanka was a well established craft which continued for the last 4000 years, little mention was found in literal sources, but archaeological excavation carried out in different parts of the island has provided sufficient information to understand the quality and the method of production , art, form, typology, distribution, usage, trade and technology of production of pottery during different periods of Sri Lankan history"(p.12). Five types of wares can be identified in Sri Lanka such as, Black and Red Wares (BRW), Red Wares (RW), Mica Coated Ware (MCW), Black Ware (BW), Graphited Ware (GW). Red ware is the most common pottery found scattered through the country. Red Ware is found in five basic categories. Plain Red Ware is most commonly found in normal low fired pottery. Fine Red Ware well finished fine body type. Painted Red Ware painted with different coloured clay before firing, and other two are Red Slipped Ware and Polished Red Ware De Silva & Dissanayake (2008).

If the surfaces of the pots are decorated with paintings and art works, it is called as a painted pottery. Kandyan era is famous for painted pottery and several types of

product categories belong to that era can be identified. More attention had been paid to the surface decoration of the product during the process of manufacturing. It was decorated with traditional motifs as decorative elements which gives an extra attraction to the object. They were very keen to manufacture the product using all their creative abilities as they derive pleasure from their work. Above all, the main objective of the manufacturing in that era was to present a high quality product to the society.

Figure 3.6: Decorated Water Pots

Source: Colombo Museum Collection

Figure 3.7: Decorated Water Pots

Source: Kandy Museum Collection

High temperature earthenware products can be divided in to reddish brown and white, according to colour of their body. The brown colour body mixture is a development of the low temperature earthenware body. It is heat resistant. It can be fired at around 1000^0C – 1250^0C in an electric or gas kiln. It does not melt because of the content of feldspar and silica. Advanced cooking pots and pans can be produced from this material. Strength is the advantage of this body mixture. Any glaze can be applied to this body because the body has the features to obtain high firing cycle.

White/ Ash coloured earthenware is a well known material in Sri Lanka. It is same as porcelain, but it is not expensive as porcelain. As a result most of the designers and manufacturers use white colour earthenware for their products. It has the necessary

strength and glaze which are appropriate for their products. Tea sets, tableware, tiles, sanitary ware and ornaments are made out of this material. Clay cooking pots are rarely produced using high temperature earthenware clay body in Sri Lanka. The production cost will be higher than the cost for normal production processes (low temperature firing), and also it needs high firing cycles. This temperature is difficult to achieve from the normal wood kiln. Low fired cooking pots are suitable to produce clay cooking pots, because it has a quality of water absorption and appropriate thickness.

3.3 Variety of Earthenware Products and Product Usage

Earthenware product can be identified as a quality and nature friendly material. The varieties of earthenware product cannot be limited to a one area and it has a high demand of many areas. As people's needs and their uses are different, they need a range of products cater to their daily requirements. According to the variety of clay products, it can be divided in to three main areas.

1. Domestic ware
2. Architectural ware
3. Ritual ware

These products have been categorized according to the usage of the product. Except those three categories, the ornamental ware and accessories also can be made out of clay material.

3.3.1 Domestic Products

Products which are mostly used in the household come under this category. Therefore they have become more familiar kitchen utensils. Earthenware, stoneware and porcelain clay are used to produce domestic products. Products used for the domestic purposes are clay pots and pans.

There is a diverse range of domestic products in Sri Lankan households. Earthenware products can be considered as one of the main domestic products. Most of culinary items can be categorized under the earthenware products. "*Hattiya, Muttiya, Athiliya, Kundahattiya, Appalla, Koras,* Lids" are known as culinary products. These products are mainly used in the kitchen or pantry. In the past there were several types of cooking utensils which were manufactured to fulfill people's requirements. The main aspect of domestic product is 'functionality'.

3.3.2 Architectural Products

Tiles, sanitary items, wash basins, and roof tiles are identified as architectural products. It has long manufacturing processes and different types of firing methods. It is quite different from the process of tableware manufacturing. Earthenware, stoneware and porcelain are used as main materials for the architectural products. Durability and the strength are the most important physical aspect of architectural products.

3.3.3 Ritual Products /Ecclesiastical Products

The vessels specially use in temples, "*Viharas'"* and "*Devalas'"*, can be identified as ritual products. It has a limited product range. Such as "*Dummala kabala"* (Incense Holder), "*Kothalaya"* (spouted vessel), "*Pahana"*, lamps are used for ritual purposes. These products have many conspicuous features. Ritual products are fully painted and they have an aesthetical pleasing.

3.4 Functional Aspects of Domestic Earthenware Products

As mentioned above domestic products are generally used in the kitchen. Cooking pots and pans can be categorized under the domestic products. Cooking pots can be divided in to three main categories according to the purpose of the usage, as these products can be used for several purposes. It is one of the special features of earthenware culinary products.

"Ceramic vessels have served a variety of culinary and non-culinary purposes for ten thousand years ago, but it is in domestic culinary containers may be used for carrying liquids, storing dry substances, or heating contents over a fire. Each use places different demand on the vessels, and so its suitability for a particular task on its design".

(Rice, 1987, p.207)

Either fashionable or plain clay objects would satisfy a wide diversity of human needs, both in the past and present. Earthenware vessels can be used for variety of purposes.

Earthenware products are used for various functions in the kitchen. Rice (1987) stated that, according to their function, domestic containers can be categorized as follows;

1. Processing Products
2. Transport Products
3. Storage products

3.4.1 The purpose of Earthenware Processing Products

Processing products are more important than the Transportation and Storage products. Because (preparation products) same products are used for these purposes. In the process of preparing meals there are number of stages one has to go through. *"Nebiliya", "Koraha", "Hattiya", "Muttiya", "Atiliya", "Kundahattiya",* and *"Appalla"* are used for different processes like boiling rice, cooking vegetables, fish and meals etc. These products have specific qualities to suit specific purposes, for an example *"Nebiliya"* has got a special quality to remove stones from rice. It has a concave surface for this purpose (See Section 2.6.2.1). Processing products have special qualities like thermal shock resistance, quality of rapid cooling and rapid

heating, and the quality of water absorption (some percentage). These qualities vary with the products which are used for different purposes.

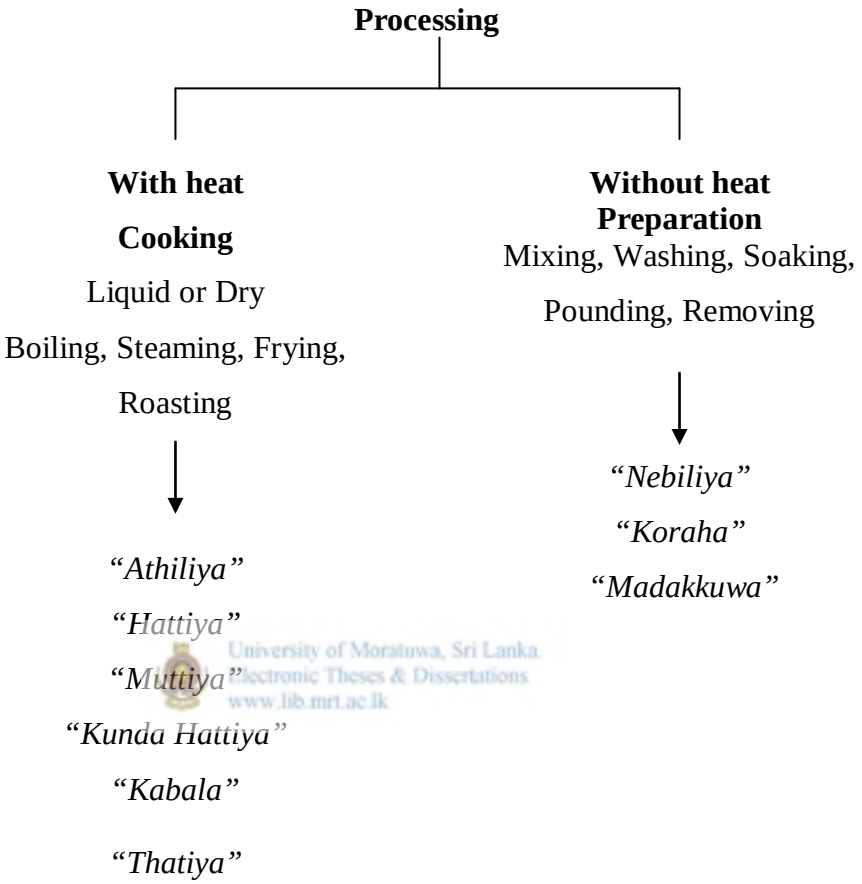


Figure 3.8: The Purpose of Processing and Use of Products

Processing objects are mainly based on the purpose of heating and non heating method. Boiling, Steaming, Frying, Roasting can be identified under the heating method and Mixing, Washing, Soaking, Pounding; Removing can be categorized under the non heating system. One product can be used for several purposes. It is a special feature of clay vessels. Some of the vessel forms are used for these functions and are expected to get the maximum use of the heat from the fire. They are generally likely to have a rounded shape rather than angled to avoid the thermal

shock. In addition the rounded contours permit greater exposure of the vessel's base, walls and content to the heat.

The shape of orifice is very important of the processing objects and their functions. Vessels can be named as unrestricted and restricted orifices. Unrestricted orifices (open lip) help adding and removing food, but slightly constricted or vessels which have a narrow necks would prevent overcook of food reduce evaporation. Vessels used for simmering or frying may be more open and have slightly flat bases. *"Hattiya", "Athiliya"* and *"Kunda Hattiya"* consist of a wide mouth with unrestricted orifices, wide body and flat or round base. Cooking pots have a grip to hang or for carrying purposes.

Thickness of the vessel is an important fact for the purpose of processing. Thick wall makes the clay vessels strong, so that pounding, stirring or mixing food in them can be done properly and easily. Thickness of the rim helps to hang the object properly. Thick wall can be a disadvantage for cooking, as it would pave the way to waist fuel by taking long time for cooking food.

3.4.2 The purpose of Earthenware Transport Products

In the past, food was carried from place to place, to serve different purposes. Clay products were used for food transportation (cooked foods) purposes. Earthenware is more suitable for food storage purpose as they have no side effects. But the time duration is limited to keep the food for sometime without getting spoiled. If it is a hot curry it can be kept at least 40 minutes without getting cooled, and having a good smell is another special quality of the earthenware clay body. It can be divided as short distance transport and long distance transport. Transport is rarely use in Sri Lankan society. According to the Rice (1987) it can be classified as follows;

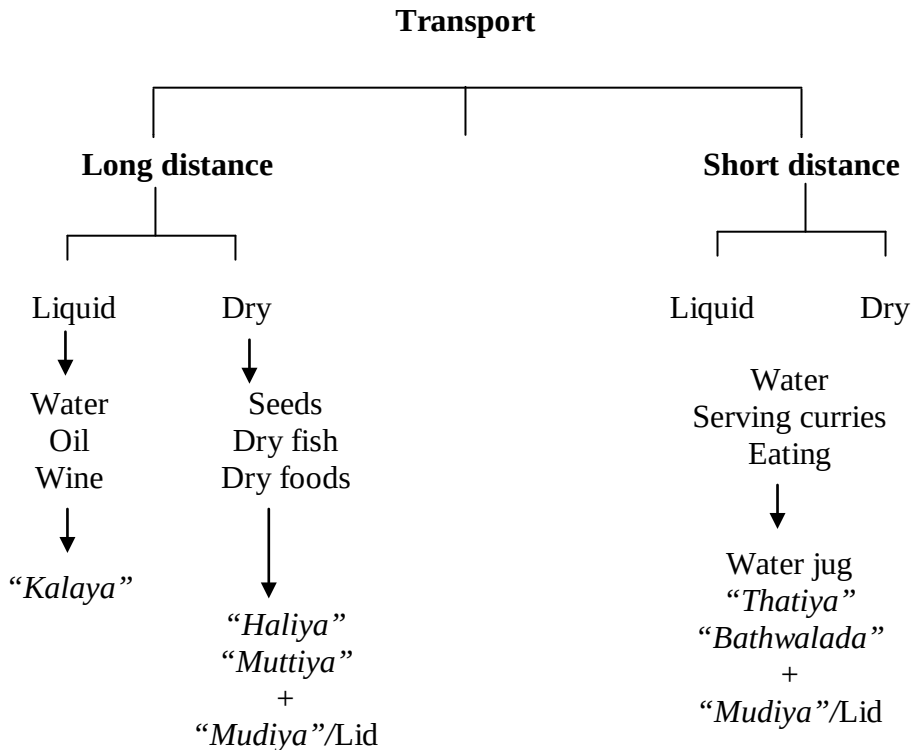


Figure 3.9: The Purpose of Transport and Use of Products

"Atiliya", *"Kundahattiya"*, *"Appalla"* are used for the purposes of long distance transport. But sometimes it can be used for short distance transport as well. Lid is very important to transport, these objects are used for covering the foods. Clay products like *"Hattiya"*, and *"Muttiya"*, cannot be separated as preparation or transport objects since most of them are used for both purposes. The usage varies according to the, behavior of the people and the provincial features.

Most of the objects which are used for transporting food possess a small opening, to reduce the spillage when it is transferred from one place to another. These vessels have special features; the thin neck profile helps to tight the container well and easy for hanging and handling. It is the main concern of objects in which liquids are transferred. Most of containers consist of a thick wall which helps to keep the contents cooler, specially storing the liquids like water. And it also helps to increase body strength and stability. Surface appearance is also important for transferring objects as surface texture or rough effects provide a much safer grip. There is a

variety of decoration methods which are used as functional purposes. Specially the neck surface is decorated with texture designs.

Besides these facts curry pots are used for long and short distance. Items which are used for eating and serving purposes have open unrestricted orifices. This makes easy access for serving and eating food. Most of the serving objects have a flat base; which maintain stability of the product. Most of vessels have thick wall and sloping shoulders in order to keep the warmth of the contents and prevent spilling while it is carried or passed around. Nowadays *"Hattiya"* and *"Athiliya"* are also used for serving purposes. They add a new impression to the table.

3.4.3 The purpose of Earthenware Storage Products

Storage is one of the original ways of storing food in Sri Lanka. People used to store their food for future needs, by using different traditional methods. Sand, salt, and clay were used as storage materials. Earthenware serves the purpose of storing food as it was no any bad effect on food.

There are two types of storages; long term storage and short term storage. It can also be classified as dry storage and liquid storage. "Vessels used for long term storage or needing infrequent access is generally large and when full it too heavy for easy movement. A survey of ethnographic data suggest that liquid storage vessels may be move available in shape than dry storages vessels; liquid vessels are relatively short and squat" (Henrickson & Donald 1983,p.623).

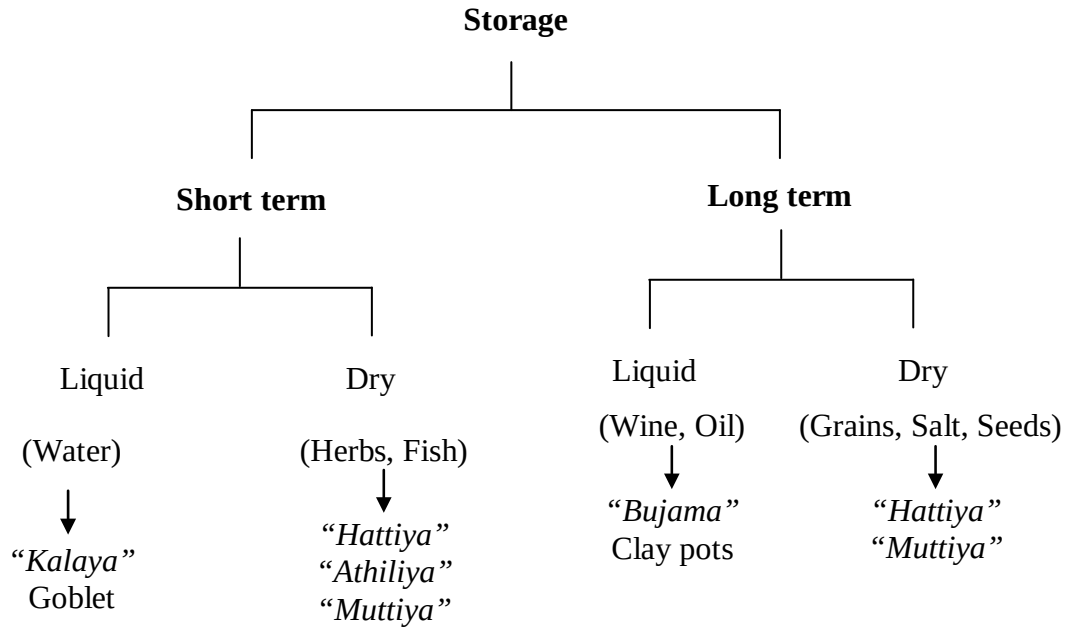


Figure 3.10: The Purpose of Storage and Use of Products

Vessels used for long term storage have a greater volume than those used for short term storage. Specially in the short term and long term, dry storage vessels have unrestricted orifices. Wall thickness is important for products of storage because it improves vessels stability and keeps moisture content outside and inside of the vessel.

Dry storage vessels are short, broad and squat while liquid storage vessels are tall. Liquid storage vessels have unrestricted orifices, which help to reduce spilling. Lid or *"Mudiya"* can be used as a covering object. There are more dry storage methods than the liquid storage methods in Sri Lankan kitchen. Sometimes both come together. *"Hattiya"*, and *"Muttiya"* are used as storage items. *"Pani Kevum Muttiya"* is a special object in the New Year season. *"Kevum"* can be kept for a long time by adding treacle. It can be identified as a dry and also a liquid storage method. Typically *"Pani kevum"* is used after the new year season. Other one is known as *"Achcharu Muttiya"*, which is also used at special events of the house. Earthenware is the only object that can be used for this purpose. Since it shows no reaction to any acid, *"Achcharu"* is kept only in that pot.(because vinegar is used for preparing

"Achcharu"). In addition to that *"Jadi Muttiya"*, *"Pani Muttiya"*, are special storage elements in the Sri Lankan kitchen. Gunasekara, Premathilake & Silva (1971).

Storage products can be described as short term usage products and long term usage products. The *"Muttiya"* can be covered with the base of the *"Nebiliya"*. It is well fixed to the orifice, and it provides air seal surface. When the *"Muttiya"* is used for short term usage *"Nebiliya"* is kept on the top of the orifice keeping it upside down.

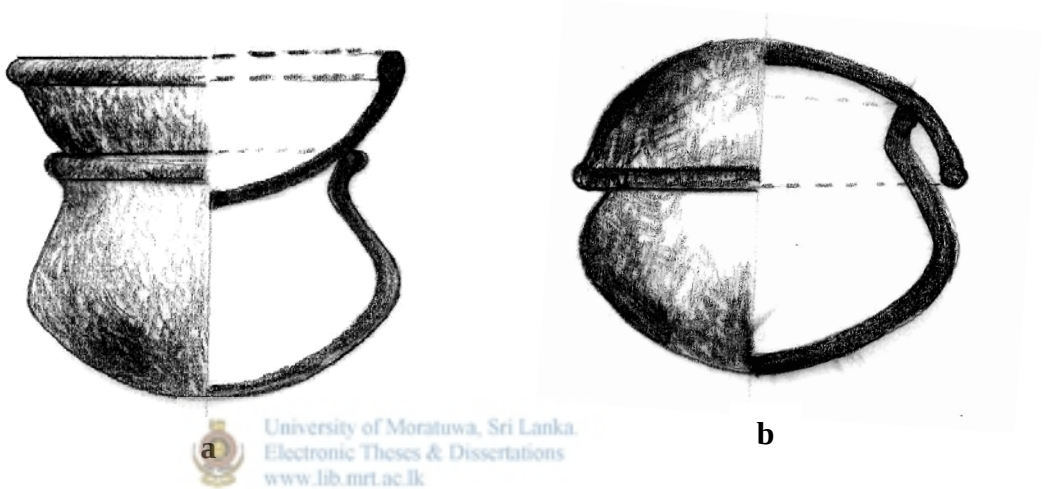


Figure 3.11 : Storage *"Muttiya"* and *"Nebiliya"* (a,b)

3.5 Basic Cooking Methods in Sri Lanka

Several types of cooking methods can be identified in Sri Lankan society. Sri Lankan food is spicy and nutritious. According to the method that Sri Lankan dishes are prepared, it can be divided in to four groups, as;

1. Boiling
2. Steaming
3. Frying
4. Roasting

3.5.1 Boiling

The food is heated until the water inside is boiled. This method of preparing food dates back to prehistory. Humans would have started boiling food from the time they discovered fire. Boiling is a quick method of preparing meals and it does not destroy the nutrients of the food. One can prepare grams, cereals, yams and vegetables by boiling.

The water should be heated beyond 100^0C in order to prepare the food properly. The container that is used for this purpose must also be able to withstand heat. Earthenware products can be used for boiling food. Their ability to withstand heat is an advantage.

Among earthenware products that can be used to boil, *"Muttiya"* is very important. A part from that, *"Hattiya"* and *"Athiliya"* are also important. The interior of the pot that is used for boiling must be spacious. When food boils, it moves to and fro inside the pot, it is vital that the pot has enough room to allow this. Thus, the body of the pot needs to be big and the belly needs to slim down (in width) gradually. This helps to increase the air pressure inside the vessel and to minimize the outward flow of hot air. By covering the top (orifice) of the vessel, it can accelerate the boiling. *"Karamudiya"*,*"Nebiliya"* or *"Madakkuwa"* can be used to cover the orifice. One need to seal the orifice of the *"Muttiya"* and the *"Nebiliya"* is ideal for this. In conclusion, pots with greater depth and small orifice are ideal for boiling food.

Figure 3.12: *"Muttiya"* covered with *"Nebiliya"*

Rice is prepared in such vessels. The *"Muttiya"*, in which rice is cooked, is covered at the top (orifice) with *"Nebiliya"*. Ones the rice is boiled the fire is lowered to allow it simmer. The orifice, then, is covered with the *"Nebiliya"* and the steam inside the *"Muttiya"* boils the grains of rice. If the food is boiled prior to cooking, the amount of time required for the cooking process comes down. It is important to pre cook (boil) food such as potatoes and sweet potatoes.

When cooking in a clay pot, the vapour gets out through the body surface. This happens because the clay is porous, and it is definitely an advantage. *"Muttiya"* is ideal for boiling. Apart from that, *"Hattiya"* and *"Athiliya"* are also used. The round shape of the *"Muttiya"* allows holding a large amount of food inside it. The *"Muttiya"* is manufactured to withstand the pressure that is generated inside it (when cooking). That is why it has a thick body. The *"Muttiya"* also has a wide collar which allows lifting it easily.

3.5.2 Steaming

Steaming is another method of cooking in Sri Lanka. Even sweetmeats are prepared by steaming. Food that easily dissolves in water is prepared using this method. Food(s) such as *"Pittu"*, string hoppers, *"Helapa"*, *"Wandu"* yams and cereals are steamed. Wheat flour and rice flour are also steamed.

Quite a large vessel is required for steaming because a large vessel can hold a large amount of water which will generate a lot of steam. And the vessel should have a restricted orifice in order to steam effectively. The vessel is filled with water and the orifice is covered with a cloth (ideally a clean cotton cloth). This piece of cloth is known as *"Kadawesma"*. After that food is laid carefully on the top of the cotton cover. Then, the food is entirely covered by another vessel. A special lid is used for this, which is called *"Karamudiya"* or *"Wahantharawa"*. The purpose of the second cover is also to retain the evaporated water. The *"Pittu Mudiya"* is a special lid used for covering, but a big *"Karamudiya"* can also serve this purpose.

"Muttiya" or a big *"Hattiya"* is used to fill water. This vessel should have a large body. This is covered with a *"Pittu Mudiya"* which is shaped like a bell. This shape allows holding a lot of food inside, and as it gradually becomes slender towards the top, hot air can circulate very well inside it. This lid has a small knob to lift it. Towards the bottom, the shape becomes restricted but it ends with an unrestricted collar. The collar and the knob are essential to lift the lid.

As this vessel is made of earthenware clay, it can withstand a lot of pressure. The thickness of the body and its shape are other important factors that make the vessel pressure resistant. For the lid to remain stable on top, its weight and strong wall are important. The strong wall absorbs air and water.

The water must be heated well to steam food. A hearth that uses firewood would take 25 to 30 minutes to get heated while a gas cooker would take 15 to 20 minutes. This time differs according to the size of the vessel, the amount of water in it and according to the properties of the clay body.

Figure 3.13: Use of *"Kadawesma"*

3.5.3 Frying

Preparing food by frying is another method of cooking in Sri Lanka. There are two methods of frying; surface frying and deep frying. Different kinds of oils are used for frying but coconut oil is the mostly used oil. Butter and margarine can also be used for frying. They give more flavors to the food. Unlike water, the oil must be heated to 100^0C or higher. And the utensil that is used for frying must be made of a material

that can withstand such temperatures. Earthenware cooking pots can withstand such temperatures. Only a little amount of oil (or margarine, butter) is used for surface frying. Oil is not absolutely necessary when surface frying in clay pots. If it is a pot that has been used previously, it has an oily surface. The interior is non-sticky. As the clay body has absorbed oil that was used in previous occasions, the pot will have an oily surface when reusing. *"Hattiya"* and *"Athiliya"* are also used for frying. The depths of these utensils are essential for cooking and mixing the food. Apart from these utensils, clay *"Thachchi"* is also used in some areas. *"Mellum"* and various other foods can be prepared by surface frying. Coconut, which is used for *"Mellum"*, also increases the oiliness of the surface. As too much fat is harmful for the body, this method can help to avoid health hazards.

Deep frying requires a utensil with a wide orifice depth. One can use *"Hattiya"* and *"Athiliya"* for this. The shape of the bottom of those pots help hold oil and heat it quickly. The foods cooked in clay pot have a better taste. And one can store the food for 2 or 3 days in those pots. In order to do the storing properly, one must remove the excess oil in the pot. The porosity of the clay body plays an important role here. Therefore metal pots are more suitable for deep frying than the clay objects as they (clay objects) have the quality of porosity. Metal (*"Thachchi")* pots are used to prepare traditional sweets like *"Kevum"*, *"Kokis"*, and *"Aasmi"*.

3.5.4 Roasting

People have been roasting food for a very long time. Among food that is roasted, meat and yams are the most important ones. *"Kabala"* and *"Thatiya"* (tray) are the earthenware pots that can be used for frying.

"Roti" and *"Dosai"* are among the food prepared using *"Thatiya"*. Sometimes *"Thatiya"* comes with only one handle (instead of two). The round edge of the orifice prevents food from spilling. It is easy to clean this utensil. *"Kabala"* has a wide mouth, an orifice and an unrestricted shape that help to absorb heat well. Its

wide surface helps to evaporate the water content of the food rapdly. Grains, nuts, chilli, pepper, and rice are roasted using *"Kabala"*.

3.6 Identification of Earthenware Culinary Products

Earthenware vessels are named in different ways. In general terms used for vessels are *"Valam"* or *"Hatti"*, *"Mutti"*. There are several types of Earthenware pots available in Sri Lankan society. The usage of the product, functions and the product identifications (name of the product and according to the product sizes) may vary according to provincial features. These products can be used as short term usage and also the long term usage. Generally earthenware products can be identified as follows.

Table 3.1: Function Terms of the Local Household Pottery

Function	**Common term**	**Size**		
		Small	**Medium**	**Large**
Storing water	*Kale*	*Kotale*	*Kale*	*Bujama*
Begging foods	*Patraya*	*patraya*	-	*Taliya*
Boiling/Storing rice	*Halivalam*	*Mutti*	*Appalla/Hali*	*Barani*
Cooking curries	*Halivalam*	*Kundahatti*	*Hatti*	*Athili*
Eating /Cleaning rice	*Halivalam*	*Adivalanda*	*Koraha, Nembiliya*	-
Boilling paddy/rice	*Appallapodi*	-	-	*Mahaappalla*
Covering Vessels	*Mudi*	*Pittumudi*	*Karamudi*	-
Eating foods	*Taliya*	*Pingana*	*Palagana*	-

Source: (De Silva & Dissanayake , 2008, 20p)

3.6.1 Earthenware Culinary Products and it Function

Earthenware cooking pots can be described as cooking pots, pots used for cleaning and washing food items and auxiliary products.

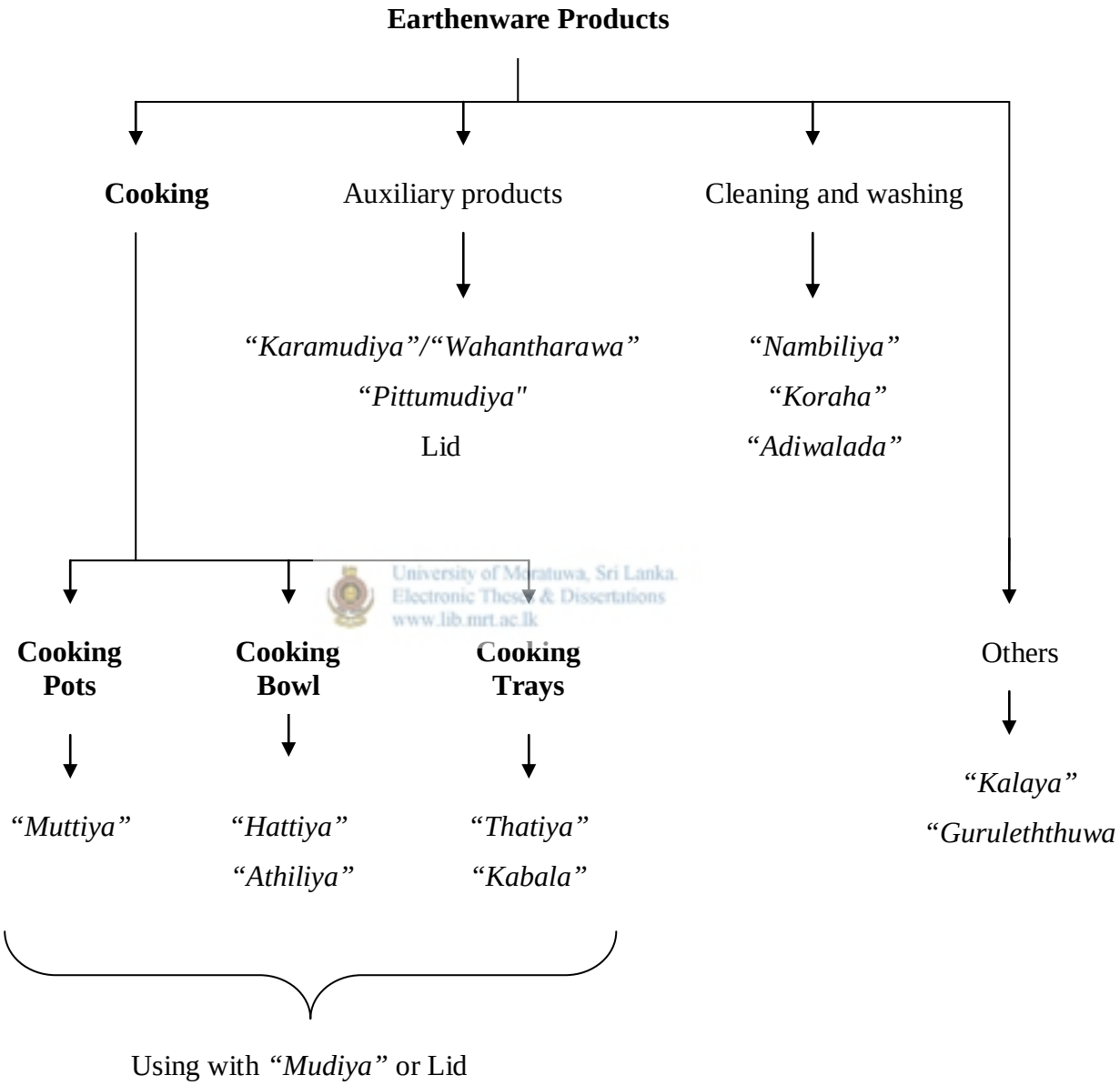


Figure 3.14: Earthenware Culinary Products and their Functions

3.6.2 Identification of Earthenware Cleaning and Washing Objects

3.6.2.1 *"Nebiliya"*

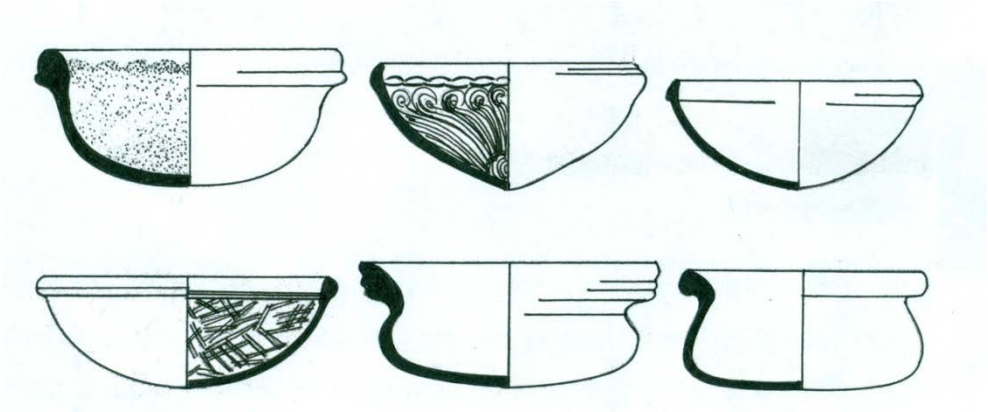


Figure 3.15: Variety of *"Nebiliya"*- Section

An unrestricted bowl type vessel has simple contours. Position of rim ticking in relation to vessel wall is on the exterior and junction between the thickened part and wall is abrupt. Point of greatest thickness is at the bottom. Shape of thickened part is slightly convex downwards to the exterior. The mouth is wide and the diameter of the orifice is nearly twice the vessel's height. Characteristic comb marks inside is for sifting the sand and grit from rice mainly. *"Irigahana katuwa"* is used to decorate the object before the pot is fired. This textured surface helps to develop the functionality of the product. Interior surface with a rough texture can be used for cleaning and smashing yams. The idea of sifting to see the sand remains in the vessel whilst the water and rice pour out from the*"Nebiliya"*to another vessel. In this process the rim works as a drip ledge. Any types of grains are shifted in this, such as *'Kurakkan, Meneri,'* Green gram, etc.

(Alles, 1997) stated that, The *"Nebiliya"* is fashioned like a gemming basket and serves a similar purpose. It is used for washing rice and as gemming basket the stones, being heavier, sink to the bottom and remain in the grooves of the pot when the rice swirled round and that which comes to the top with the addition of water is slowly allowed to pass through the fingers a little at a time in to another open vessel or bowl, usually a *"Koraha"*. This process which is repeated again and again, each

time with the addition of a little water taken by dipping the *"Nebiliya"* in to the water in to the *"Koraha"*, is known as "*Garanawa*". Different shapes of *"Nebiliya"* can be seen in different areas in the country. They take these different shapes according to the particular purpose of using the product. Three types of *"Nebiliya"* can be identified in the past *"Banda Nebiliya"*, *"Thoppi Nebiliya"* and *"Kara Nebiliya"*. *"Kara Nebiliya"* is used in present and also it is used as a lid when cooking rice.

3.6.2.2 *"Koraha"*

Figure3.16: Variety of *"Koraha"*- Section

"Koraha" is a pot much bigger than the *"Nebiliya"*. A foot is fixed at the bottom to steady the vessel when placed on a flat surface. Characteristic comb marks inside is an essential feature for sifting rice. Rice is sifted in to *"Koraha"* with the help of *"Nebiliya"* and the rice after sifting is rubbed and washed in the *"Koraha"*. Position of thickening in relation to vessel wall is in the exterior. Junction of thickness is at a low level. The shape of thickened part slopes downwards to the exterior. This rim helps to pouring water from one vessel to another, and also holding it firmly with hand. *"Diya Koraha"* and *" Pol Koraha"* are bigger than the normal one and they are used for bathing and *"Vilkoraha"* is another type, which is used for soaking of paddy.

3.6.2.3 *"Adi Walada"*

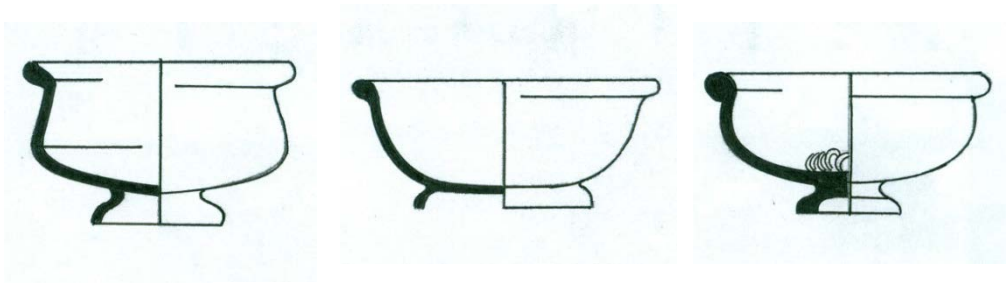


Figure3.17: Variety of *"Adiwalada"* - Section

A shallow bowl with a circular stand; this is called the *"Adi walada"* or *"Mati coppaya"* and *"Bath walada"*. This is an unrestricted vessel with a wide mouth. Position of thickening in relation to vessel wall is in the exterior. Junction of thickened part with wall is gradual. Shape of thickened part is slightly convex on the exterior. This rim can serve as a drip ledge and a holder for the vessel. Normally this serves a variety of functions such as to scrape coconut in to it and squeeze coconut to obtain milk, to wash vegetables as a container or a bowl, and this is also used a s a lid for curries etc. some people eat rice in this pot using as a plate. It is because the particular form of this pot which serves so many purposes, but there is no specific size for this pot. This is called the *"Adi walada"* or *"Mati coppaya"* by the low country people, while the up country people called it *"Bathwalada"* or *"Madakkuwa"*.

3.6.3 Identification of Earthenware Auxiliary Objects

3.6.3.1 *"Karamudiya"/"Wahantharawa"*

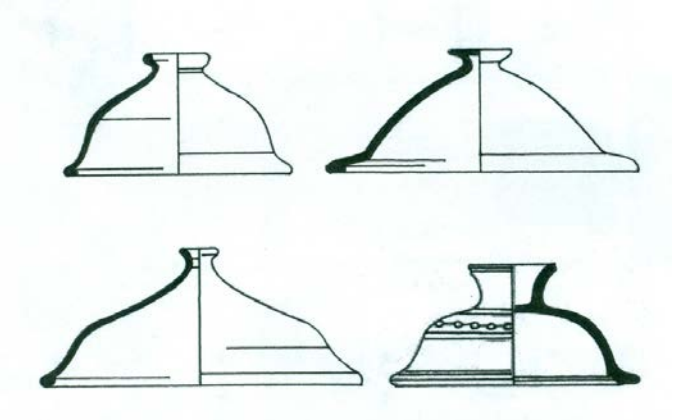


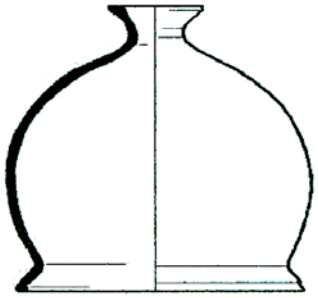
Figure 3.18: Variety of Lid- Section

Lid can be named as *"Karamudiya"*or*"Wahantharawa"*. It can be used to cover the *"Hattiya"*, *"Athiliya"* and *"Muttiya"*. This is a piece of shallow pot with a wide mouth. It has a round shape knob on the top to hold it. But when resting on the ground, this handle is used as the stand.

Figure3.19: A Lid

3.6.3.2 *"Pittumudiya"*

a



b

Figure 3.20: Section of *"Pittumudi"* (a , b)

a

b

Figure 3.21: Variety of *"Pittumudi"* (a,b)

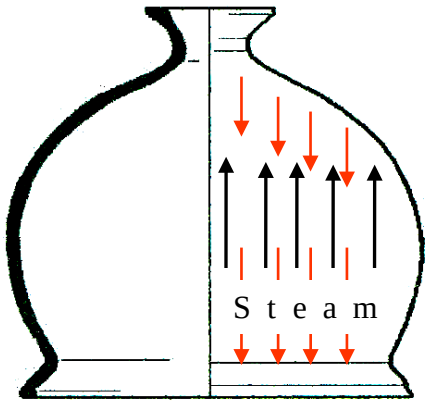


Figure 3.22: Importance of *"Pittumudiya"*

There is a one type of lid which is a further development of *"Karamudiya"*. It is deep and bell shaped and also it has a wide mouth and ring handle at the top. It has less surface decorations. This is used as a lid to cover the pot with boiling water and steaming purposes. Curved surface helps to formulate steam inside the body. As the bottom area of the lid fixes well to the pot, there will be no any steam leakages.

3.6.4 Identification of Earthenware Cooking Objects

This section tries to identify basic design elements, design principals and functional aspects of the earthenware cooking pots. The majorities of cooking vessels are sphere shaped and consist of large basal surface; which helps to transfer heat to a greater extent. They are identified as restricted and unrestricted orifices. It depends on usage of the product. Cooking pots are short and squat. It has a restricted orifice and helps to prevent rapid evaporation of boiling foods. According to the shape, form and usage of the product, cooking pots can be classified in to three types.

1. Cooking pots

   "Mutti"

2. Cooking bowls

   "Hatti" and *"Athili"*

3. Cooking trays

   "Kabala"

Cooking pots, bowls and trays are commonly used in every house. Those three main types of clay pots are developed in spherical shape. It can be identified as the basic shape of every cooking pot. All products are symmetrical and they consist of the center of gravity.

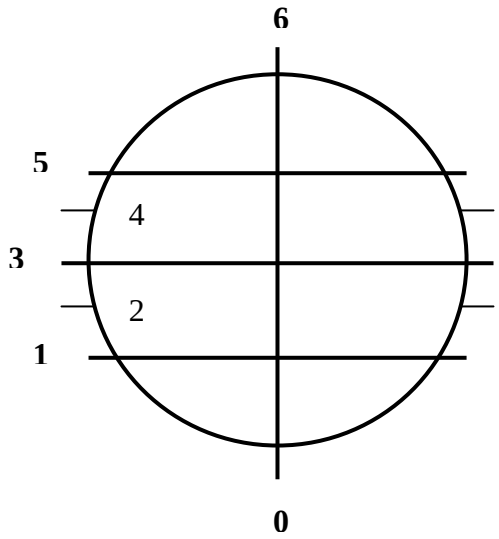
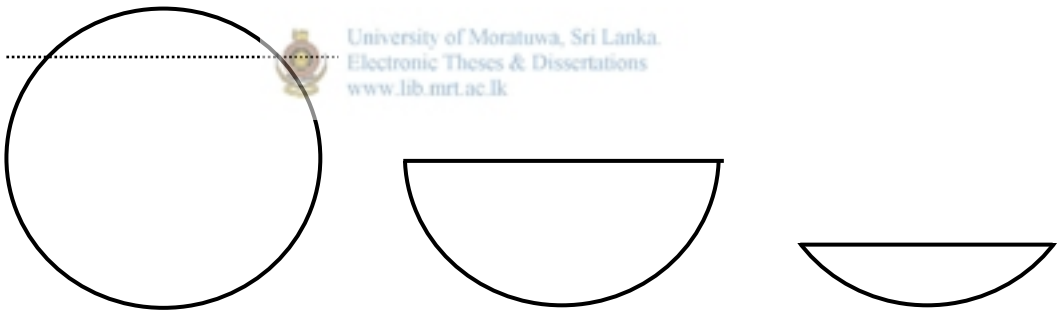


Figure 3.23: Structural Development of the spherical Shape



Pot Shape Bowl Shape Tray Shape

Figure 3.24: Shape Varieties

All the cooking pots can be identified as a development or changes of the *"Muttiya"*. *"Muttiya"* gets a spherical shape and the body structure is consisted with bend

points. The points are making turning points and angles. It affected to identify it is restricted or unrestricted form, and also to create short, height, or flat based products.

3.6.4.1 Cooking Pots

Cooking pots get a spherical shape. The orifice is less than the maximum diameter of the pot. The pot is much protected and safe due to the shape. Therefore *"Muttiya"* can be identified as another kind of a cooking pot.

3.6.4.1.1 Form Analysis

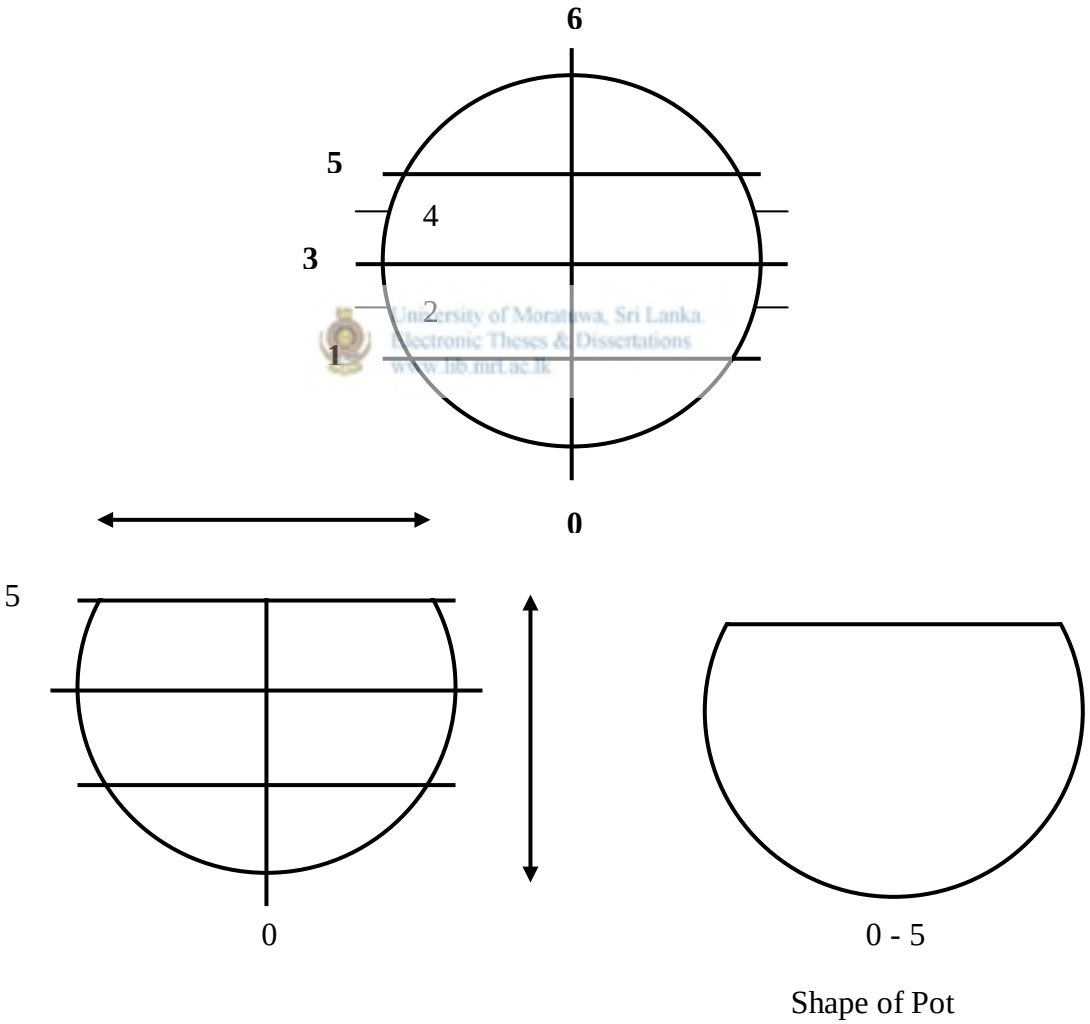


Figure 3.25: Form Analysis of Pot Shape

Figure 3.26: Veddas Pot

Source: (Seligmann & Seligmann, 1993 p.328)

3.6.4.1.2 *"Muttiya"*

Figure 3.27: Variety of *"Muttiya"*

"Muttiya" is a kind of cooking pots that is commonly used for cooking and storing. It serves a variety of functions and has a wide range of sizes. It can be identified as a restricted vessel. The bottom part of it looks like an unrestricted form but from the maximum diameter body shape turns in to the restricted form. It has a wide flat orifice and flared rim which turns from inwards to outwards. Sloping shoulders meet the concave bottom to form a sharp angle. The orifice's diameter is less than the vessel's maximum diameter, so that the contents are protected. When transporting, pots are placed one on another. The slightly convex bottom is well fitted to the flared rim.

The form of a *"Muttiya"* is used for many culinary and storing purposes. It is given different names according to the purposes and usage. When rice is cooked in

"Muttiya" it is called *"Bath –muttiya"*. *"Lunu"*, *"Goraka"*, *"Jadi"*, pickles are also stored in *"Muttiya"*. Oil-cake such as "kevum" too is stored in *"Muttiya"* and is called *"kevun- Muttiya"*. *"Muttiya"* is also used to boil milk. Small *"Mutti"* are used for boiling milk on ceremonial occasions and preparing milk rice for such purposes. A *"Muttiya"* which is used for toddy tapping is called *"Gas-Muttiya"*, and Coomaraswamy (1956) refers to this as *"Uga Muttiya"* which is used for *"Aluth sahal Managalya"* at Kundasale temple and also to *"Embul Muttiya"* which contain the medicinal preparation of juices of plants and oil for the *"Nanamura Mangallaya"*. These pots are not only used for domestic functions but also for ritualistic events. "Lawrie" talks about *"Nanumura mutti"* and a *"Gas Mutti"* which may have been used to bathe image and symbols during the *Nanumura Mangallaya* ceremony. Apart from these pots, there are other several types of *"Muttis"* which are used for the ritualistic purposes; such as, *"Nidan Mutti"* and *"Arakshaka Mutti"*. They are small *"Mutti"* which are meant for burying purpose and hanging on roofs etc, with charmed protective materials in land when there is new construction work.

The exterior wall of the vessel is thick. At the point of the lip it has become very thick. The bottom gradually becomes curved and it has a big rounded body. Some times there may be simple decorations on the outside walls of the pot.

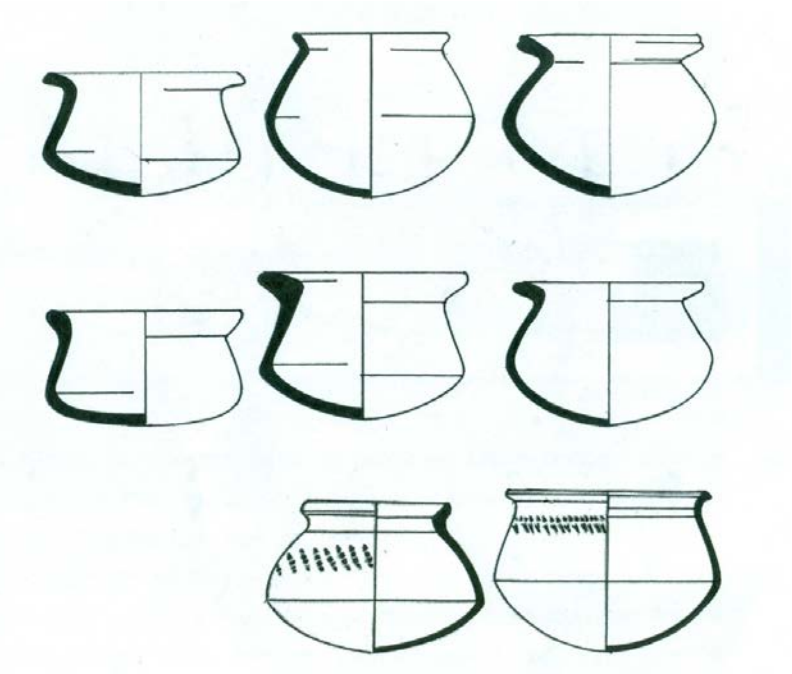


Figure 3.28: Variety of *"Muttiya"* - Section

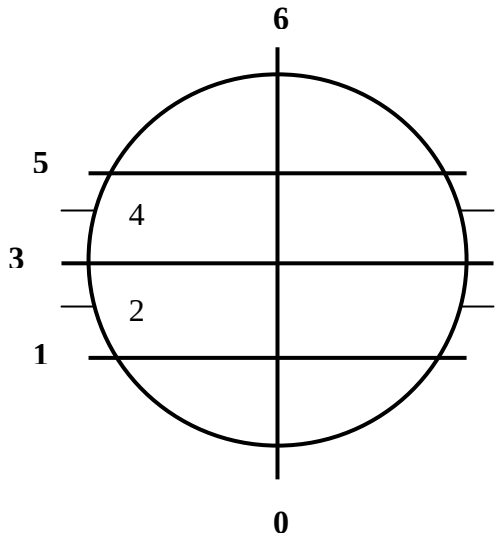
To keep the *"Muttiya"* on a flat surface a *"Daranuwa"* has to be used. There are six types of *"Muttiya'* which are used for culinary purposes. This categorization can be varied in different provinces in Sri Lanka. Boiling rice is a main usage of a*"Muttiya"*. The sizes of product depend on the weight and the rice content kept on it. *"Muttiya"* is covered with *"Nebiliya"*. It helps to steam rice well as, it well fixes to the orifice and no gap is left to waste hot steam. Not only that *"Karamudiya, Wahantharawa"* or *" Madakkuwa"* are also used as covering items.

3.6.4.2 Cooking Bowls

The basic shape of cooking bowls can be identified as a development of half of spherical shape. *"Hattiya"* and *"Athiliya"* are categorized as cooking bowls. They get restricted and unrestricted orifices. The shape is good enough to prepare a large quantity of curry with gravy and without gravy. Curry is mixed properly and heat is absorbed well in these bowls due to the proper shape of them.

3.6.4.2.1 Form Analysis

Two types of basic structures used to develop the bowl shapes objects. Such as *"Hattiya*" and "*Athiliya"*



a

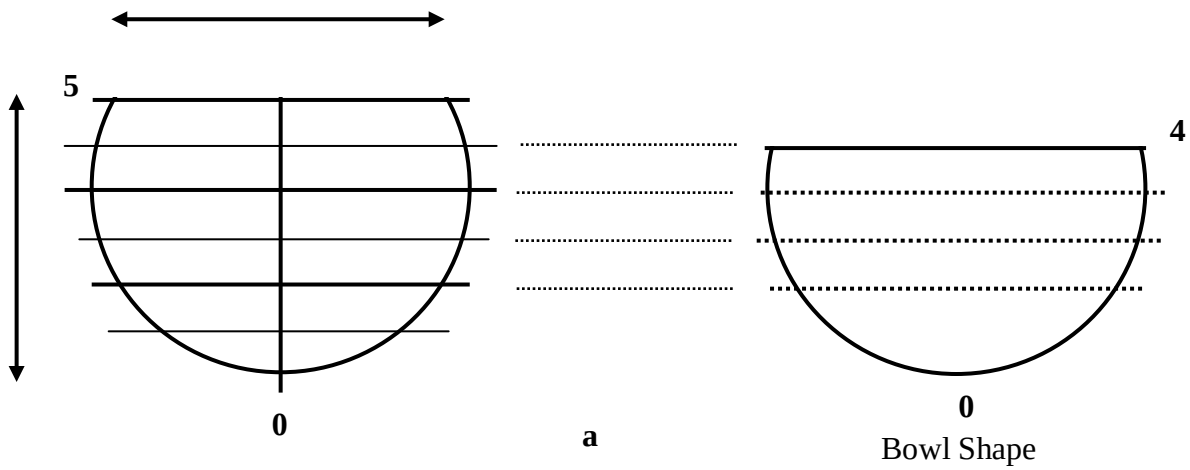


Figure 3.29: Form Analysis of Bowl Shape (a,b)

3.6.4.2.2 *"Athiliya"*

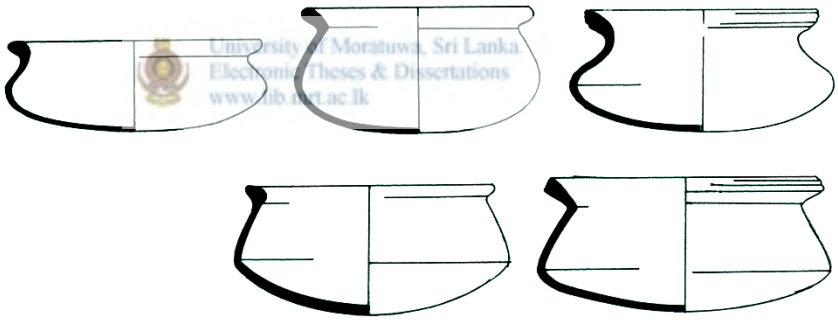


Figure 3.30: Variety of *"Athiliya"* - Section

Figure3.31: *"Athiliya"*

"Athiliya" is a shallower vessel with a wide mouth and this mouth is wider than the belly. It could be found in every household in the past and it is here in present society. It is commonly used for the preparation of curries without gravy, or for preparing dry curries. Curd is set in such pots and is called *"Kiri Athiliya"*. Coomaraswamy (1979) says *"Kanbola athiliya"* was used for preparing sweet meets: a pot with a handle which is not very common.

"Athiliya" is a shallow curved vessel with an unrestricted upper part and a widely open orifice.

(Silva & Dissanayake , 2008, 23p)

The rim is flattened and turned outwards. The diameter of the orifices equals the maximum diameter of the vessel. It looks like a bowl and it is easy to stir well and one can see any content in the vessel. It's an unrestricted vessel with variations to the simple contours. The height is equal to the radius of the orifice. The vertical edge has changed the bowl form to a shape of a cooking vessel.

The thickened part flattens outward (See Figure 3.30). This makes the stirring easy and to see the contents in the vessel. The point of thickness is at the lip and it gradually reduces the thickness when towards the bottom. The vessel can be held firmly by the rim (slightly convex bottom) making it easy to place on the hearth and heat quickly and to take out from the hearth after heating. When keeping it on a flat surface, one must keep it on a *"Daranuwa"*. If the bottom of the vessel is made thin, it helps to absorb heat well. But if it is too thin, it leads to Thermal Crack. Sometimes the top of the outside surface is adorned with simple decorations. *"Athiliya"* is covered with *"Kara Mudiya"* or a Lid.

Figure 3.32 : *"Hattiya"* covered with *"Adiwalada"*

"Athiliya" can be found in four different sizes, sometimes it comes in five or six sizes. They vary in diameter and height of the vessels and rim profiles. There are several types *"Athiliya"*. According to the De Silva & Dissanayake (2008) *"Athiliya"* is a large size step of the *"Hattiya"*. But in different places in Sri Lanka, *"Athiliya"* is seen as a small step away from *"Hattiya"*. It differs from place to place in Sri Lanka. Sometimes both names (*"Athiliya"* or*"Hattiya"*) are used for the same object. But the common theory is that these two types of objects are used for two different purposes.

3.6.4.2.3 *"Hattiya"*

(See Section 3.7)

3.6.4.3 Cooking Trays

Cooking trays can be described as a frying object in the culinary family. *"Kabala"*, *"Thatiya"* are also identified as trays. *"Kabala"* is not a creative object; it is a part of a damaged or broken pot. It is 'reuses' object. But in present society several types of designs *("Thatiya" or "Kabala")*, are manufactured.

3.6.4.3.1 Form Analysis

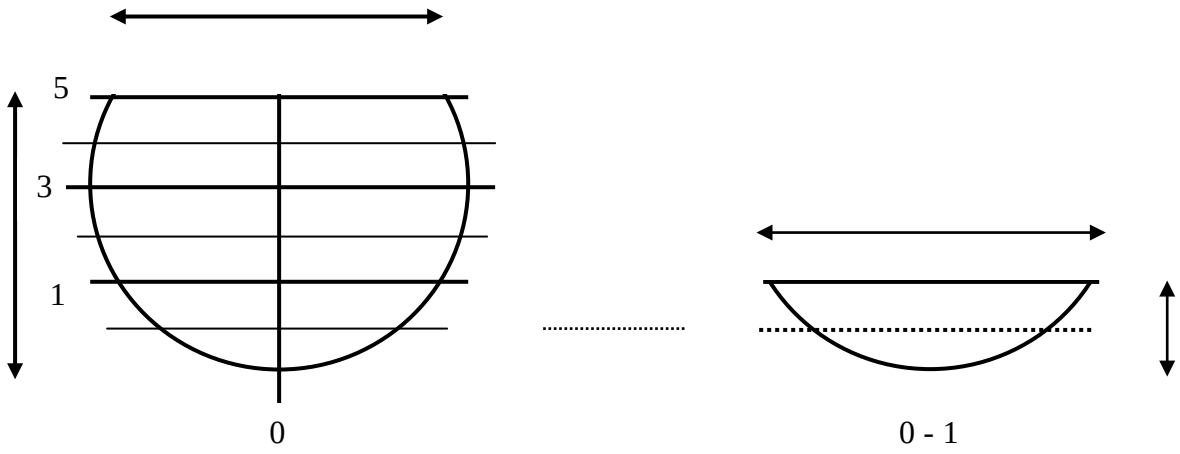


Figure 3.33: Form analysis of Tray Shape

3.6.4.3.2 *"Thatiya"*

"Thatiya" is a flat plate which is used for eating and serving food. Today the name *"Thatiya"* and *"kabala"* are used for the same object. *"Roti Thatiya"* is a common item in every household, but it is not used for serving and eating purposes. Other than that *"Thatiya"* is used to prepare dry substances .This is shallow and has a concave interior. The height of the *"Thatiya"* is ¼ of the maximum diameter of the orifice.

"Thatiya" is very similar in shape to *"Kabala"*. *"Thatiya"* is finer than *"Kabala"*. Earthenware *"Thatiya"* comes in curved and flat shapes. In terms of the build quality, *"Thatiya"* is better than *"Kabala"*. The superior surface quality of *"Thatiya"* is a special feature of it. Flat based *"Thatiya"* is commonly used in every household. In the past it had no handle. But sometimes in today's designs *"Thatiya"* has a handle. It helps to hang the object properly. (this is useful when the utensil is hot).

"Thatiya" has three main variations in terms of rim profile,

1. The interior rim profile
2. The exterior rim profile
3. The rimless profile

An interior rim profile helps to prevent liquids from spilling over. When it has an exterior rim profile it helps to pour the liquids to another vessel and works as a drip edge. The other types of *"Thatiya"* have restricted orifices. The curving shoulders prevent content from spilling, when taking it out with a spoon. The flat bottomed *"Thatiya"* can be placed on a flat surface without any stand. These shapes of *"Thatiya"* can be observed in modern curry dishes.

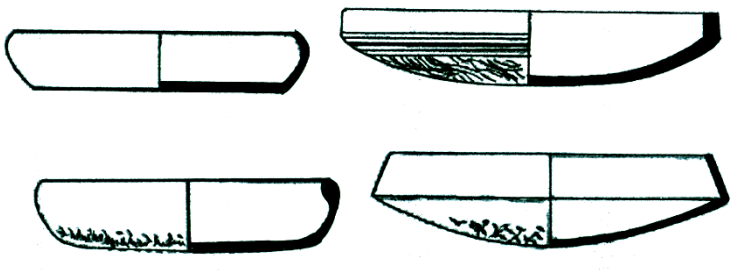


Figure 3.34: Variety of *"Thatiya"* - Section

Figure 3. 35: Side View of *"Thatiya"*

"Kiri roti thatiya" is a special type of *"Thatiya"* for making *"Kiri roti"*, which is a kind of food. This pan has one, two, three or sometimes four cavities to make special kind of *"Roti"*.

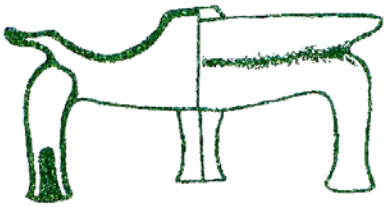


Figure 3.36: *"Kiri Roti Thatiya"* - Section

3.6.4.3.3 *"Kabala"*

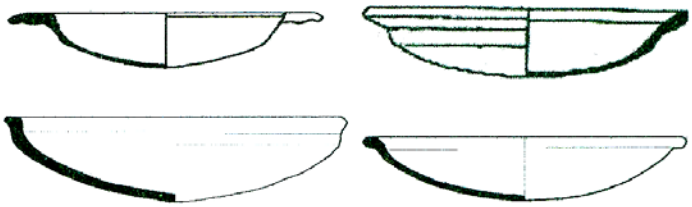


Figure 3.37: Variety of *"Kabala"* - Section

This is a simple unrestricted vessel. Having the maximum diameter at the orifice it facilitates taking out food and observing color changes while roasting takes place. The meaning of the *"Kabala"* is an article of no use, which is usually thrown away. Pieces that came from the lower body of broken pots *"Hattiya"*, *"Muttiya"*, *"Athiliya"* were used as *"Kabala"* (a roasting try) in the past. But today *"Kabala"* is manufactured as a separate piece. This has been used for roasting chilies and other grains like gram, green gram, etc. Sometimes *"kabala"* is used to prepare *"Roti"* other than that, it is also used for burning incense and to keep charcoals lighted for warming up a place. The *"kabala"* has been identified with the change of term as *"Dummala Kabala"* or *"Gini Kabala"*. *"Kabala"* is rarely used in present days.

3.7 Structural Analysis of *"Hattiya"*

3.7.1 Identification of *"Hattiya"*

"Hattiya" can be described as an important culinary product. De Silva &, Dissanayake (2008) explained as, "General terms under for vessel are *"Valam"* or *"Hatti", "Mutti""*(p.20). Coomaraswamy (1979) stated that generic terms for vessels are *"Heliya"* and *"Valada"*. But term *"Helivalam"* measures four pieces used to cook a rice meal, which are namely *"Muttiya", "Heliya", "Hattiya"* and *"Nebiliya"*. *"Hattiya"* is more spacious and normally used to prepare curries with gravy. It is bigger than the *"Athiliya"* . It is a simple restricted vessel with composite contours. This vessel is shallower than *"Athiliya"* but some types are deeper than *"Athiliya"*. It has a convex spherical body and this helps to boil and mix curries properly. The round body helps to take the contents out with a spoon. The orifice or the lip has a greater thickness but it gradually reduces thickness at the bottom. The bottom is not rounded but it has an angular shape. Occasionally the top of the outside surface is adorned with simple decorations.

There are several sizes of *"Hattiya's"* in use today, and small size differences can be identified from province to province. They varied in size, functional features and aesthetical aspects. *"Hattiya"* is also called as *"Athiliya"*, this is also different according to the province. In Down South a larger *"Hattiya"* is known as *"Athiliya"* but in the up country, *"Athiliya"* is identified as a small *"Hattiya"*. It is shorter than the *"Hattiya"*. *"Appallaya"* and *"Haliya"* are the other terms for *"Hattiya"*. "In the past, *Hattiya"*, was known as *"Appalla"* in the up country. In Down South *"Haliya"* and the *"Hattiya"*are called as *"Athiliya"*. Pottery sellers tell that people come and ask for *"Podi Athili"* and *"Loku Hatti"*.

Figure 3.38: A *"Hattiya"*

Figure 3.39: A *"Kundahattiya"*

"Kunda Hattiya" is another version of the *"Hattiya"*, it looks like an *"Athiliya"* and currently it is rarely used in practice. This is more spacious and normally used to prepare big curries with gravy. *"Hattiya"* is also used as a container to set the curd. Before the introduction of the machine made curd pot *"Muttiya"*, *"Kunda Hattiya"* and *"Athiliya"* were used to prepare the curd. After introducing the machine made curd pot it reduced the use of traditional pots to set the curd as the machine made production processes is easy and faster than the traditional method. It has a simple manufacturing process, and the ability to produce a huge amount.

Machine made curd pots can have 30% of damages and defects during the firing occasion. However the percentage of damages and defects will be less in the man-made products as they are produced by the potter wheel. Although there will be clay wastage and fuel wastage as well, people do not consider this matter, as the machine provides an easy manufacturing method. Hence it is obvious that this is not a very suitable method in the clay industry since it has many drawbacks. Subsequently it has adverse effects on clay deposits on the earth and also on creative abilities of people.

Figure 3.40: Wheel Thrown Curd Pots

Figure 3.41: Curd Pot making Machine

a

b

Figure 3.42: *"Kiri Hattiya"* (a,b)

Clay body has a quality to set the curd. It helps to absorb the water content from the curd because of the quality of porosity. *"Hattiya"* is used as a long term storage for the curd processes; and is called *"Kiri Hattiya"*. It can be re- used for cooking purpose again. Specially *"Hattiya"* and *"Kundahattiya"* are used to prepare curries. However the present curd pot cannot be used for cooking purpose, as it cracks when kept on the hearth. These will occur as a result of the thickness of the body. Man made clay pots take the shape gradually reducing the wall thickness from orifice to base. It helps for heat absorption and fixes clay particles as a bond. This does not happen in the machine made curd pot. It is difficult to clean the curd *"Hattiya'* because of the straight angles of the inside surface. This New "*Kiri Hattiya*" cannot be used as a cooking pot, as it has a small orifice which does not suite to make, some gravy food.

"Hattiya" is used as long term storage and also for the short term usage. When preparing *"Malu Abulthiyal"*, *"Hattiya"* is used as long term storage until the fish pieces become seasoned. It provides a good smell and a good taste for the curry.

"Hattiya" was in a good standard which had quality and functionality. Gradually the qualities of the product were decreasing because of the arrival of other alternative

products. *"Hattiya"* is produced using a potter's wheel, and a symmetrical form. As a result of that Sri Lankan clay pots have got rounded and curved shapes. Most of the products are created according to the Sri Lankan culture.

"Hattiya" can be described as a product which is developed during the process of manufacturing the *"Muttiya"*. Globular shape is a steady structure which controls the volume of a liquid. Usually the shape of a product provides safety, and gives an aesthetical appearance despite the different forms that it gets restricted or unrestricted. It promotes the concept of well packing item too. Although the shape of the *"Hattiya"* maintained its standards such as proper size and etc. at the beginning, gradually the qualities like proper design and the functionality were not paid much attention.

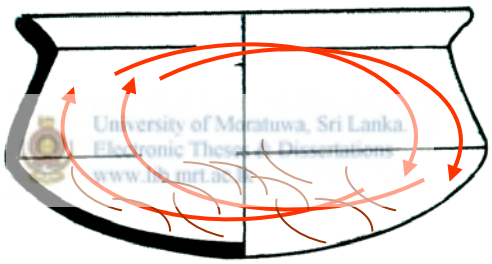


Figure 3.43: Importance of *"Hattiya"*

Basically *"Hattiya"* takes six different sizes. Small *"Hattiyas"* are used for domestic cooking purposes and big ones are used to prepare curries for special occasions either weddings or almsgivings (two small sizes, one medium size, three large sizes (See Section 3.7.8). Usually *"Hattiya"* can be covered with a Lid *("Karamudiya"* / *"Wahantharawa").* Large *"Hattiyas"* can be covered with a *"Koraha"*. *"Madakkuwa"* is also used to cover the *"Hattiya"*. That depends on the requirement of the situation.

3.7.2 Manufacturing Processes of *"Hattiya"*

"Hattiya" is manufactured using a potter's wheel. As a result of that it takes the shape of a symmetrical object. Before start the throwing; good clay compound which are free from unnecessary particles should be selected. In the first stage of the manufacturing process, the rim and half of the body is made and extra clay is removed from the wheel without a base. It should be kept outside until it becomes hard (leather hard).

a b

Figure 3.44: Steps of Manufacturing
"Hattiya", *"Edikaranawa"* (a , b)

Figure 3.45: Leather hard Products – without Base

Bottom part of the vessel is finished manually using a *"Thalana lella"or "Athakoluwa" and "Ath gala"*. The round stone (*Athgala*) is used to finish and shine the surface of the product. *"Hattiya"*, has a greater thickness in the rim. The reason for that is, it needs more than 1cm of thickness in order to rotate the object when it is in leather hard condition and it also helps to push the clay to the bottom part. And the thickness of the orifice is important to hang and carry the object.

a b

Figure 3.46: Making a Bottom part of the vessel (a , b)

Figure 3.47: Finishing Products

Figure 3.48: Green ware products

Figure 3.49: Tools

Figure 3.50: Variety of "*Athakoluwa*"

Figure 3.51: Variety of "*Athgala*"

Figure 3.52: Covered with *"Kabal"* (Damaged pots)

Figure 3.53: Covered with Clay

Figure 3.54: Firing

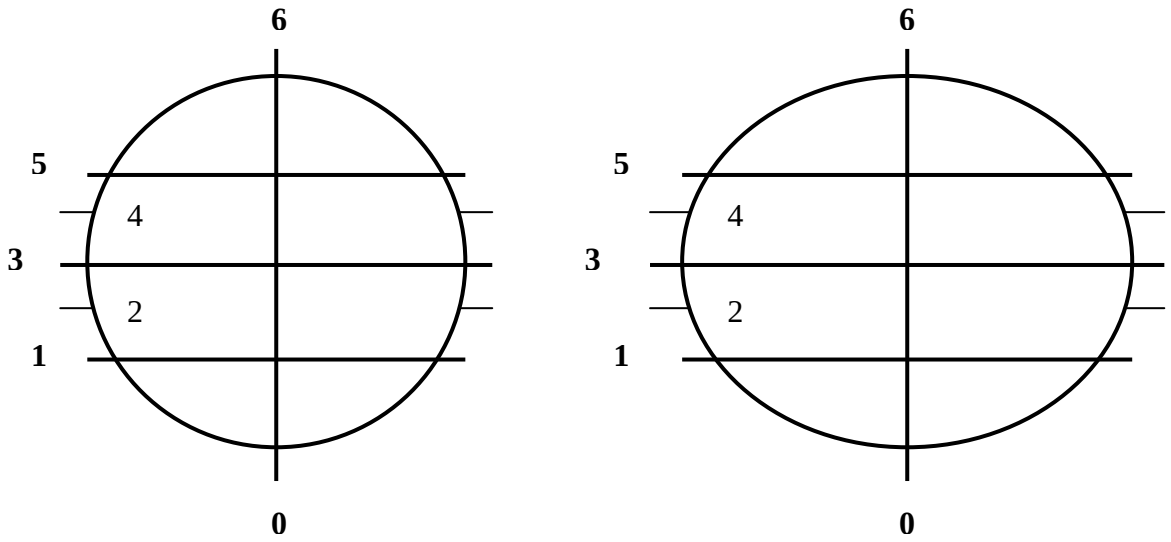
The bottom part of the pot gradually becomes thin, it is good for heat absorption and it helps to obtain a bottom crack when it is heated. It should gradually reduce the wall thickness. Thick wall is important to absorb water and to retain the heat within food. Earthenware can be fired at around 750^0C to 850^0C in wooden kiln. Clay Shrinkage differs according to the clay composition.

3.7.3 Structural Analysis of *"Hattiya"*

Clay pot is mainly consisted with three parts, Orifice, Belly and Base. These three elements are very important facts to create a completed product. Next heading will be explaining about the line segment of the *"Hattiya"*.

3.7.3.1 Line Segment of *"Hattiya"*

Shape of the *"Hattiya"* is wider than the round shape, it gets oval or ellipse shape. Following drawings will explain the evolution of the shape of the *"Hattiya"*



a

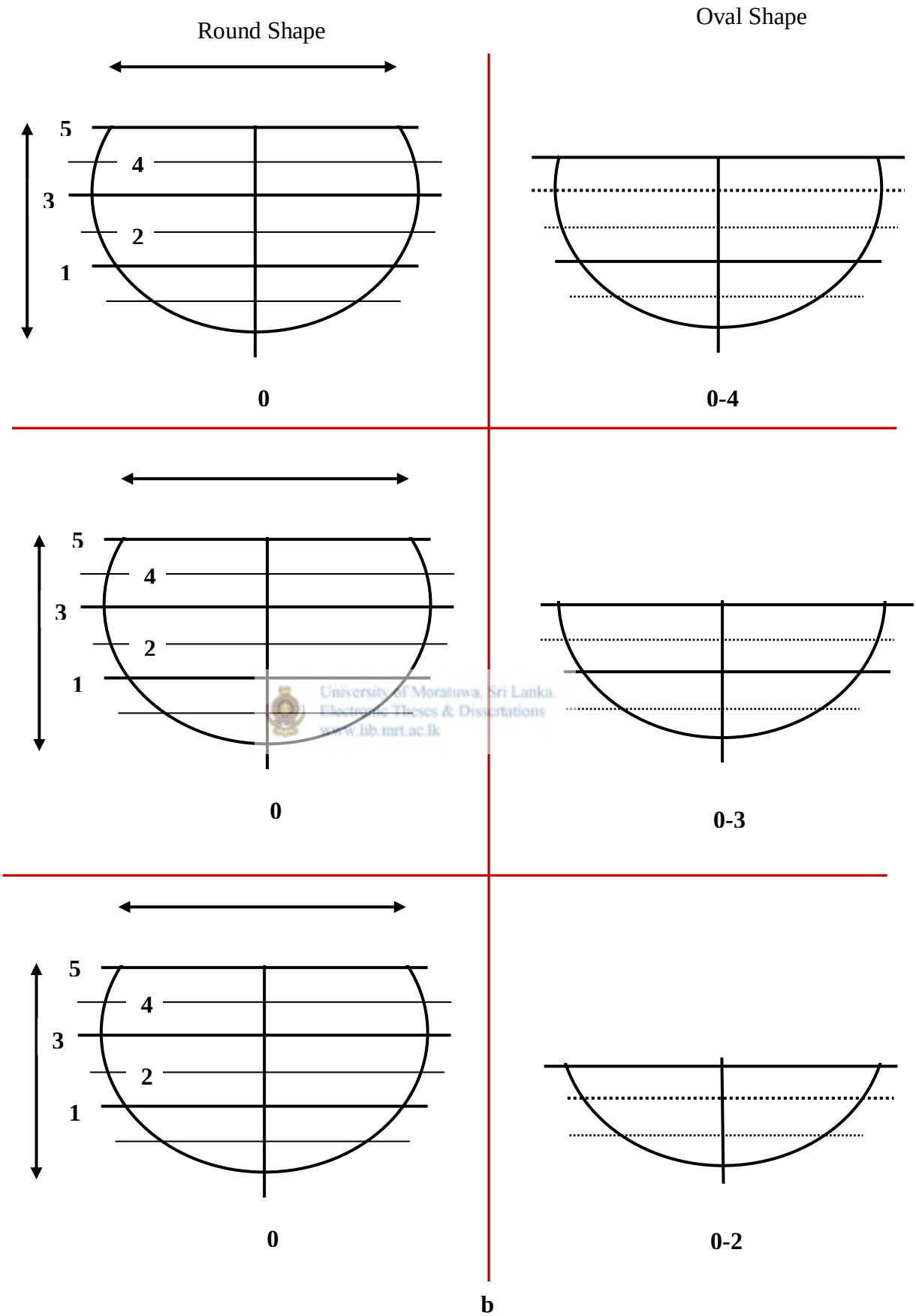


Figure 3.55: Line Segments of *"Hattiya"* (a,b)

Small Size

Medium Size

Large Size

Figure 3.56: Variety of *"Hattiya"*

3.7.3.2 Structure of a *"Hattiya"*

"Hattiya" is a useful culinary item in Sri Lankan kitchen. *"Hattiya"* can be identified as a further development of the *"Muttiya"*. The body shape of *"Hattiya"* is developed by changing of corner point. When corner point varies, the overall shape and the form of the pot also change. It helps to create unrestricted or restricted shapes.

Following drawings explain the changes of bend points;

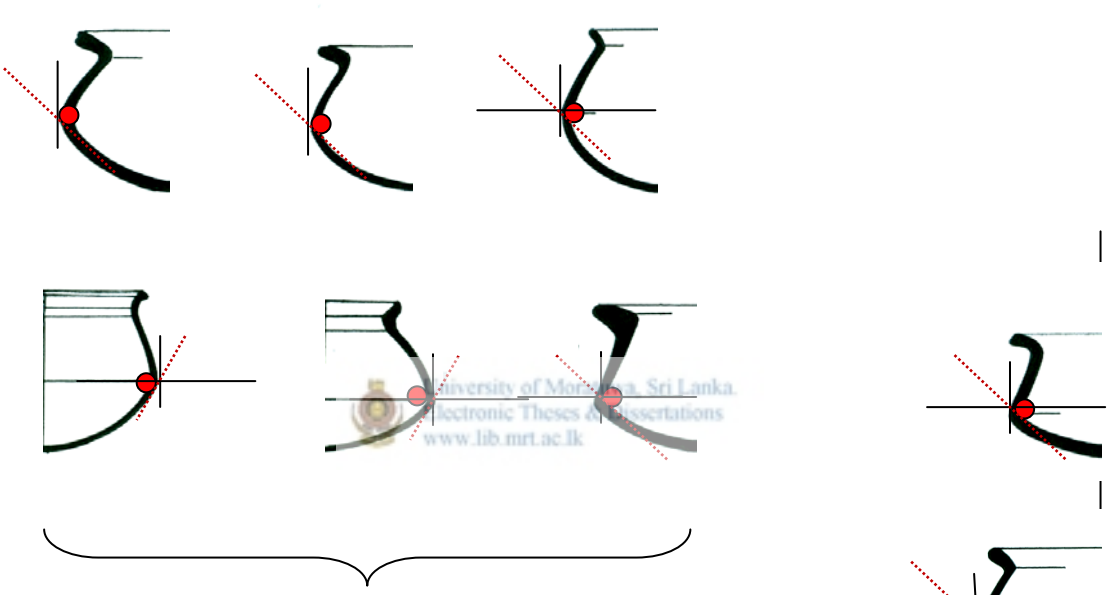


Figure 3.57: Bend point Changes - *"Muttiya"*

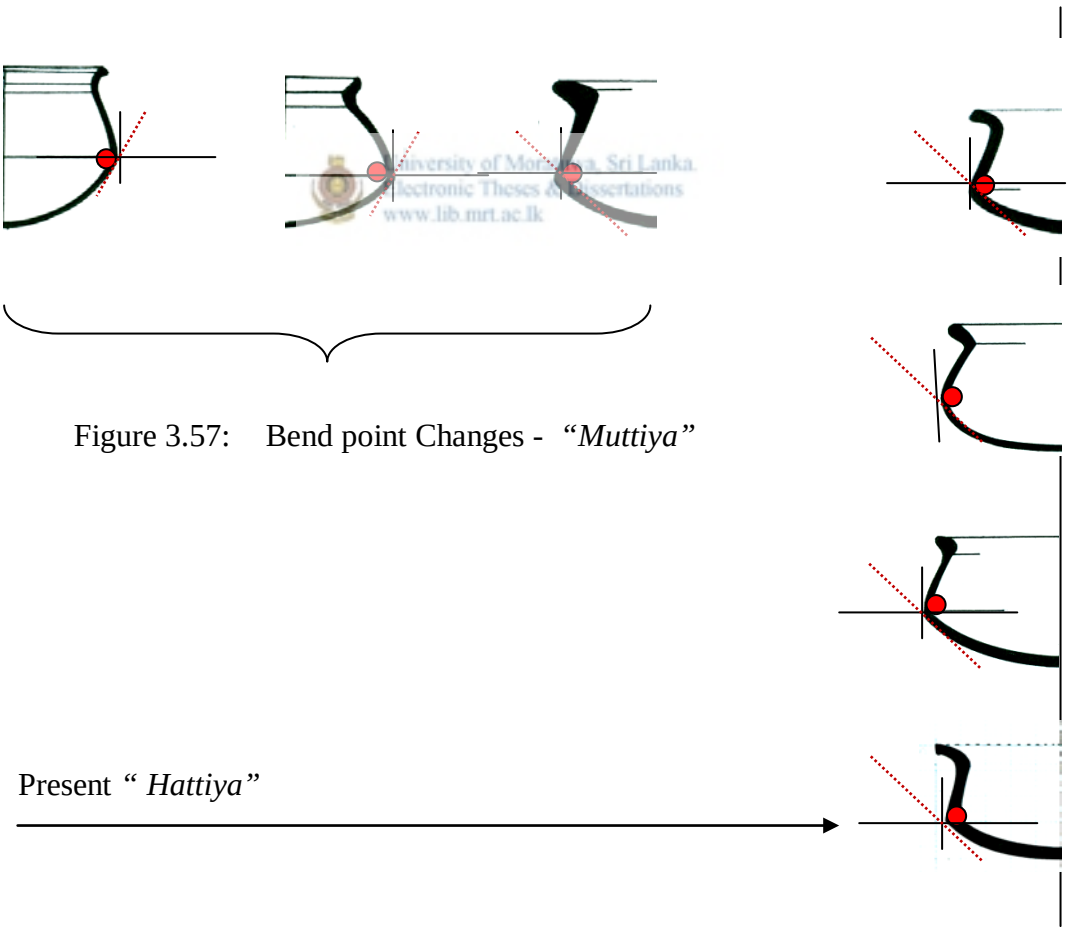


Figure 3.58: Bend point Changes and structural development of the *"Hattiya"*

Bend point has a direct effect to change the product when profile. Generally the bend point of the *"Muttiya"* is in the upper part of the vessel structure when *"Hattiya"* is made. The lower part of the body gets a spherical shape with a big volume. When the bend point moves to the lower part of the vessel structure, the mouth of the pot becomes wider and height becomes lesser than the *"Muttiya"*. That profile is identified as a *"Hattiya"*. This is shown from the drawings. Changing the bend point has an effect on the use of the product and product functionally.

The structure of the *"Hattiya"* can be divided in two parts as the upper part and the lower part. A vertical view of the exterior can be divided in to four parts. ¼ of the height (from the bottom) can be identified as the lower part while the upper part accounts for ¾ (three quarters). The upper part consists of an orifice, belly and the lover part consists of a base.

Figure 3.59: Upper Part & Lower Part of the *"Hattiya"*

The structure of the clay vessel is developed according to these three parts. It helps the structural properties of the product. This can be identified as the basic structure of the product. The upper part of the vessel is more functional than the lower part of the vessel. "Mostly upper part of the vessel indicated the functional and stylistic characteristic of a pottery vessel" (De Silva & Dissanayake, 2008, 18p).

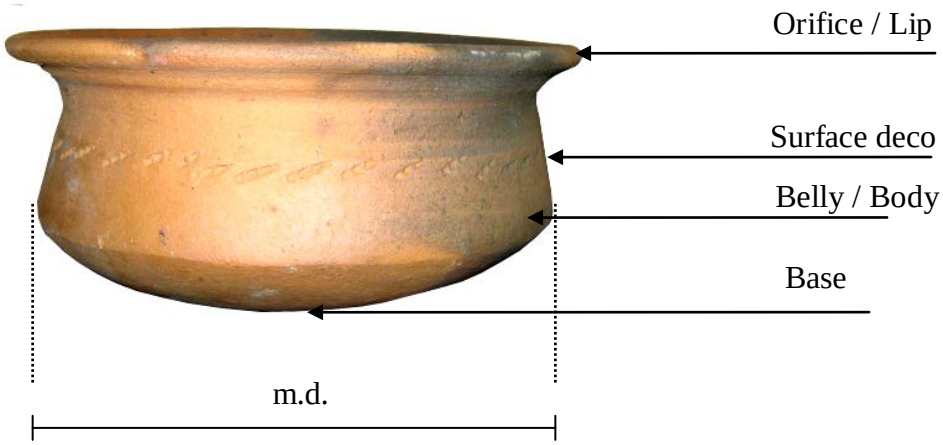


Figure 3.60: Basic Structure of the Vessel *("Hattiya")*

The orifice, the belly and the base are important for product functionality. A structure of a vessel might look simple but it consists of angles, curves, and corners. All body shapes need to address functional requirements.

Ceramic products have numerous limitations. They cannot be created in several shapes. When developing vessel shapes, much attention has to be paid to the wall thickness and the product weight, the weight of the clay vessel is important to handle the object easily and thickness has an effect on water and heat absorption of the clay vessels. All body shapes and forms have to be created according to the usage of a product. These facts can be identified as main considerable factors when manufacturing clay vessels.

3.7.4 Orifice and Rim Varieties of *"Hattiya"*

"Hattiya" has an unrestricted orifice and several types of lip formations can be identified. Essentially the lip of the *"Hattiya"* is turned in to outside the body but it gets various angles. Several types of orifices can be identified in the earthenware products (See section 2.7.3.2). The following lip shapes are used for *"Hattiya"* and also for the other culinary products.

a. Abrupt

b. Gradual

c. Exterior

1

a **b**

2

a **b**

3

c

Figure 3.61: Identification of Lip Variations of the *"Hattiya"*

The orifice should be curved with a grip, because it is easy to hanging the object and staking the object. The orifice (No3. picture) has a small grip; it is like a primary stage of the orifice (See Figures: 3.1, 3.2, 3.3, and 3.4). It is difficult to hang with fingers. No.2 (a) picture is similar to a present *"Hattiya"* orifice. It has an angle to the exterior and unrestricted orifice. But it has a small angle and a grip.

Orifice is formed of the lip; it can be called as a rim. In the past history culinary products did not have a rim. However it was developed as a rim through their

experiments and experiences. Rim is useful to hold the object with or without food. Shape of the rim is important when, *"Hattiya"* is kept on the hearth and taken if off with hot gravy. Not only that but it also helps for staking purposes and the lid can rest on it. Orifice angle and the width of the product will help to keep the lid, because it provides space and correct angle for the lid to rest on the *"Hattiya"* well. When staking *"Hatties"*, it has to be turned upside down to remove water inside and to stack them well. Vessel rim is important to bear the heaviness of products when they are being stack. Therefore the rim should be made thicker than the other areas of the clay structure.

Presently the importance of the orifice has not been considered. It has become a less important part of the vessel (but it takes part in entire body). If it has a tiny wall, it will break easily when it is hanging. Human anthropometrics has to be considered to decide the thickness and the angle of the orifice. Otherwise, people who use the object will not be familiar with it. It is a main issue that has to be considered of the present products. Orifice should be a rough surface, because the rough texture of that surface provide grip when it is held. Following pictures explain the angles and the forms of the orifice, of present *"Hattiya"*.

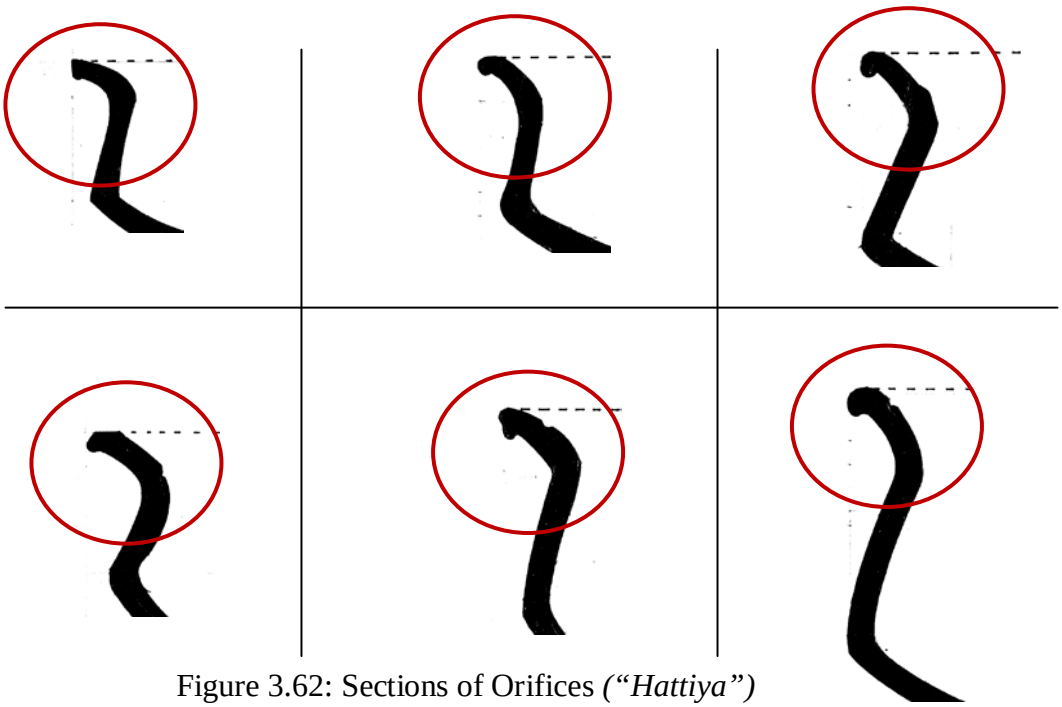


Figure 3.62: Sections of Orifices *("Hattiya")*

Figure 3.63: Variety of Orifices (*"Hattiya")*

Shape and form of the orifice is a main considerable element of clay cooking pots. It should consist of a right angle, suitable thickness, required proportion and an appropriate texture.

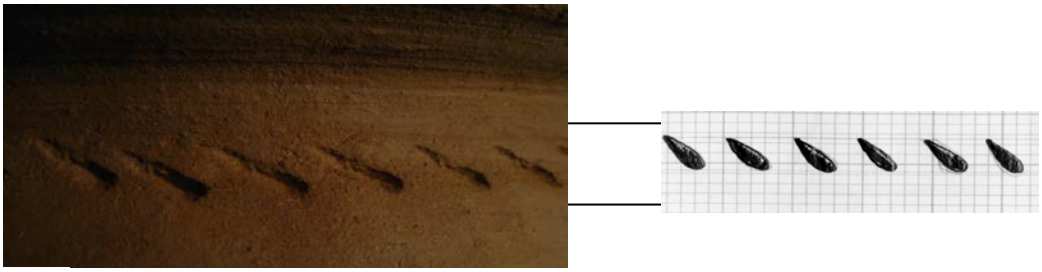
3.7.5 Importance of Body, Base and Stability of the *"Hattiya"*

Body and base are the other important elements of the vessel structure. The area of a vessel body can be identified as the area of orifice to base, and also it can be termed as belly. *"Hattiya"* has different types of body shapes but they all look alike. Vessel body has a volume. Traditionally outside surface is used to do decorations. In the past there were valuable decorations and designs created on top of the surface. When it is compared with present situations, design had been used for the surface decorations, which did not have any value. However there was a precious tradition. People did not pay much attention to the aesthetical pleasing of the products. It is a one of the main feature of clay cooking pots. There are six sizes of *"Hattiya"* used in current situation. Potters pay less attention to finish and decorate to small *"Hattiya"*, because they can be sold faster than the large *"Hattiya"*, with a short period. Therefore they do not bother to finish and create designs on them. They spend much time to finish and decorate large *"Hattiya"* consequently large pots are rich with design qualities and aesthetical values. People have the talent to create good products but they do not consider these factors.

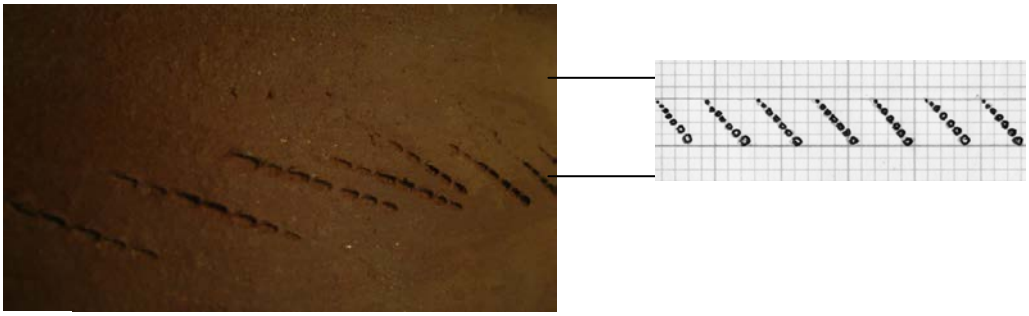
Surface decorations of *"Hattiya"*

a

b



c



d

Figure 3.64: Variety of Surface Decorations Used in *"Hattiya"* (a,b,c,d)

Surface decoration gives the first impression of the product, because the aesthetical appearance is also important as the product functionality. Earthenware clay pots can have smooth or rough textured surfaces. There is a possibility of cracking the pots which have smooth surface during the process of firing. Thickness of the clay body (clay compound) provides a cooling effect for the inside surface, as it is an important aspect of the clay vessels. It facilitates the quality of warmth and the coolness of the product.

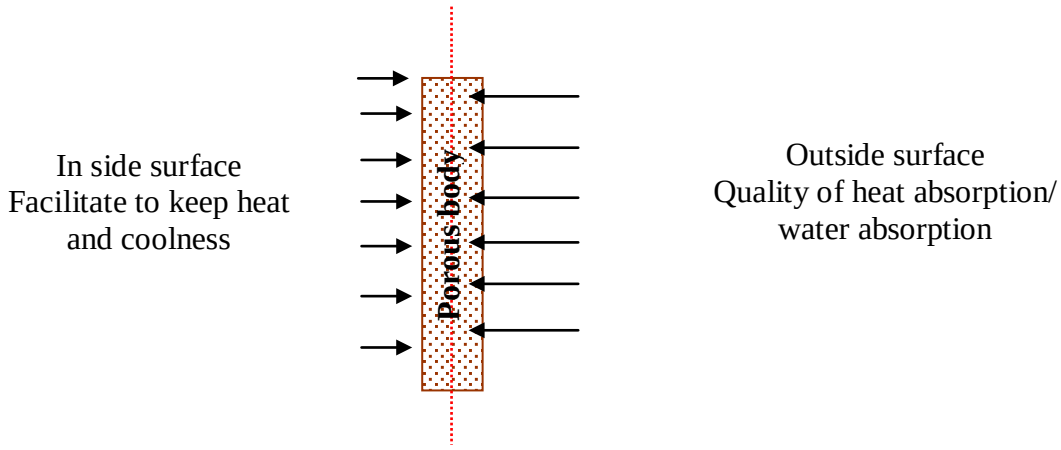


Figure 3.65: Section of a clay body

Body of the *"Hattiya"* is always fixed with the orifice and the base. Base is also an important part of the clay vessel. Wheel throwing product mostly gets a rounded base because the bottom part of the object is done manually. Base has direct effects to the product stability. The shape of the bottom and the thickness are important for handling and staking the object. Body thickness is important for cooking purpose, and should not be a thin surface. Different part of the body need to have different thicknesses. Center of gravity of the *"Hattiya"* is an important factor for staking objects and keeping them on the hearth. It helps to handle the product in a proper manner, with ample confidence.

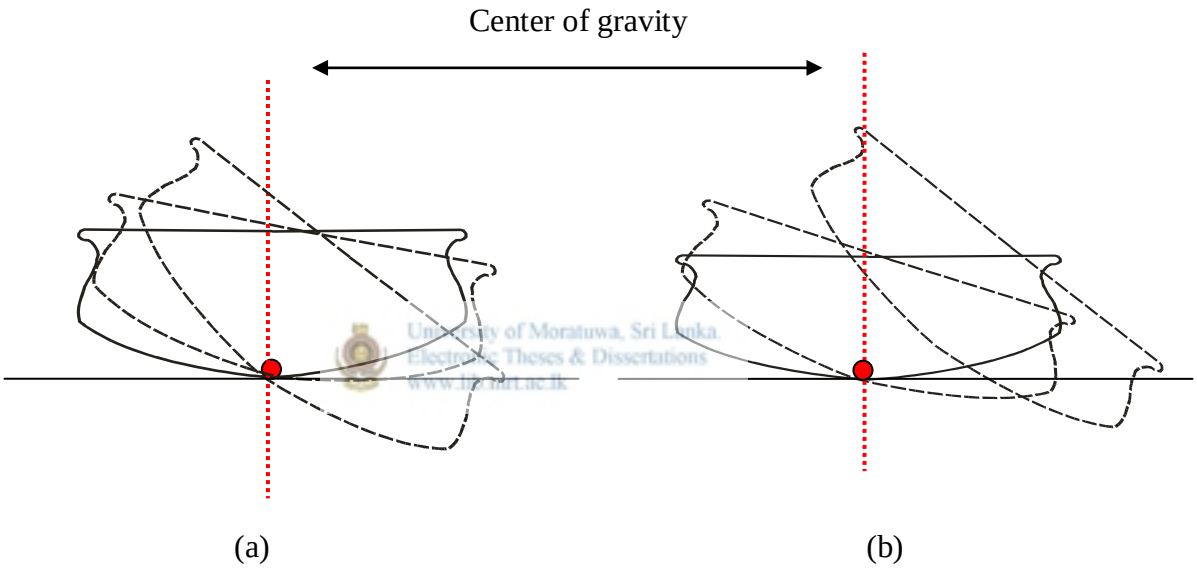


Figure 3.66: Stability of the *"Hattiya"* (a/b)

"Hattiya" cannot be kept on a flat surface because it has a curved base. De Silva & Dissanayake (2008) "The majority of cooking vessels are sphere shaped. These vessels have a large basal surface that helps transfer heat to a greater extent. They are short and squat" (p.20). Most of the earthenware cooking pots consist of a round base. A rounded base is good as it absorbs heat gradually.

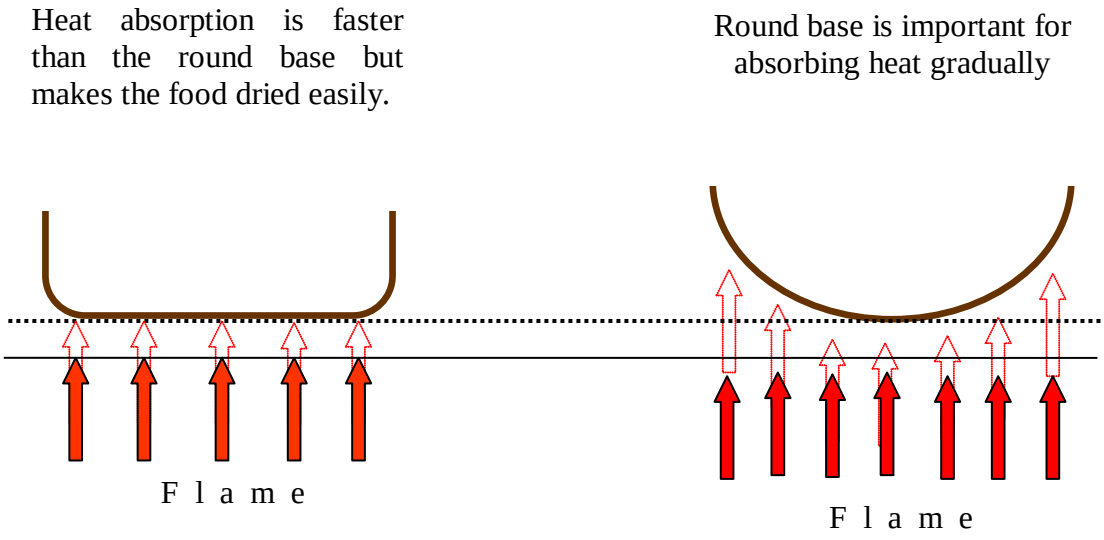


Figure 3.67: Variety of Base Shapes and heat absorption

Rounded base has an advantage, as the round surface is movable or rotatable unlike the flat base. Flat base can be damaged easily when rotating the object, because of straight angles of the base. It is an advantage of the *"Hattiya"*. The round base is difficult to be kept on a flat base. Although it is a disadvantage, people have overcome these difficulties as they have developed and found innovative solutions to them. They use a *"Daranuwa"* which should be less hard than the clay body to obtain the product stability.

Pots which have round bases can be handled well with gravy food. It is easy to rotate and move away when kept on a *"Daranuwa"*. It also has enough spaces to mix the curry when cooking. Enamel and stainless steel spoons are not good to use with clay cooking pots, as both are materials. It would damage the inside surface of the *"Hattiya"* or any other clay pot. It is better to use spoons made out from coconut shells (less hard than the fired clay). As these spoons have curved edges, they can be used to touch the inside surface of the clay body, when cooking food.

Figure 3.68: Spoons made out of coconut shells

Flat base

Round base

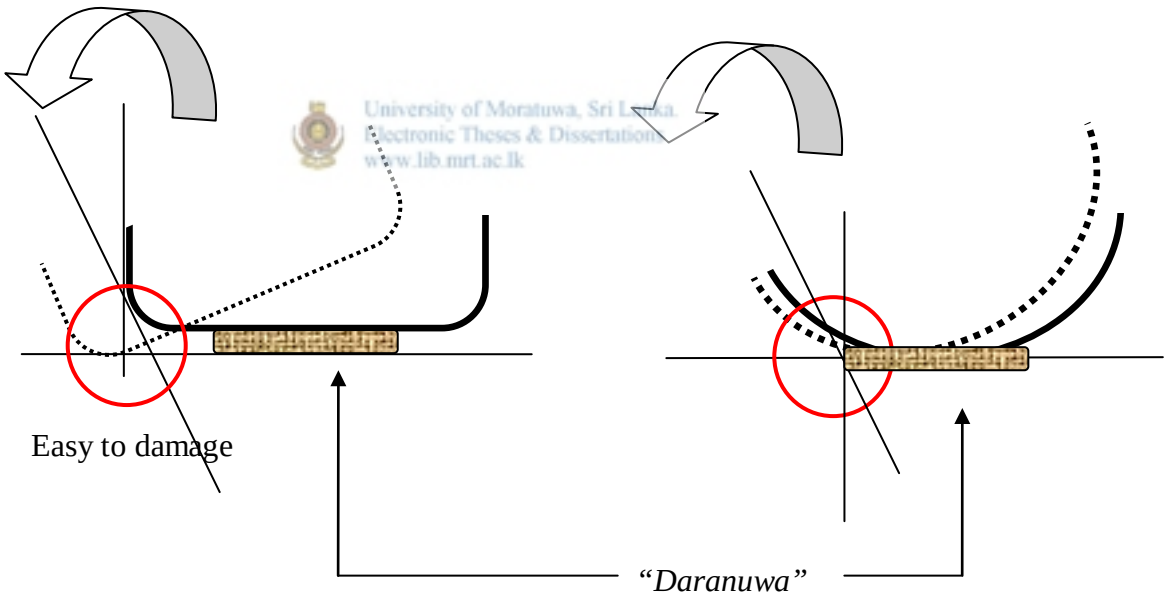


Figure 3.69 : Use of *"Daranuwa"*

Cleanliness and maintenance are very important for culinary products, as they should be kept always clean and hygienic. Therefore shape and form of the product have to be paid more attention as those two factors are very important in cleaning of products. *"Hattiya"* has a round base and the round base is easy to clean. There have

been some textured which gets corner points and get the restricted form. If it has a deep curve it may make a space to deposit food particles and cleaning difficulties may also arise. Thus it is a considerable point when designing the clay cooking pots.

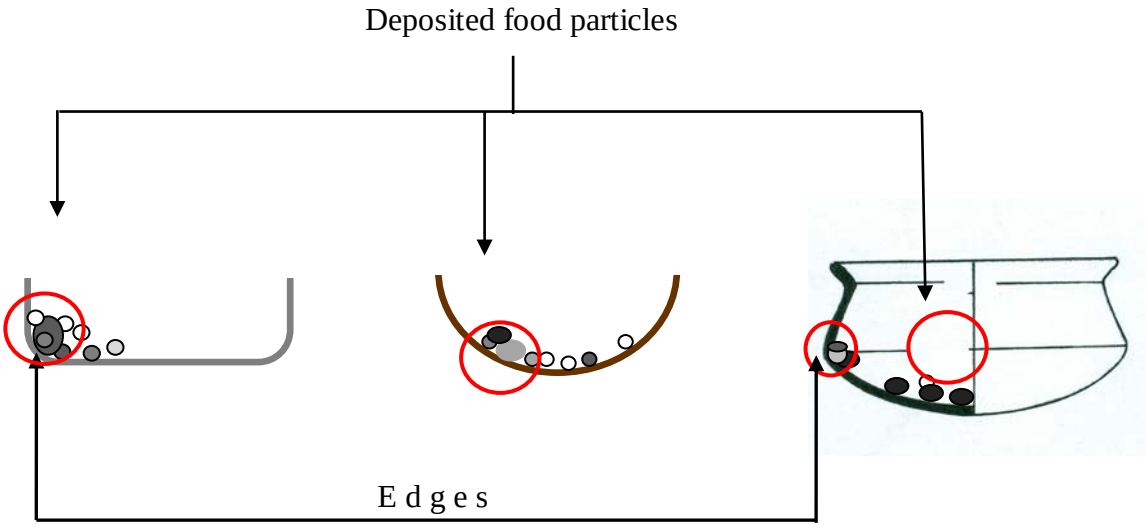


Figure 3.70: Importance of the Base

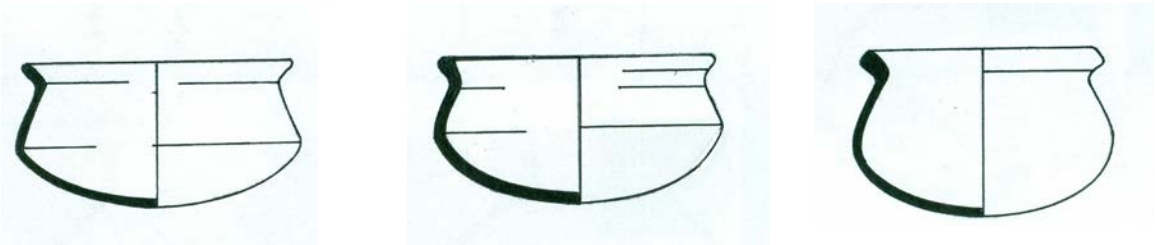


Figure 3.71: Variety of Base Shapes of the *"Hattiya"*

(See Section 2.7.1.3), several types of base shapes can be identified in the present *"Hattiya"*. Most of the base shapes do not consider the usage of the product. Product has an angular shape; it cannot be kept on the gas hearth. It can be identified as a disadvantage of the product.

Base is also important to the product stability. When staking *"Hatties"* has to be kept upside down, as the orifice can easily rests on the round base. It helps to remove the extra water inside the surface and also the product transportation. It is easy to stack one by one. When transporting *"Hattiya"* people use rush and reed in between the products to protect them from the damages.

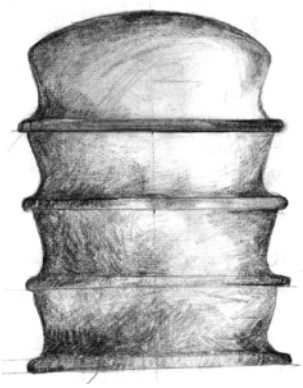
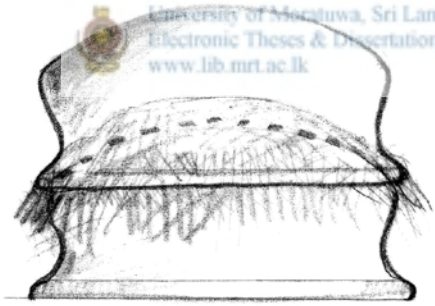


Figure 3.72: Product Stacking



Rush and Reed layer

Figure 3.73 : Product Stacking when Transporting

3.7.6 Relationship Between *"Hattiya"* and Lid

"Hattiya" cannot be used without a lid. It is an essential part of the culinary items. Traditionally it was called *"Wahantharawa"*, *"Karamudiya*" (See Section 3.6.3.1). Basically lid is used as a covering object but it can be used for different purposes, such as to scrape coconut, mixing foods etc.

Different types of lids can be found in the society. Top of the lid has a knob; it helps to hang the object. The diameter of the lid depends on the diameter of the orifice. There are several sizes of lids available in the market. It has similar shapes and forms but it is different from each other's with sizes.

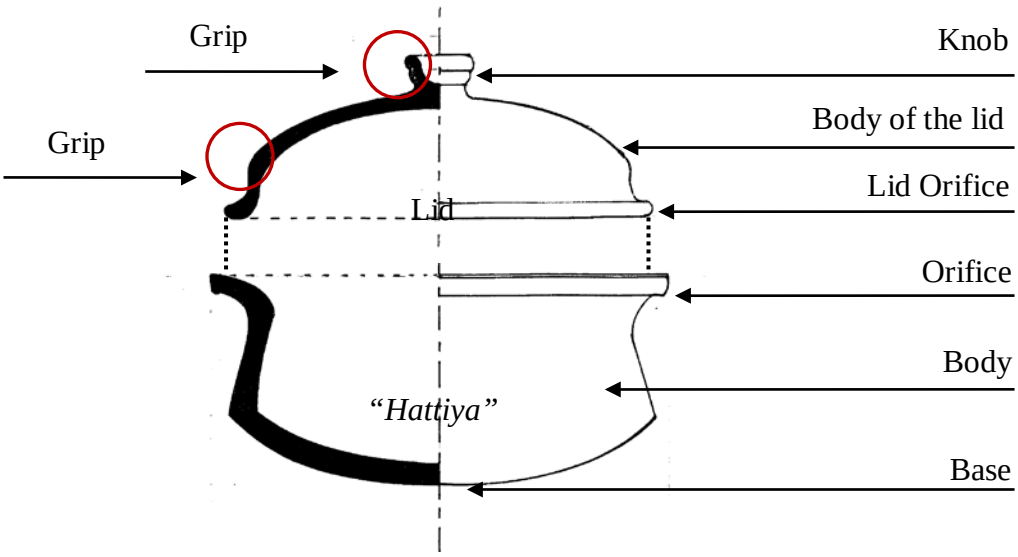


Figure 3.74: Structure of the Lid

Earlier people did not use lids to cover the object. Yet they have identified the importance of the lid. It helps to reduce the cooking time, reduce fuel consumption, and protect the nutrition of the meal. Basically a lid gets a globular shape and it helps to formulate the air and steam inside the lid.

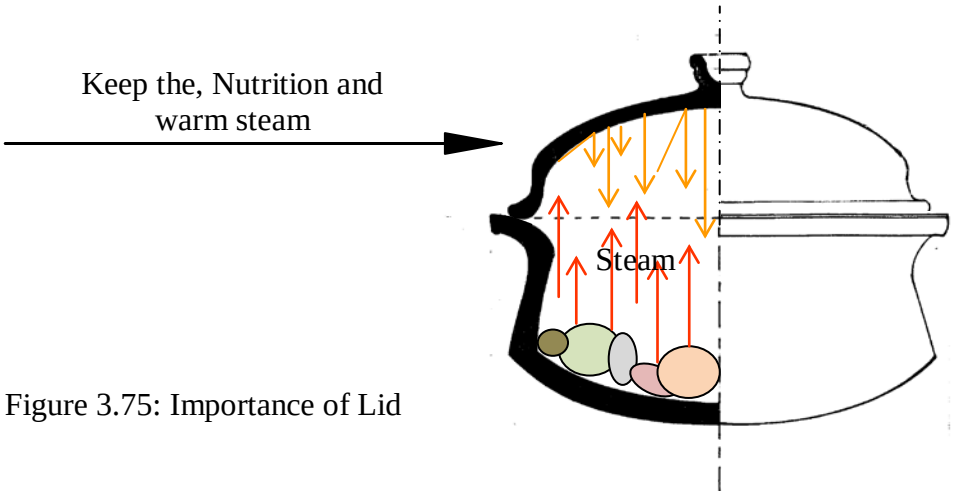


Figure 3.75: Importance of Lid

1 Traditional lid fulfills basic requirements, such as cleaning, hanging, well fixed to the pot rim. Gradually it was developed in several manners, people made different types of lids for different purposes. *"Pittu Mudiya"* is a good example for development of the lid. Lid is created using with potter's wheel, but occasionally they make the top of the lid by manually and knob is attached in the final stage.

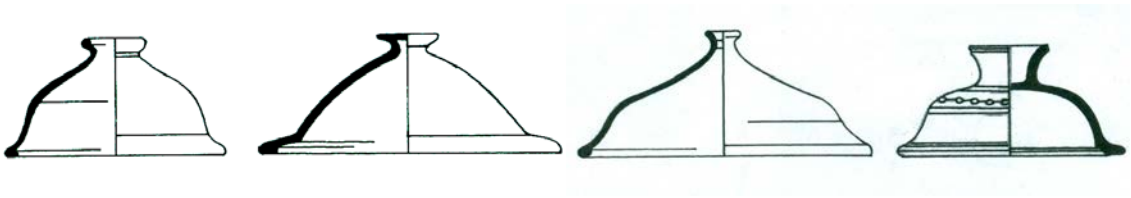


Figure 3.76: variety of Lids

Figure 3.77: A Lid from Colombo museum collection

Figure 3.78: Lid varieties in present usage

"Karamudiya" is an essential part of the *"Hattiya"*. Lid is designed for each *"Hattiya"*, because their orifice diameter differs from each other. The angle and shape of the vessel rim should be considered. If they are not in a correct position it will be not well fixed in to the vessel rim. Manufacturers are less concerned about the size and the quality of products. It is a main considerable aspect. Products are decorated with Engraving and Hand painting techniques. Big *"Hattiya"* is covered with *"Koraha"*, there are no bigger lids to cover the large *"Hatiyas"*. The knob is an important part of the lid when it is using. But it makes difficulties when staking. Anthropometrics is needed to be considered when manufacturing the product. It should be easy to carry, well fixed grip are main considerations. They have not paid much consideration to overcome with design errors in present usage products; it is a need of the society.

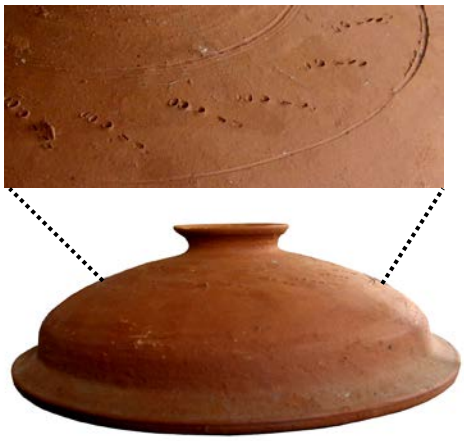


Figure 3.79: A Lid with decoration

Figure 3.80: A Lid with decoration

a

b

Figure 3.81: Variety of Surface Decorations in Lids (a , b)

3.7.7 Current situation of the '*Hattiya"* and Lid

Presently *"Hattiya"* comes in six sizes and lid comes in four sizes. The size of the *"Hattiya"* is designed according to the family size. Now a day's families consist of less number of members such as two or three. Therefore the size of the product also has been changed to facilitate their needs. There had been ten or twelve numbers in one family in the past and they had to use larger size culinary products. When comparing small and large sizes of *"Hattiya";* small *"Hattiya"* has less design qualities, as they have a good market for small size products. They have time to pay more attention to the objects which are of large sizes. Although functionality is an important aspect of products, people did not consider much about it. Hence problem related to the functionality arise when the products are being used. This drawback makes consumers unhappy and disappointed about clay products.

There are two varieties of the product (*"Hattiya"*) in the present market. They are known as polished ware and non polished ware. Polished ware can be identified by its shiny surface. Though it has been proposed even for gas cooker, it is still at the developments stage. The price of polished ware is also higher than the price of ordinary vessels. Following table shows the prices of ordinary *"Hatties"*.

Table 3.2: Price of Ordinary *"Hatties"* and Lids

"Hattiya"	Size	Price of *"Hattiya"*	Price of lid *"Karamudiya"*
Type 1	Small	55/=	55/=
Type 2	Small	65/=	65/=
Type 3	Medium	95/=	95/=
Type 4	Large	135/=	135/=
Type 5	Large	175/=	175/=
Type 6	Large	350/=	350/=

Price depends on the size of the products. Price of the product is gradually increasing according to the size of the product. In cost calculation, price of the clay body includes the fuel and transportation cost. In the usage of clay cooking pots, the quality of heat absorption of products and the fuel material are two important factors which have to be considered by the manufacturer as well as the consumers. Fuel material is very important factor in using clay cooking pots, as it has a direct effect on the heat absorption of products. If the clay pot has a thick body it has to be kept on the hearth for a long time. This will cause fuel wastage, despite whatever the fuel material used (gas or wood)

When compared to other cooking pots made out of enamel and aluminum the heat absorption capacity of the clay products is low. However people in the current society hesitate to use aluminum and enamel objects because of their side effects. Therefore they tend to use clay cooking pots to have a healthy life without paying much attention to the fuel wastage.

Consumers like to buy new designer products more and more according to present needs, through the present clay *"Hattiya"* does not serve the purpose effectively. Identify the current position of the *"Hattiya"* and identifying their importance is a main task of the earthenware industry. Thus it is very important to identify certain drawbacks of this specific object *"Hattiya"* and the ways to overcome them in order to produce a product, which is of a good standard.

3.7.8 Size Varieties of Present *"Hattiya"*

There are six types of *"Hattiya"* in the current society. The size varies in height and width of the object. Their orifices, bellies and base segments have slight differences, but more differences can be seen in angle, thickness and shape of the base. Sometimes the shape and the proportion of the *"Hattiya"* vary from place to place. The following areas which are famous for earthenware cooking pots have been used in this study.

From Kandy District: Menikhinna, Urispaththuwa, Wattegama, from Kurunegala District: Abagaswewa, Paduwasnuwara, from Rathnapura District: Eheliyagoda, Nakandala, Gampaha District: Biyagama, Kegalle District : Molagoda

Slight differences can be seen in the product *("Hattiya")* indifferent areas. The height, volume and surface decorations vary according to the place where they were manufactured. As mention above, *"Hattiya"* can be classified in to six groups and it is common for all areas. From area to area the size variation can be between 1cm and 1,1/2 cm. It is totally neglected here and, the main value of the product is taken in to consideration. The length and width are use to take the mean value. There are no significant differences in shape and form of the product in different area

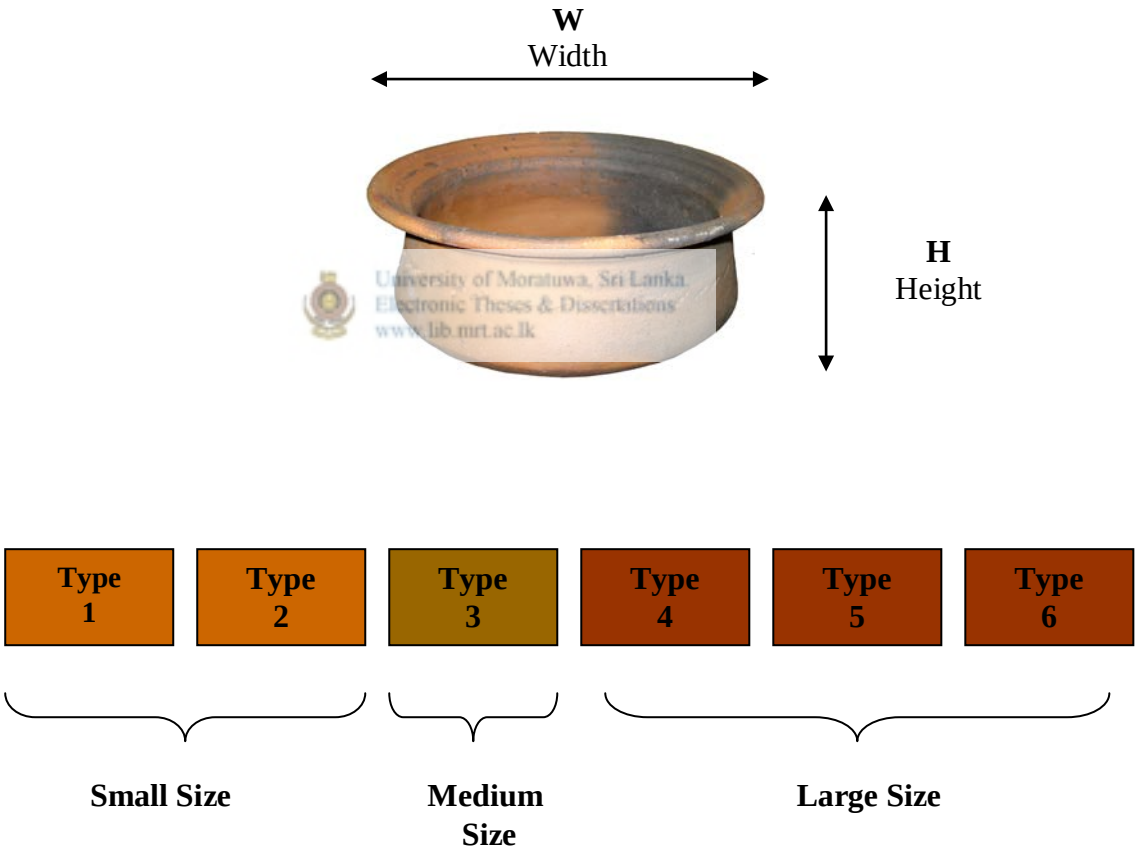


Figure 3.82: Size Variations of Present *"Hattiya"*

When considering the size, there are three types of *"Hattiya'"* (Type-1, 2, 3) which can be used to prepare curries for day-to-day needs, and the other three are used in special occasions (for large preparations). Small objects are of less quality but large *"Hattiya"* are of good quality. As a result, small pots can be sold quickly but it takes time to sell large pots. Manufacturers have to pay more attention when producing large "*Hattiya"*. This improves the quality of the product. They produce small "*Hattiya"* quickly, without considering product efficiency or functionality of the product. This would reduce the usage of earthenware products.

Type – 1

(Small Size)

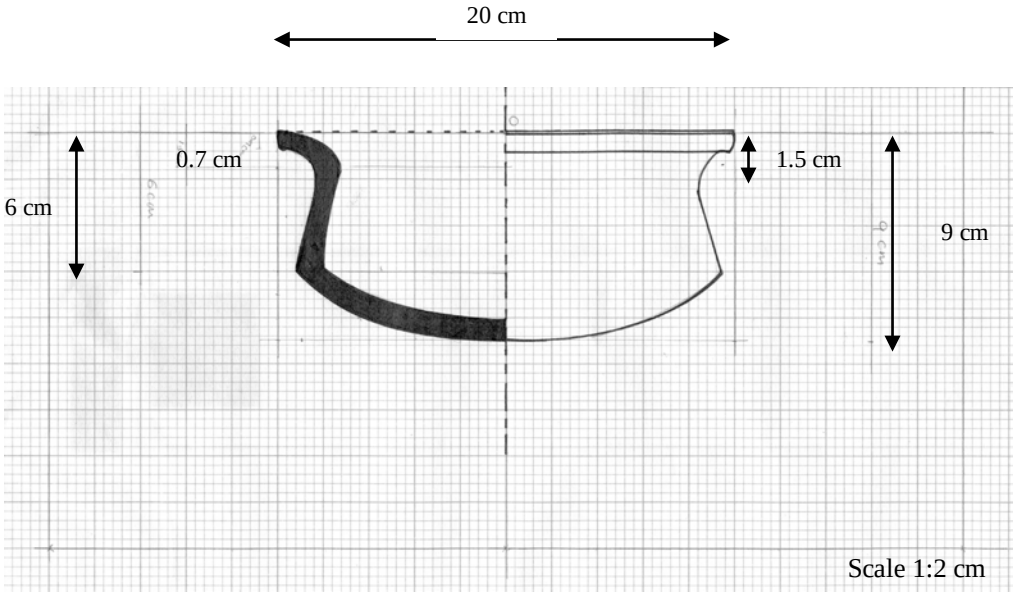


Figure 3.83: Section of the – "*Hattiya*" Type - 1

a

b

Figure 3.84: Side View – "*Hattiya*" Type – 1 (a,b)

Type – 2

(Small Size)

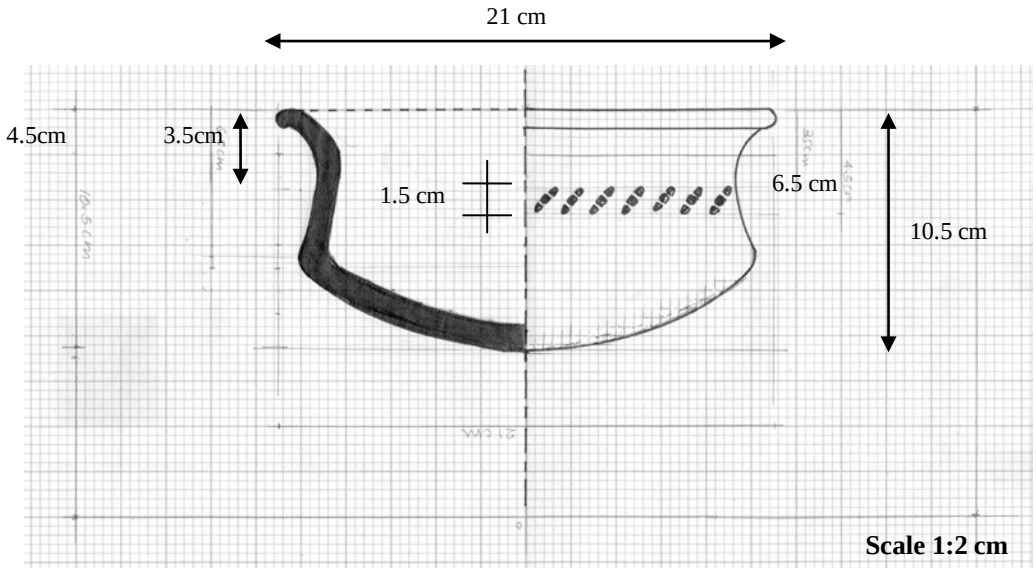


Figure 3.85: Section of the – *"Hattiya"* Type - 2

Figure 3.86: Base of the *"Hattiya"* Type - 2

Figure 3.87: Side View -*"Hattiya"* Type - 2

Type – 3

(Medium Size)

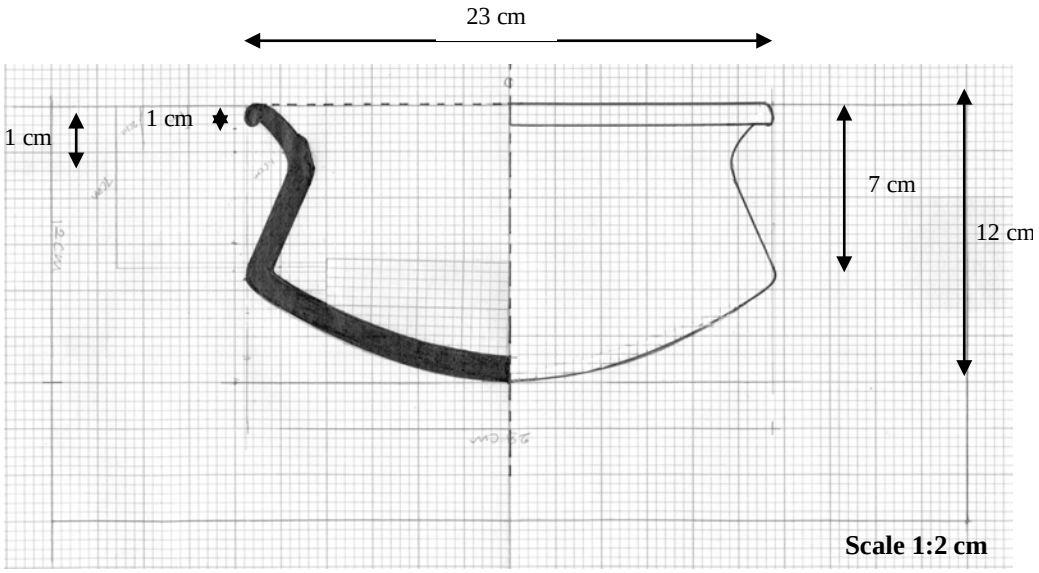


Figure 3.88: Section of the – *"Hattiya"* Type - 3

a

b

Figure 3.89: Side View -*"Hattiya"* Type – 3 (a,b)

In this research three sizes are used as samples objects, [Type – 1(Small Size), Type – 2(Small Size), Type – 3(Medium Size)]. These three types of objects are used for daily purposes. A lid or *"Wahantharawa"* is used to cover the *"Hattiya"*. Some vessels come with simple decorations on the belly. The designs look similar but the pots a

Figure 3.90: Shape of the Base– *"Hattiya"* Type - 3

Type – 4

(Large Size)

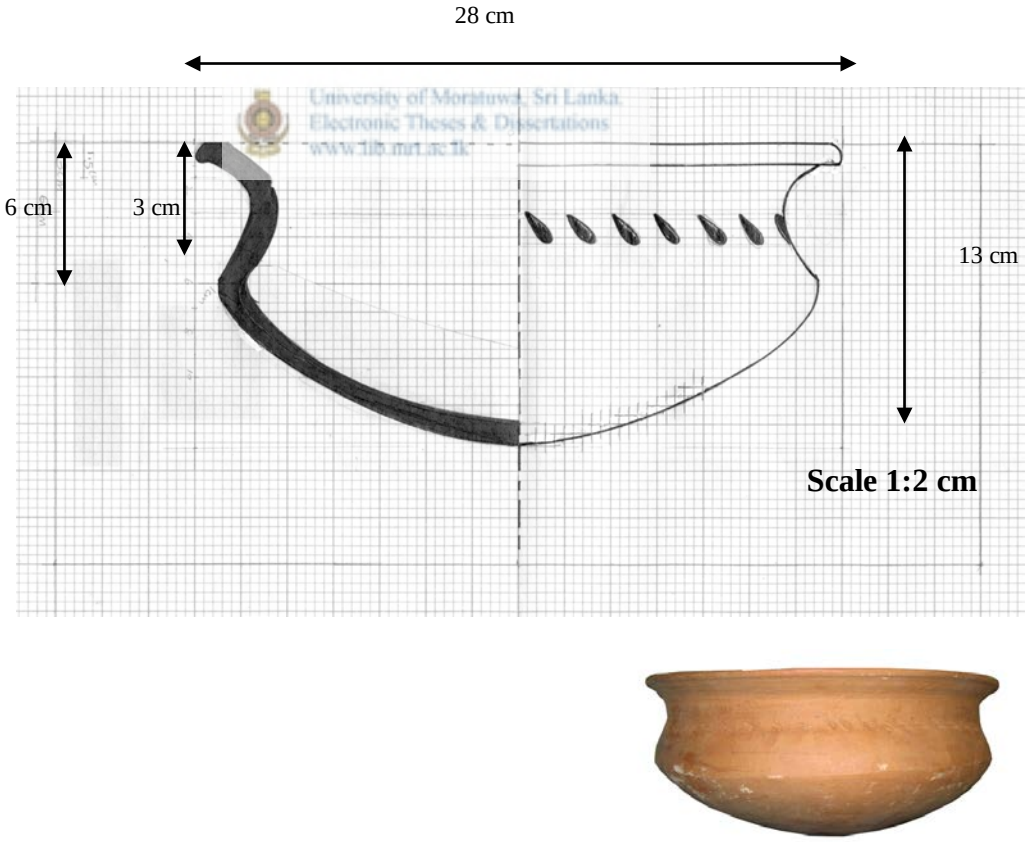


Figure 3.91: Section of the – *"Hattiya"* Type - 4

a **b**

Figure 3.92: Side view -*"Hattiya"* Type – 4 (a,b)

Type – 5

(Large Size)

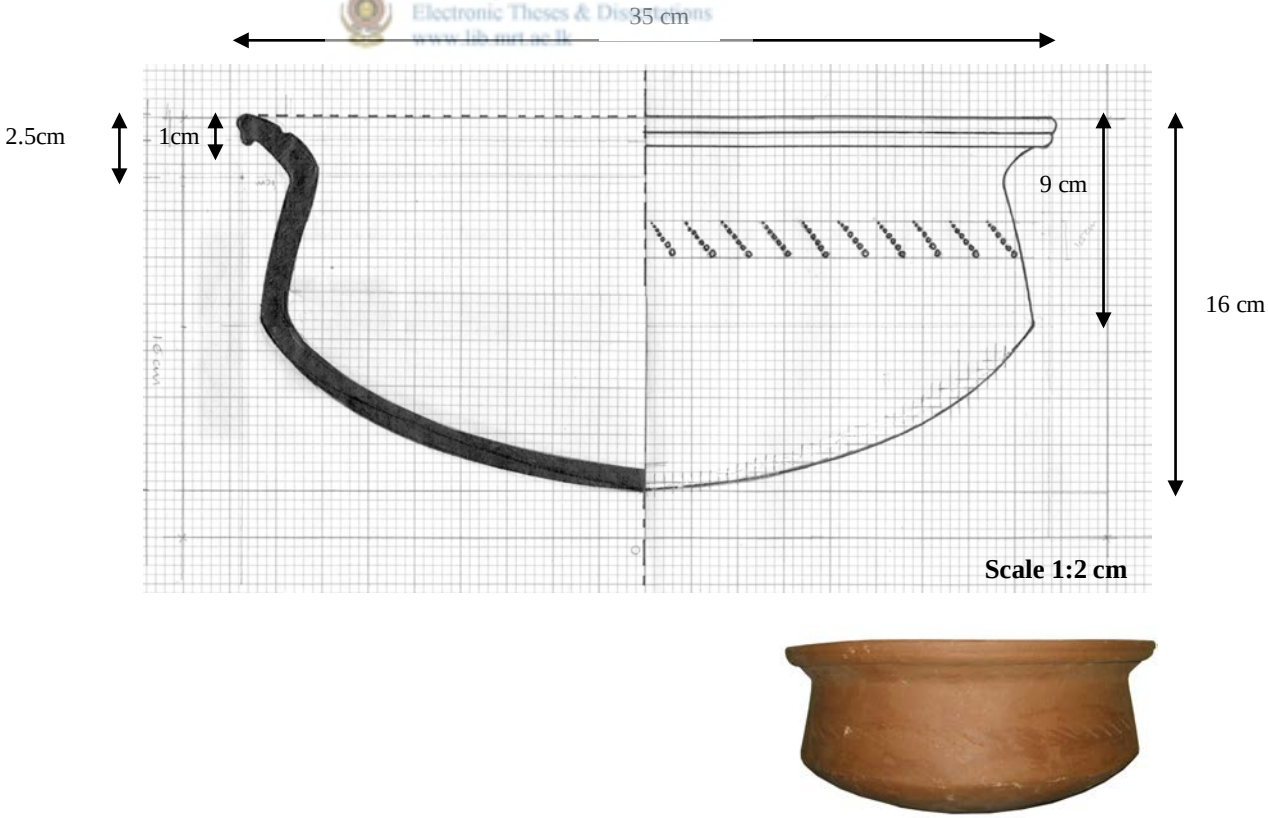


Figure 3.93: Section of the – *"Hattiya"* Type - 5

Figure 3.94: Base of the *"Hattiya"* Type - 5

a **b**

Figure 3.95: Side view of the *"Hattiya"* Type -5

Type – 6

(Large Size)

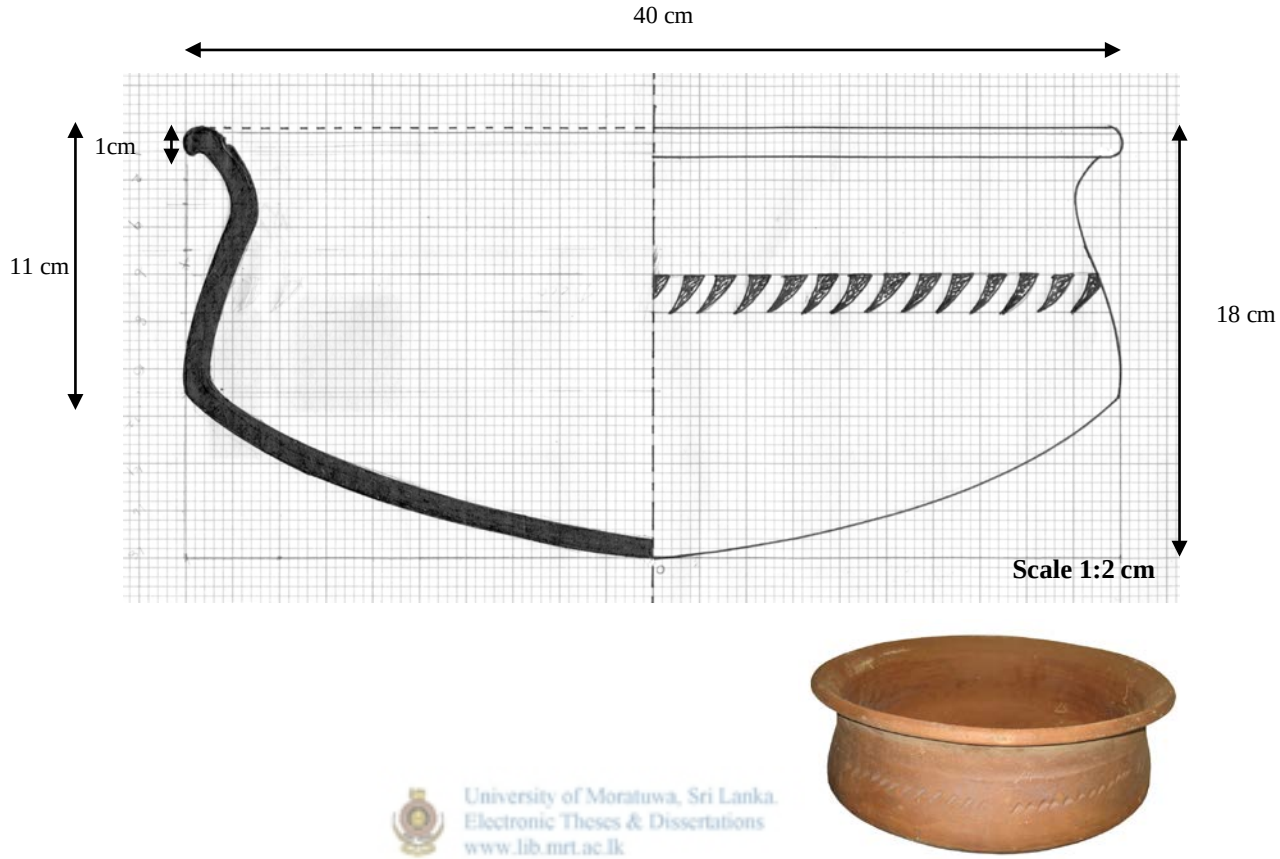


Figure 3.96: Section of the – *"Hattiya"* Type - 6

a **b**

Figure 3.97: Side View of the *"Hattiya"* Type -6 (a , b)

Figure 3.98: Base of the *"Hattiya"* Type - 6

3.7.9 Size Varieties of Lid

Lid- Small

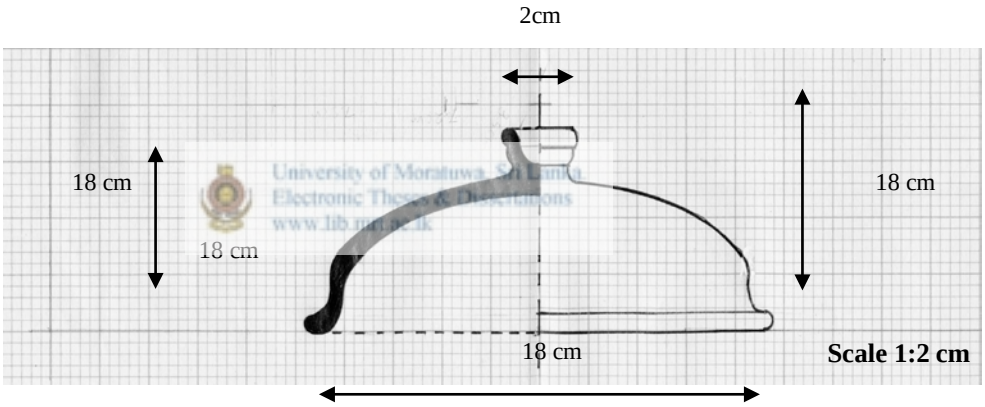


Figure 3.99: Section of the - Lid

Figure 3.100: Variety of Lids

3.8 Summery

The origin of the earthenware industry and domestic culinary products in Sri Lanka has been discussed in detail in this chapter. In this study, *"Hattiya"* has been focused on as the sample object, because still it is used for cooking purpose in most of the houses. As a culinary item *"Hattiya"* is more popular than the other items. Therefore the structure of the *"Hattiya"* has been analyzed here paying attention to other parts of it orifice, belly and base. Lid has been analyzed as a supportive object. Basically it has discussed the design elements and design principles. Six types of *"Hattiya"* have been thoroughly discussed and three objects of them had been selected for the questionnaire. Next chapter will include consumers' ideas and opinions which were collected through the questionnaire survey about the selected objects.

Chapter Four

METHODOLOGY

4.0 Introduction

This chapter discusses the research method in detail. It includes definitions of key factors, the research model, hypothesis testing, questionnaire design, questionnaire survey method, method of sample selection and method of data measurement.

4.1 Research Method

Survey is a method of collecting information for describing and analyzing data. F.Arlene stated that "Surveys are systems for collecting information to describe, compare, and predict attitudes, opinions, values, knowledge, and behavior. An essential components of the system is the design or environmental arrangement in which data are collected, analyzed, and interpreted. Design can be categorized as experimental or descriptive" (p.21).

A survey can be identified as an experimental or a descriptive method. This research focuses on collecting information from a selected group, using an existing product ("*Hattiya"* & Lid). It will be to develop and identify people's achievements, their preferences, failures and errors of the present usage product. "Descriptive designs produce information on groups and phenomena that already exist. No new groups are created. Descriptive designs are also called observational by some surveyors" (F.Arlene, 1995, p.23). This research use descriptive research and use statistical survey method to collecting data.

The questionnaires focus on Design Elements and Design Principles with a view to achieve design efficiency of the product. Product Balance and Proportion can be

identified as Design Principles of ceramics products and Value, Texture, Shape and Form can be identified as Design Elements.

Table 4.1: Key Factors

Index	The key factors that have to be considered
Design Principles	Proportion Balance
Design Elements	Shape & Form Texture Value

4.2 Definition of Key factors

Design Principles and Design Elements (identified in chapter two) are categorized under five main factors. Following table presents key factors, variables and measurements which are categorized under those main factors. Future analytical model will be constructed based on following measurements.

Table 4.2: Definition of Key Factors

Index	Key Factors	Variables	Measurements
Design Principles	Proportion	Appearance (Q-1, Q-9, Q-35)	• Aesthetical pleasing • Functionality • Lip and body proportion
		Body	• Aesthetical pleasing

		Base Lip (Q-13, Q-38)	• Effect for functionality
	Balance	Structural balance (Q-40, Q-42)	• Thickness of the wall • Thickness of the orifice • Thickness of the body
		Product balance (Q-16)	• Center of gravity • Stability • Staking • Use of purposes
Design Elements	Shape & Form	Gripping (Q-3), (Q-11)	• Angle of the collar (Orifice) • Orifice thickness • Body angle • Surface Texture of Orifice and Belly
		Stability (Q-4, Q-10, Q-39)	• Product Balance • Staking • Center of gravity of the product
		Aesthetical Pleasing Handling and using (Q-14)	• Product Attractive • Angles and shapes • Outer appearance • Easy to pour • Space (inside) • Cleaning • Durability
		Handling and Using (Q-2, Q-5, Q-7,Q-	• Easy to pour • Space availability • Cleaning and durability

		12, Q15)	
		Product identification (Q-6)	• Shape/Form • Appearance • Product colour
		Transport (Q-18)	• Easy to transport • Packing
		Fuel wastage (Q-8, Q-17))	• Shape and Form of the base • Body thickness • Quality of heat absorption
	Texture	Gripping (Q-21, Q-26)	• The surface quality of the lip area
		Rough & smooth surface (Q-19, Q-25)	• Cleaning purposes • Easy to handle • Heat absorption • Thermal shock resist • Psychological feelings • Aesthetical value • The quality of water absorption Water evaporation
		Heat absorption (Q-24)	• Quality of thermal shock
		Durability (Q-23)	• Strength of the product • Hardness
	Value	Aesthetical Value (Q-20, Q-27, Q-29,	• Colour • Decorations

		Q-31)	• Texture • Surface and surface decoration
		Market value (Q-49)	• Price
		Cultural value (Q-30, Q-33)	• Taste • Smell • Appetizer
		Physical value (Q-22, Q-32, Q-36, Q-37, Q-47)	• Quality of heating & cooling effects • Thermal shock resist • Water absorption • Product weight
		Social value (Q-28, Q-34, Q-44, Q-45, Q-46, Q-48)	• Healthy life • Eco friendly products
		Product quality (Q-41)	• Outer appearance • Outer appearance and

4.3 Research Model

This model is based on predetermined specific characteristics related to measure the design efficiency of clay cooking pots *("Hattiya")* used in Sri Lanka. Those predetermined characteristics are;

1. Shape and Form
2. Texture
3. Value
4. Proportion
5. Balance

Most of the collected data are qualitative in nature; because this research required a statistical method to convert that information to analyzable quantitative data. This conversion model is evaluating each individual characteristic with; relevant value (weight) factors given by users in the sample group.

Design efficiency $\propto$ Efficiency of Shape & Form + Efficiency of Texture + Efficiency of Value + Efficiency of Prop + Efficiency of Balance.

$$\text{Efficiency of Shape and Form } \propto \left(\frac{\sum_{i=1}^{n} SH_i}{n}\right) \times \frac{1}{p}$$

By using a factor, this formula can be balance. This factor must be relating variables on right side of the equation to the left side concept.

$$\text{Efficiency of Shape and Form} = \alpha \left(\frac{\sum_{i=1}^{n} SH_i}{n}\right) \times \frac{1}{p}$$

Where;

α = Weight factor given by users

SH = Value given to each question by sample

n = Number of questions associated to each variable

p = Sample size

Accordingly;

$$\text{Efficiency of Texture} = \beta \left(\frac{\sum_{i=1}^{j} TE_i}{j}\right) \times \frac{1}{p}$$

$$\text{Efficiency of Value} = \delta \left(\frac{\sum_{i=1}^{k} VA_i}{k}\right) \times \frac{1}{p}$$

$$\text{Efficiency of Proportion} = \phi \left(\frac{\sum_{i=1}^{l} PR_i}{l} \right) \times \frac{1}{p}$$

$$\text{Efficiency of Balance} = \sigma \left(\frac{\sum_{i=1}^{m} BL_i}{m} \right) \times \frac{1}{p}$$

(SH- Shape & Form, **TE**- Texture, **VA**- Value, **PR**- Proportion, **BL**- Balance)

Where;

β,δ,ϕ,σ = Weight factor given by users

TE, VA, PR, BL = Value given to each question by sample

j,k,l,m = Number of questions associated to each variable

p = Sample size

Weight factors calculate as a percentage of each factor value to the total values given by sample group;

Example:

$$\alpha \text{ Weight Factors} = \frac{\alpha_{value}}{\left(\alpha_{value} + \beta_{value} + \delta_{value} + \phi_{value} + \sigma_{value}\right)}\%$$

4.4 Hypothesis Testing

- Null Hypothesis: [H_o] → Design efficiency is an important element to product functionality of selected Earthenware cooking pot in Sri Lanka.

- Alternative Hypothesis: [H_1] → Design efficiency is not an important element to product functionality of selected Earthenware cooking pot in Sri Lanka.

4.5 Questionnaire Design & Questionnaire Survey Method

Questionnaire can be explained as follows; “Questions take one of two primary forms. When they require respondents to use their own words, they are called open. When they are preselected for the respondent, they are called closed. In general, closed questions are considered more efficient and reliable than open questions for getting information from groups of people. Both types have advantages and limitations”. (Fink, 1995, p.32)

There are two types of questionnaire methods used for collecting data. Questionnaire method is selected according to obtain their real opinions and views as they express their own feelings. Fink A. (1995) stated that, “An open question allows respondents to give answers in their own way. These questions are useful I getting unanticipated answers and for describing the world as the respondents really sees it rather than how the researcher does. Some respondent also prefer to state their views in their own words. Sometimes, the responses provide quotable material” (p.32). Close ended questionnaire provides correct data systematically and it produces standardize data for statistical analysis.

“Closed questions are more difficult to write than open ones because the answers or response choices must be known in advance. However, some respondents prefer closed questions because they are either unwilling or unable to express themselves while being surveyed. Finally, closed questions produce standardize data that can be analyzed statistically.”

(Fink, 1995, p.33)

Open questions consist of the question alone. Closed questions consist of the question and the responses. Two types of questionnaires provide for data collection. Questionnaire type one is consisted with open ended questioner to establish the research question. (See Annexure -1). Questionnaire type Two (See Annexure – 2) is consisted with open ended and also the closed ended questionnaire method. Because it helps to get a correct answers with details.

Question type Two – (See Annexure – 2)

A - The questionnaire (Section – A) consists of general information like; Name, age, gender, education qualification, occupation, monthly income, no of family members, marital, use of fuel, city of residence.

B - The questionnaire (Section - B) is meant to obtain information about the variability and quality of *"Hattiya"* (present used), relevance of cooking purpose and also to achieve design efficiency and developments. The questionnaire focuses on Design Principles and Design Elements with a view to achieve design efficiency of the product.

This questionnaire survey consists of 50 questions and it is given to 60 houses. They are distributed to 30 houses in Kandy and 30 houses in Colombo equally. Sample pictures of selected objects are attached to the questionnaire to enable them to supply answers easily. They can answer the questions freely as there is no influence. 18 Males and 42 Females from both Colombo and Kandy will be participated and they will be categorized according to the four main age levels.

Table 4.3: Age Level Distribution

No of Participants	Age level
15	20-30 Years
25	31-40 Years
12	41-50 Years
08	51-60 Years

Two types of questionnaires are used to collect data in this research. Answers are obtained as a joint attempt.

For the convenience of collecting data, method of open ended questionnaires is used. Some questions are expected to be answered in writing. It is used to get peoples ideas to understand their attitudes and get their suggestions.

4.6 Sample Selection

This survey has been done on 60 people who live in two urban areas in Sri Lanka. Questionnaires are given to Kandy and Colombo. Those are the two urban areas which are selected for the survey.

"Urban can be explained as; an urban area is characterized by higher population density and vast human features in comparison to areas surrounding it. Urban area may be cities, town, or conurbations, but the term is not commonly extended to rural settlements, such as village and hamlets."

(www.wikipedia.org/wiki/urbanarea)

According to CIA world fact book, it has been declared that the entire population of Sri Lanka will be 21, 283,913 (July 2011est) in the year of 2011. According to the data in 2010, 14% of local population is urban population. Urban population of Kandy is 1,279,028 (in 2001) and area population of Colombo is 2,251,274 (2001). According to the data (2002) the city population of Colombo will be 78, 4900 and the urban population of Colombo will be 2,40,9000. The city population of Kandy will be 1, 52,200 and the urban population of Kandy will be 1, 52,200.

Since most of the villages and other areas have become urbanized presently, people tend to move to those urbanized areas due to many reasons. Therefore questionnaires have been used in these areas as a research tool. The people, who live in urban areas, lead different life styles. They consume different types of food and use different utensils to prepare the food. Preparation methods of food also have been changed according to their life style.

As they have realized the advantages of using clay products, they like to use clay pots for cooking. But, it is found that, present clay products do not meet the

requirements of the consumer, as they lack certain features. So that clay products give a hassle to the consumer in preparation of various food items, using modern techniques.

(Question type two) Kandy has been selected as a semi urbanized area in this research as still can find traditional way of life styles and people who use traditional cooking methods in the most areas of Kandy. When Kandy is compared with Colombo, it is understood that Colombo is a fully urbanized area and it is socially and culturally different from Kandy in many ways.

In order to obtain more reliable information in the research, data should be collected from its real users. Therefore in the gender distribution it has a bias towards female to select a reasonable (to minimize bias) sample. To match this criteria male is picked after every 2 families from houses, as a random sample. Fink (1995) explained about the random sampling; “Objective means of choosing a sample and is a “fair” way of getting a sample. Members of the target population are selected one at a time and independently. Once they have been selected, they are not eligible for a second chance and are not returned to the pool. Because of this equality of opportunity, random samples are considered relatively unbiased”. (p.69)

Three sizes of the “*Hattiya”* are taken as samples. Lid is used as a supportive object. The objective of the survey is to see, how the Earthenware products can be developed to achieve design efficiency and also to see the suitable way of developing these selected samples in order to match the present social context.

4.7 Method of Data Measurement

Ordinal method is used to evaluate the answers. Ordinal is a "Respondents who are asked to rate or order choices (say, from very positive to very negative) are given ordinal choices" (Fink, 1995, p.36). All questions have five options for the respondent to select. They can choose the most appropriate answer from that scale. When evaluating those collected data there is 1 to 5 or, 5 to 1 marking system through the scale; that depends on whether question is negative or positive.

Table 4.4: Scale for Positive and Negative Questions

						Numbers of Questionnaire
Negative Question	1	2	3	4	5	21
Positive Question	5	4	3	2	1	28

4.8 Questionnaire Development - (Question Type Two)

Two rating questions such as Negative and Positive are mainly used, 27 Positive questions and 22 Negative questions are used here. The last question in the questionnaire survey is a general question (No-50). The Shape, Form, Texture and Value are used as the key factors of the product and these factors are used to assess the Design Elements. Balance and Proportion are used as the key factors to assess Design Principles.

Table 4.5: Clarification of Questionaire

Key Factors	Question No.		Total of Question No.
	Negative Questions	**Positive Questions**	
Proportion	Q.No. - 13	Q.No. - 1	
	Q.No. - 35	Q.No. - 9	
	Q.No. - 38		
Total Q.No.	**3**	**2**	**5**
Balance	Q.No. - 16	Q.No. - 40	
	Q.No. - 42		
Total Q.No.	**2**	**1**	**3**
Shape & Form	Q.No. - 5	Q.No. - 2	
	Q.No. - 7	Q.No. - 3	
	Q.No. - 8	Q.No. - 4	
	Q.No. - 15	Q.No. - 6	
		Q.No. - 10	
		Q.No. - 11	
		Q.No. - 12	
		Q.No. - 14	
		Q.No. - 17	
		Q.No. - 18	
		Q.No. - 39	
Total Q.No.	**4**	**11**	**15**
Texture	Q.No. - 21	Q.No. – 19	
	Q.No. - 23	Q.No. - 24	
	Q.No. - 25		
	Q.No. - 26		
Total Q.No.	**4**	**2**	**6**

Value	Q.No. - 31	Q.No. - 20	
	Q.No. - 33	Q.No. - 22	
	Q.No. - 36	Q.No. - 27	
	Q.No. - 37	Q.No. - 28	
	Q.No. - 41	Q.No. - 29	
	Q.No. - 44	Q.No. - 30	
	Q.No. - 46	Q.No. - 32	
	Q.No. - 47	Q.No. - 34	
		Q.No. - 43	
		Q.No. - 45	
		Q.No. - 48	
		Q.No. - 49	
Total Q.No.	**8**	**12**	**20**
General Question			**1**
Total Questionnaire (Question type two)			**50**

For the identification of Proportion of the Design Principles six questions have been included in the questionnaire survey. These six questions are Q.No.13, 35, 38, 1,9 and Q.No. 13, 35, & 38 are negative and Q.No.1 & 9 is positive questions.

Three questions have been used to assess Balance which is another concept of Design Principles. Q.No. 16, 42 & 40 are asked on that and Q.No. 16 & 42 are used as negative questions and Q.No.40 is used as a positive question.

Fifteen questions are used to asses the concepts of Shape and Forms, in order to identify the Design Elements. These are Q.No. – 5, 7, 8, 15, 2, 3, 4, 6, 10, 11, 12, 14, 17, 18, & 39. Out of these questions, Q.No. 5, 7, 8, & 15 are negative questions and Q.No. 2, 3, 4, 6, 10, 11, 12, 14, 17, 18, & 39 are positive questions.

To assess the Texture of Design Elements of questions have been included. They are Q.No.21, 23, 25 ,26, 19, & 24. Out of these questions Q.No. 21, 23, 25, & 26 are negative and Q.No. 19 & 24 is positive questions.

For the identification of the product Value 20 questions are used. They are Q.No. 31, 33, 36, 37, 41, 44, 46, 47, 20, 22, 27, 28, 29, 30, 32, 34, 43, 45, 48, & 49. from these no of questions, Q.No. 31, 33, 36, 37, 41, 44, 46, & 47 are used as negative questions and Q.No. 20, 22, 27, 28, 29, 30, 32, 34, 43, 45, 48, & 49 are used as positive questions. Apart from this Q.No. 50 is used as a general question.

For the Proportion of the Design Principles 03 negative questions and 02 positive questions have been used. And for the Balance identification 2 negative questions and 1 positive question are asked.

4 negative and 11 positive questions are asked on the elements of Shape and Form to assess the Design Elements. To identify the Texture of the product 4 negative questions and 2positive questions are asked. 8 negative questions and 12 positive questions are asked to assess the Value of the product. According to this there are 8 questions used to assess Design Principles and 41 Questions are used to assess the Design Elements of the product.

4.9 Summary

This chapter has explained the method of development of questionnaire survey; sample selection and data evaluate method in detail. Questionnaire survey helps to identify the failures and to establish the developments of the *"Hattiya"*. It explains design elements and design principles in order to identify key factors to develop the product. Next chapter will present data analysis method and result of the questionnaire survey.

Chapter Five

DATA ANALYSIS

5.0 Introduction

This chapter includes all data collected through structured questionnaires. Statistical analysis is used as a main analytical method. **"**Statistic is the mathematics of organizing and interpreting numerical information. The results of statistical analyses are descriptions, relationships, comparison, and predictions" (Fink , 1995, p.1). The questionnaire was given to people (about 60 numbers) who live in urban areas in the Kandy and Colombo districts (See Section 4.5). Chi-Square method is used as a data analysis method to find out the main key considerations. Data will be described using diagrams and charts.

5.1 Sample Distribution

This is the data presentation of selected sample. The following tables and charts present information of the distribution of basic data among the participants of questionnaire survey (See Annexure – 2).

5.1.1 Sample Selection for Questionnaire

The table and figure represent the sample selection used for questionnaire survey. The questionnaire is distributed among 30 participants who have been selected at random from the Kandy district and also among 30 participants from Colombo.

Research is select equal amount of participants to the questionnaire from Kandy and Colombo. Among these equal amounts research use random sampling method to select reasonable sample. Following charts demonstrate clarity of these sample groups.

Table 5.1: Sample Selection

Name of the City	No. of Participants	%
Kandy	30	50
Colombo	30	50
Total	60	100

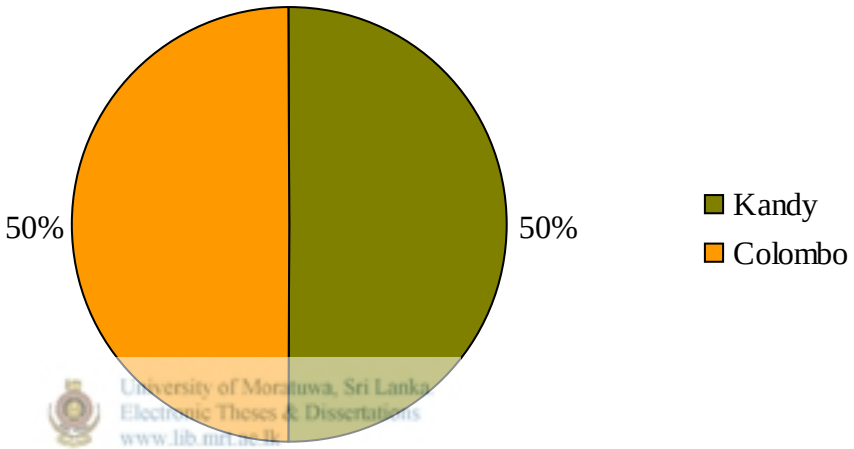


Figure 5.1: Sample Selection

5.1.2 Sample Distribution of Gender

Table 5.2: Sample Distribution of Gender

Gender	Cities				Total K & C	
	kandy		Colombo			
	No	%	No	%	No	%
Male	8	26.7	10	33.3	18	30
Female	22	73.3	20	66.7	42	70
Total	30	100	30	100	60	100

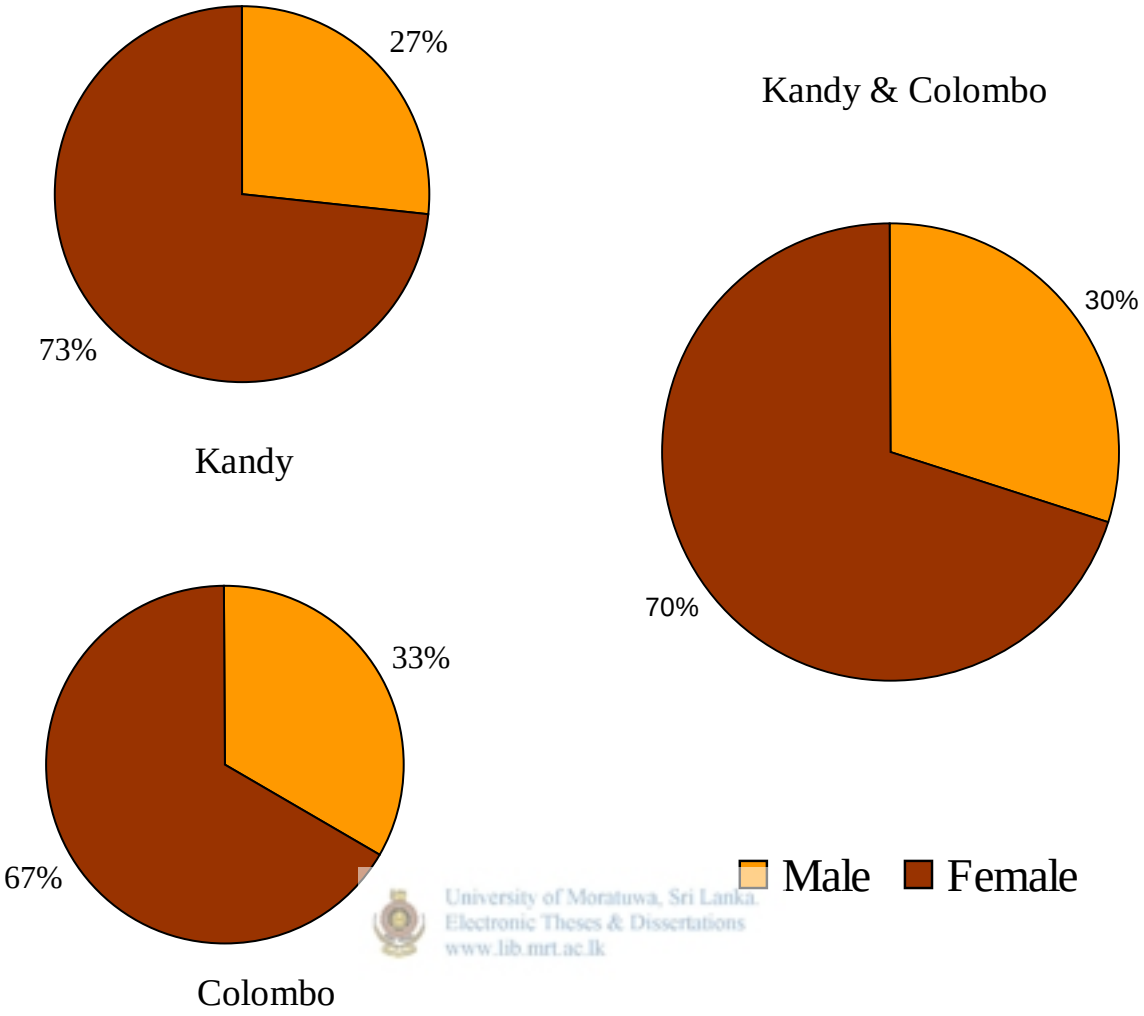


Figure 5.2: Sample Distribution of Gender

When selecting sample research try to keep % of male around 30%; as research would be collect data from its real users to get more reliable information. As a result gender distribution more bias forwards female to select a reasonable (to minimize biasness) sample to match this criteria research pick a male after every 2 families from random houses. This maintains quality of randomness within the sample.

70% of participants are female; because this questionnaire is filled by house wives they usually engaged in cooking. 30% samples represent the male. The pie-charts show the samples of gender distribution. According to this data it can be identified most of the clay cooking pots are used by females in Sri Lanka.

5.1.3 Sample Distribution of Age Group

Table 5.3: Sample Distribution of Age Group

Age Distribution	Kandy				Colombo				Total				Total	
	Male		Female		Male		Female		Kandy		Colombo			
									M / F		M / F		K & C	
	No	%	No	%	No	%	No	%	No	%	No	%	No	%
< 20	0	0	0	0	0	0	2	10	0	0.00	2	6.67	2	3.33
20 - 30	2	25	6	27.3	2	20	2	10	8	26.67	4	13.3	12	20
31 -40	4	50	12	54.5	5	50	9	45	16	53.33	14	46.7	30	50
41 - 50	1	13	2	9.09	2	20	5	25	3	10.00	7	23.3	10	16.7
51 - 60	1	13	1	4.55	1	10	2	10	2	6.67	3	10	5	8.33
61 <	0	0	1	4.55	0	0	0	0	1	3.33	0	0	1	1.67
Total	8	100	22	100	10	100	20	100	30	100.00	30	100	60	100

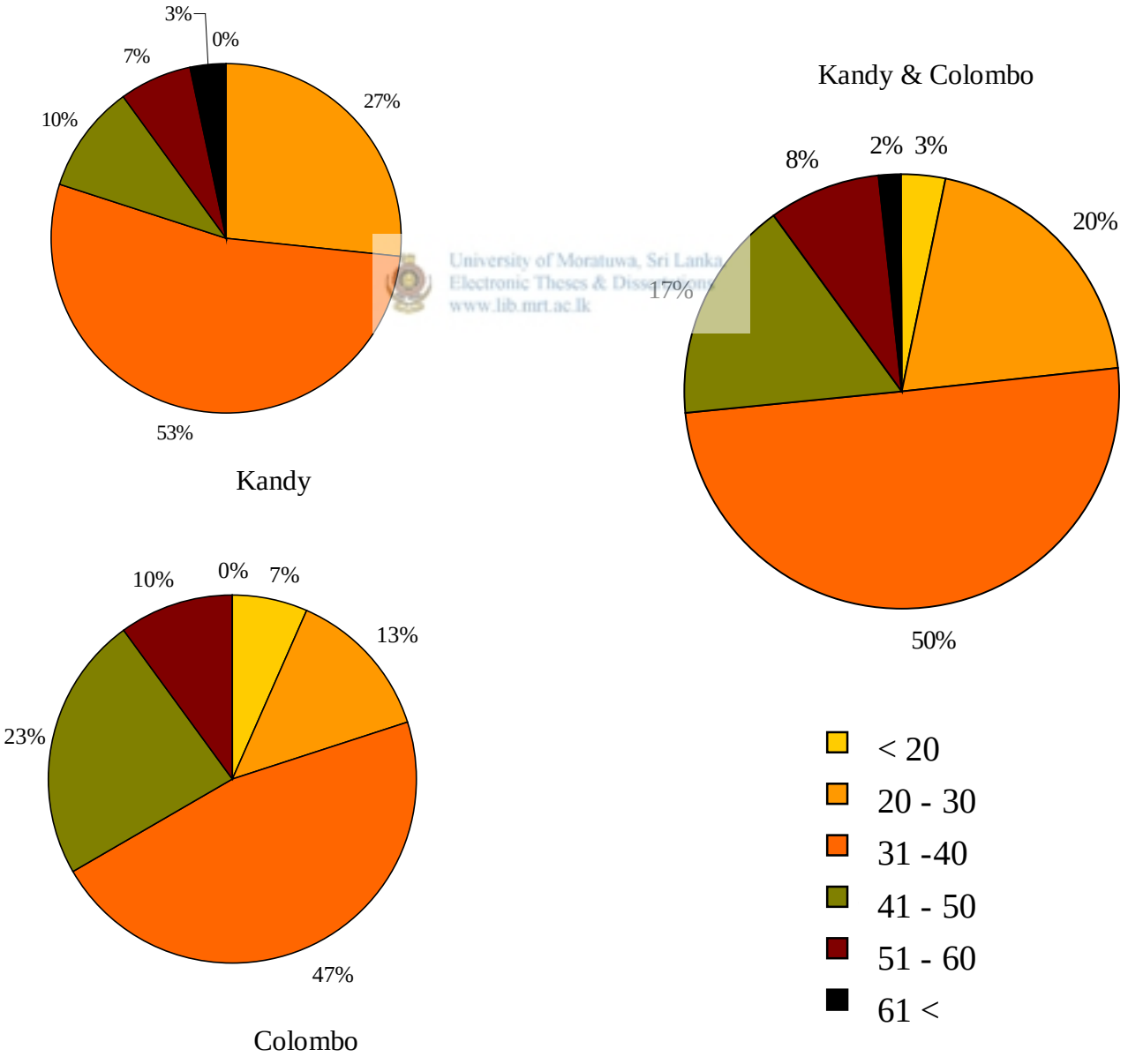


Figure 5.3: Sample Distribution of Age Group

This sample shows that 53% of participants represent the age group between 31-40 in Kandy and 47% represents same age group in Colombo. Then the overall percentage is 50 from the both districts. But those belong to the age group below 20 years age are 3% in Kandy and Colombo. The age group between 20years and 30 years the represented by 20% and, this is the second main group in the selected sample. The age limit between 41 and 50is represented as 17% in Kandy and Colombo. The overall sample presents 8% for the age of 51 and 60. The age group above 61 years of age is 2%.

5.1.4 Sample Distribution of Educational Qualifications

Table 5.4: Sample Distribution of Educational Qualifications

Education Qulif.	Kandy		Colombo		Total	
	No	%	No	%	No	%
O/L	9	30	5	16.7	14	23.3
A/L	7	23.3	7	23.3	14	23.3
Diploma	5	16.7	5	16.7	10	16.7
Degree	4	13.3	6	20	10	16.7
Masters	3	10	4	13.3	7	11.7
PhD	2	6.67	3	10	5	8.33
Total	30	100	30	100	60	100

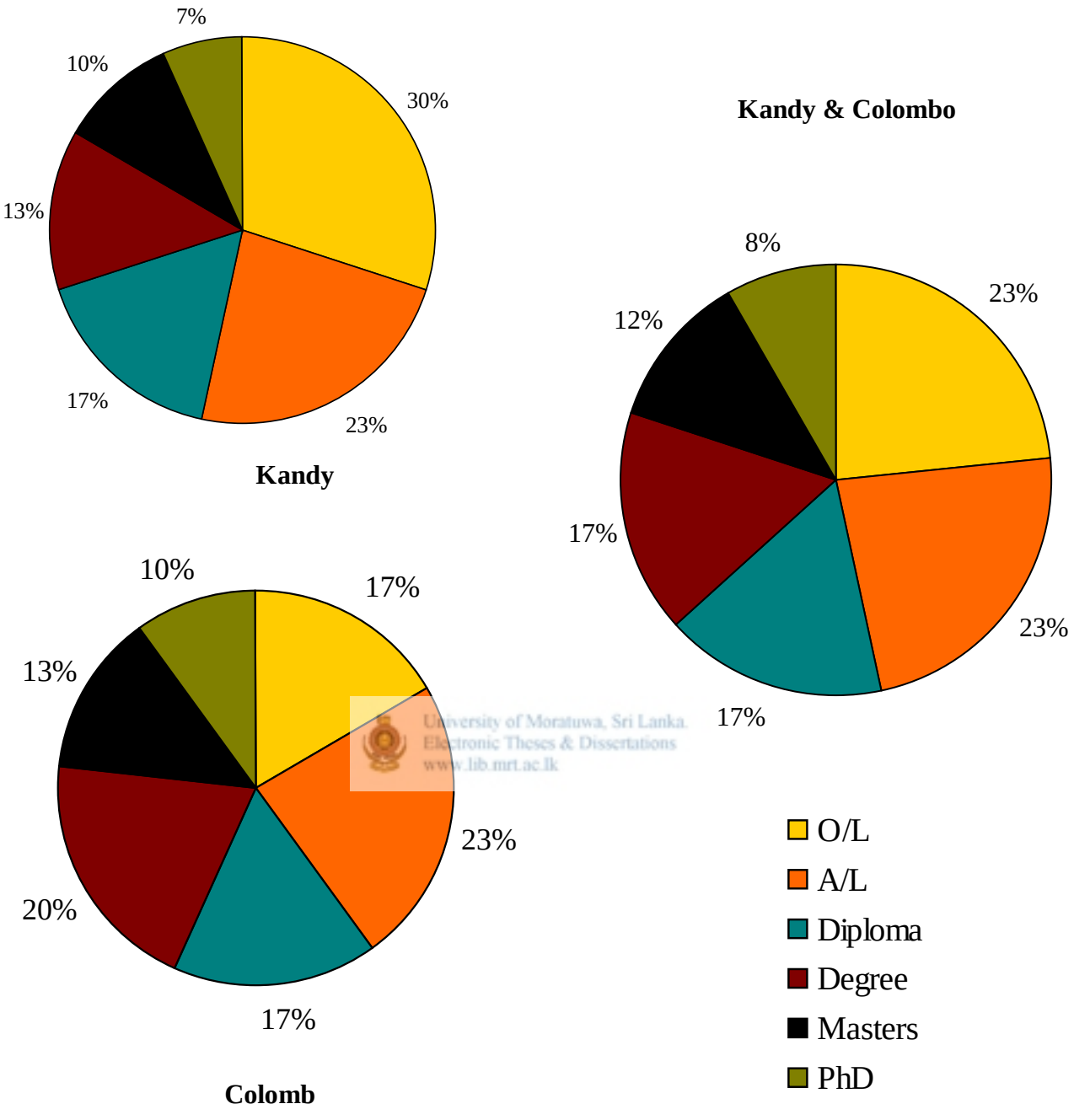


Figure 5.4: Sample Distribution of Educational Qualifications

Figure 5.4 Pie- Chart represents the education distribution of the selected sample. In Kandy and Colombo 23% qualified of O/L and 23% qualified with A/L, it gets same

average. 17% of participants had a Diploma and Degree. 12% had a master degree and 8% had PhD qualifications. In overall sample most of people are educated.

5.1.5 Sample Distribution of Occupation

Table 5.5: Sample Distribution of Occupation

Area of Occupation	Kandy				Colombo				Total			
									Kandy		Colombo	
	Male		Female		Male		Female		M / F		M / F	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Government	2	25	8	36.4	1	10	6	30	10	33.3	7	23.3
Private	3	37.5	6	27.3	4	40	11	55	9	30	15	50
Self Work	1	12.5	3	13.6	4	40	1	5	4	13.3	5	16.7
Not Work	2	25	5	22.7	1	10	2	10	7	23.3	3	10
Total	8	75	22	100	10	100	20	100	30	100	30	100

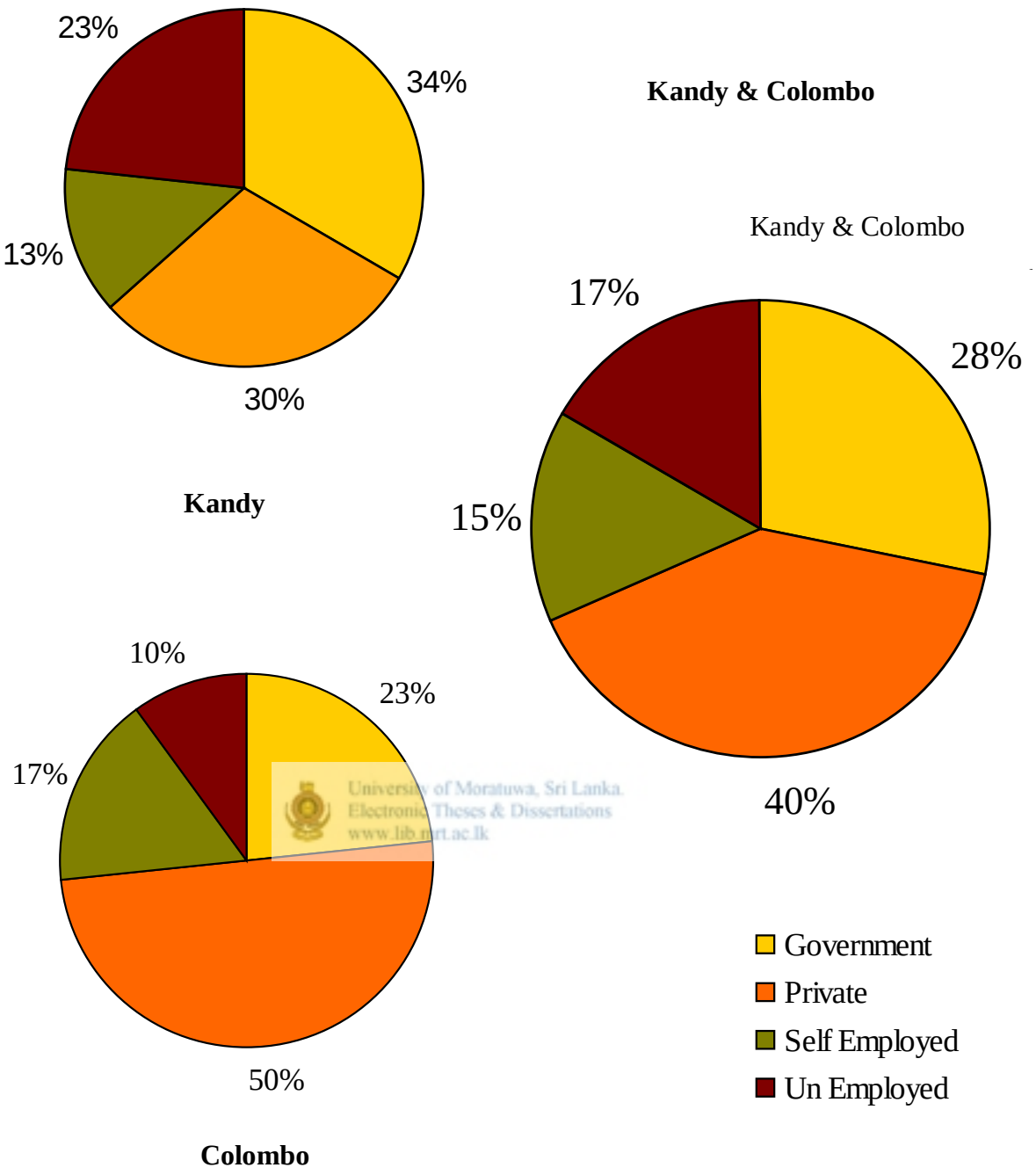


Figure 5.5: Sample Distribution of Occupation

This sample represents a big contrast between the government sector in Kandy and private sector in Colombo (50%). Kandy and Colombo 28% are employed in government sector and 40% work in the private sector. The 15% of participants are self-employers. 17% of people have been recognized as unemployed.

5.1.6 Sample Distribution of Monthly Income

Table 5.6: Sample Distribution of Monthly Income

Monthly Income	Kandy		Colombo		Total	
	No	%	No	%	No	%
< 20,000	8	26.7	4	13.3	12	20
21,000 - 30,000	7	23.3	4	13.3	11	18.3
31,000 - 45,000	5	16.7	4	13.3	9	15
46,000 - 55,000	6	20	10	33.3	16	26.7
55,000 <	4	13.3	8	26.7	12	20
Total	30	100	30	100	60	100

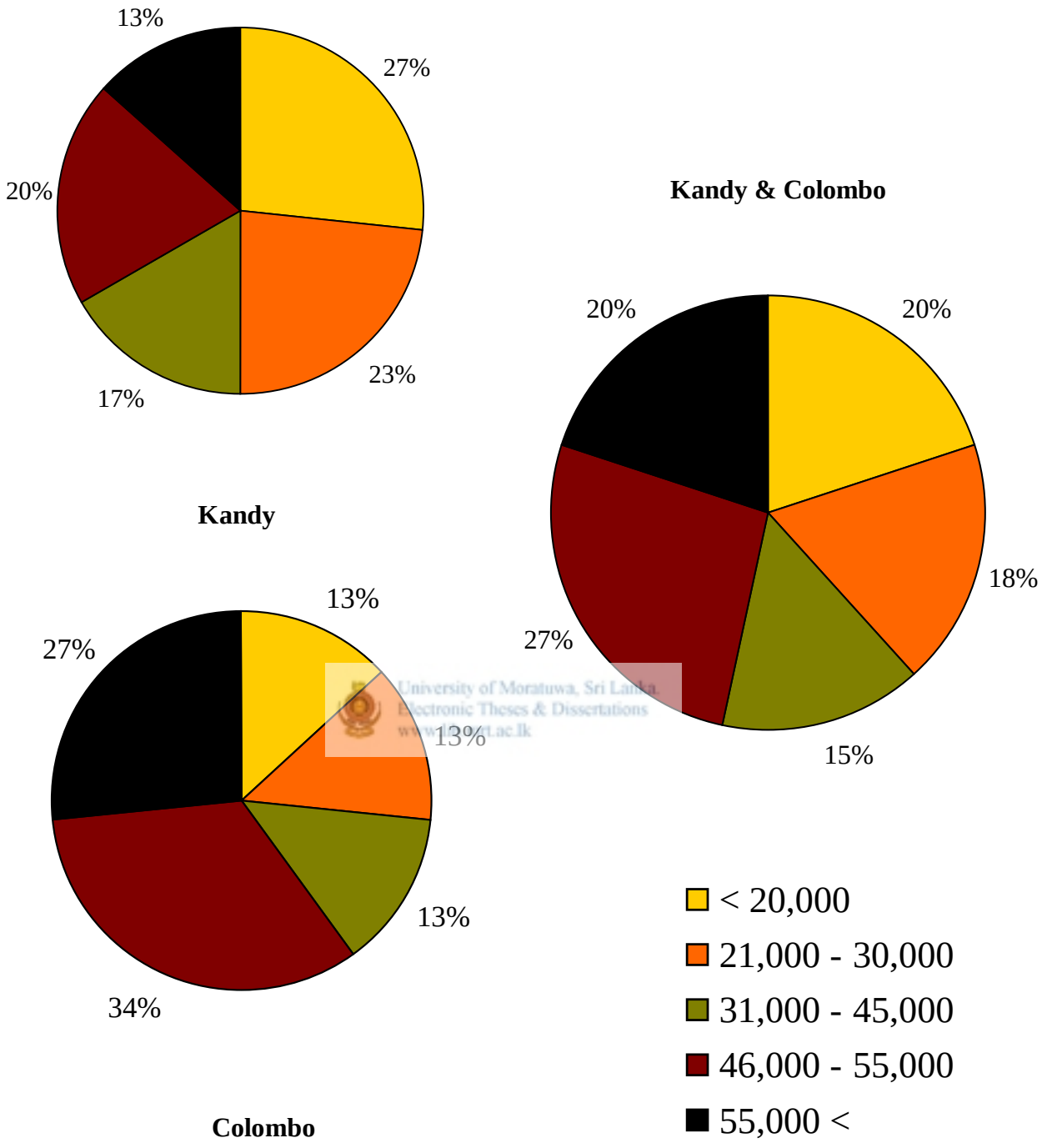


Figure 5.6: Sample Distribution of Monthly Income

From this figures (5.6), it is seen that 20% of participants from Kandy and Colombo draw monthly income less than Rs. 20,000/=. 18% of participants draw an income between Rs.21, 000- Rs.30,000 per month. It is also seen 15% of people get Rs. 31,000- Rs. 45,000 as their monthly income, and 27% of participant get Rs. 46,000 to 55,000 as monthly income and more than Rs. 55,000 per month get 20% both in Kandy and Colombo.

5.1.7 Sample Distribution of Number of Family Members

Table 5.7: Sample Distribution of Number of Family Members

No. of Family Members	Kandy			Colombo			Total No. of Members	
	No. of Families	Total No. of Members		No. of Families	Total No. of Members		Kandy & Colombo	
		No	%		No	%	No	%
1	3	3	10.00	5	5	16.67	8	13.33
2	6	12	20.00	7	14	23.33	13	21.67
3	15	45	50.00	12	36	40.00	27	45.00
4	2	8	6.67	2	8	6.67	4	6.67
5	2	10	6.67	2	10	6.67	4	6.67
6	1	6	3.33	1	6	3.33	2	3.33
7	1	7	3.33	1	7	3.33	2	3.33
Total	30		100.00	30		100.00	60	100.00

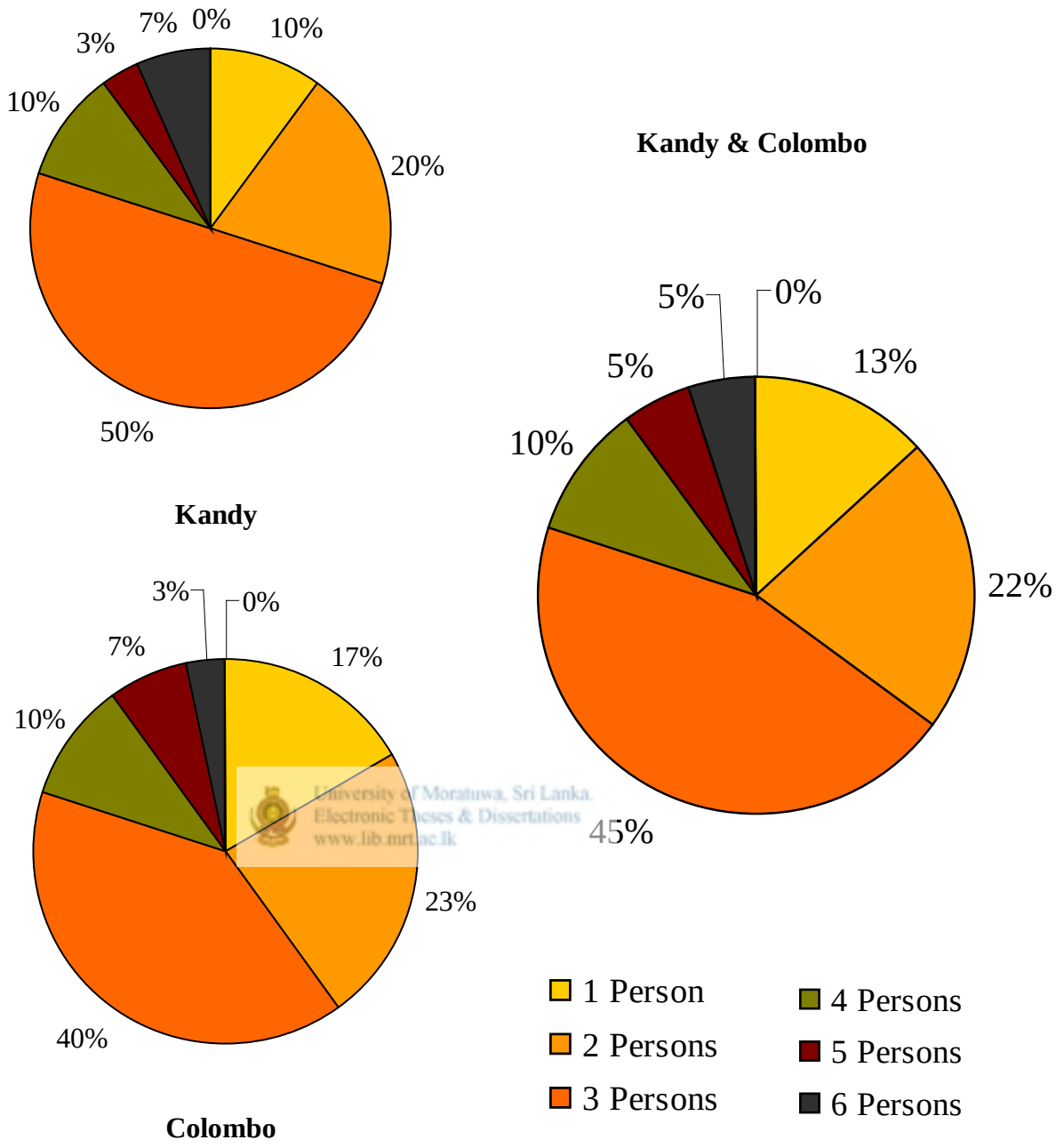


Figure 5.7: Sample Distribution of Number of Family Members

The largest area of the pie-chart represents the no. of families which consist of 3 members it is 45% in both Colombo and Kandy districts. It also shows families consists of 1 are 13% and families consists of 2 are 22% in the selected sample. Families who have 4 members can be seen as 10% and those are have 5 and 6 members can be seen as 5% of the sample.

5.1.8 Sample Distribution of Energy Usage for Cooking Purpose

Table 5.8: Sample Distribution of Energy Usage for Cooking Purpose

Energy Usage	Kandy		Colombo		Total	
	No.	%	No.	%	Total	%
Wood	5	16.7	2	6.67	7	11.7
LP Gas	19	63.3	24	80	43	71.7
Electricity	4	13.3	4	13.3	8	13.3
Kerosene	2	6.67	0	0	2	3.33
Total	30	100	30	100	60	100

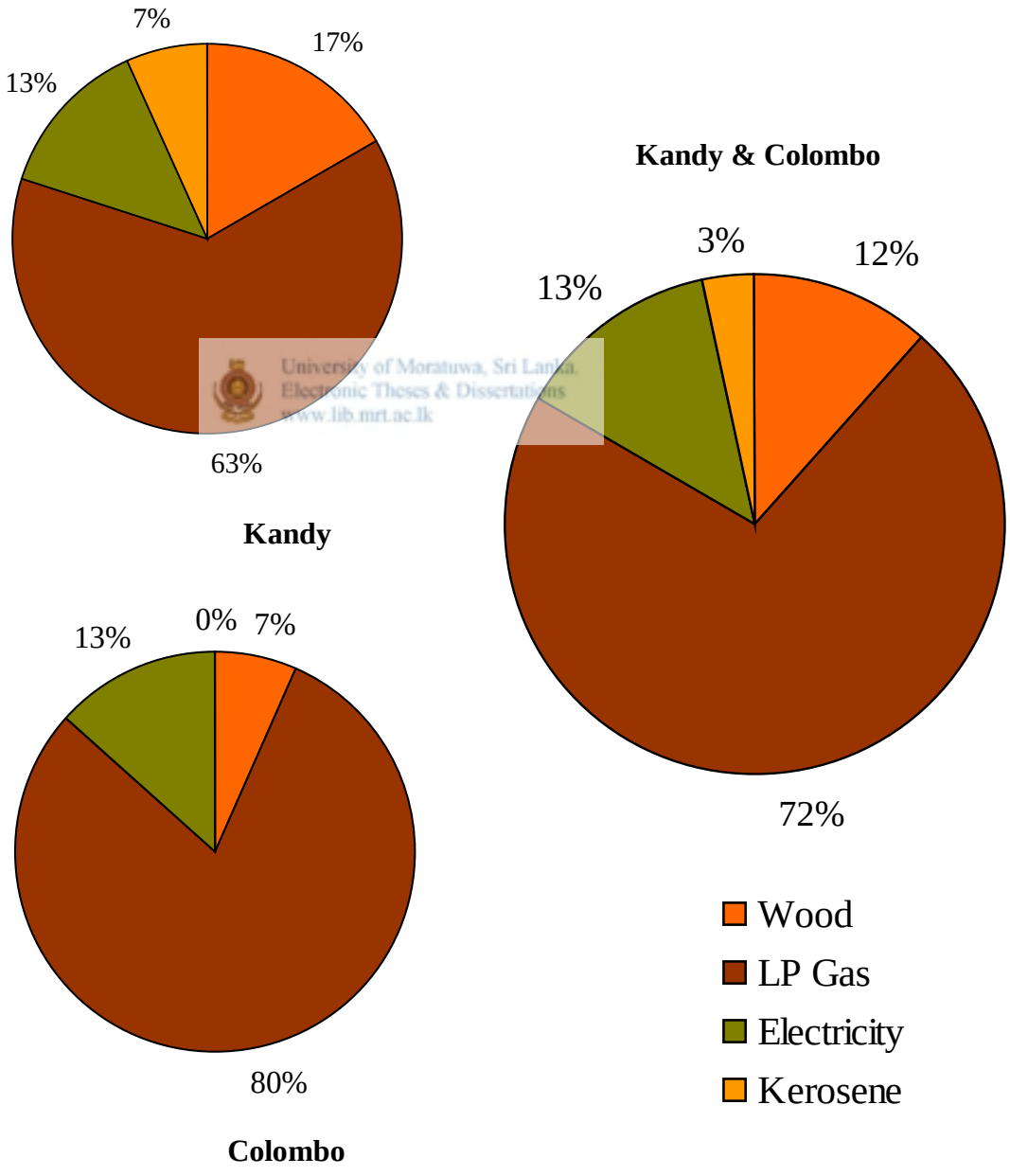


Figure 5.8: Sample Distribution of Energy Usage for Cooking Purpose

The pie-charts display the samples of energy usage. According to the data shown here 63% of people in Kandy and 80% of people in Colombo is use LP gas for their cooking. Overall 72% of people use LP gas the main energy for cooking and 13% use electricity, 12% use wood and 3% use kerosene for the purpose of cooking.

5.2 Data Records of the Survey

The following records are evaluated data of the sample. This data were collected while considering Design Elements and Design Principles of the *"Hattiya"* on two selected area according to the method which is mentioned in the chapter four.

5.2.1 Survey Data of Key Factors

Table (5.9) and Figure (5.9) shows the findings of questionnaire No.50 in the questionnaire survey. It is a common question and it described the validity of focused factors are given from their experiences; they have expressed their suggestions too.

α, β, δ, ϕ, σ represent wait age factor of Shape & Form (α), Texture (β), Value (δ), proportion (ϕ), and (σ) balance represent. This figure identified to balance respectively. This figure identified to balance proportionate equations as shown in chapter Four.

Table 5.9: Data of Key Factors of the Survey

Key Factors		Kandy		Colombo		K & C	
		Total	%	Total	%	Value	%
Shape & Form	α	167	28.07%	170	27.96%	337	28.01%
Texture	β	148	24.87%	155	25.49%	303	25.19%
Value	δ	120	20.17%	122	20.07%	242	20.12%
Proportion	ϕ	76	12.77%	73	12.01%	149	12.39%
Balance	σ	84	14.12%	88	14.47%	172	14.30%
Total		595	100.00%	608	100.00%	1203	100.00%

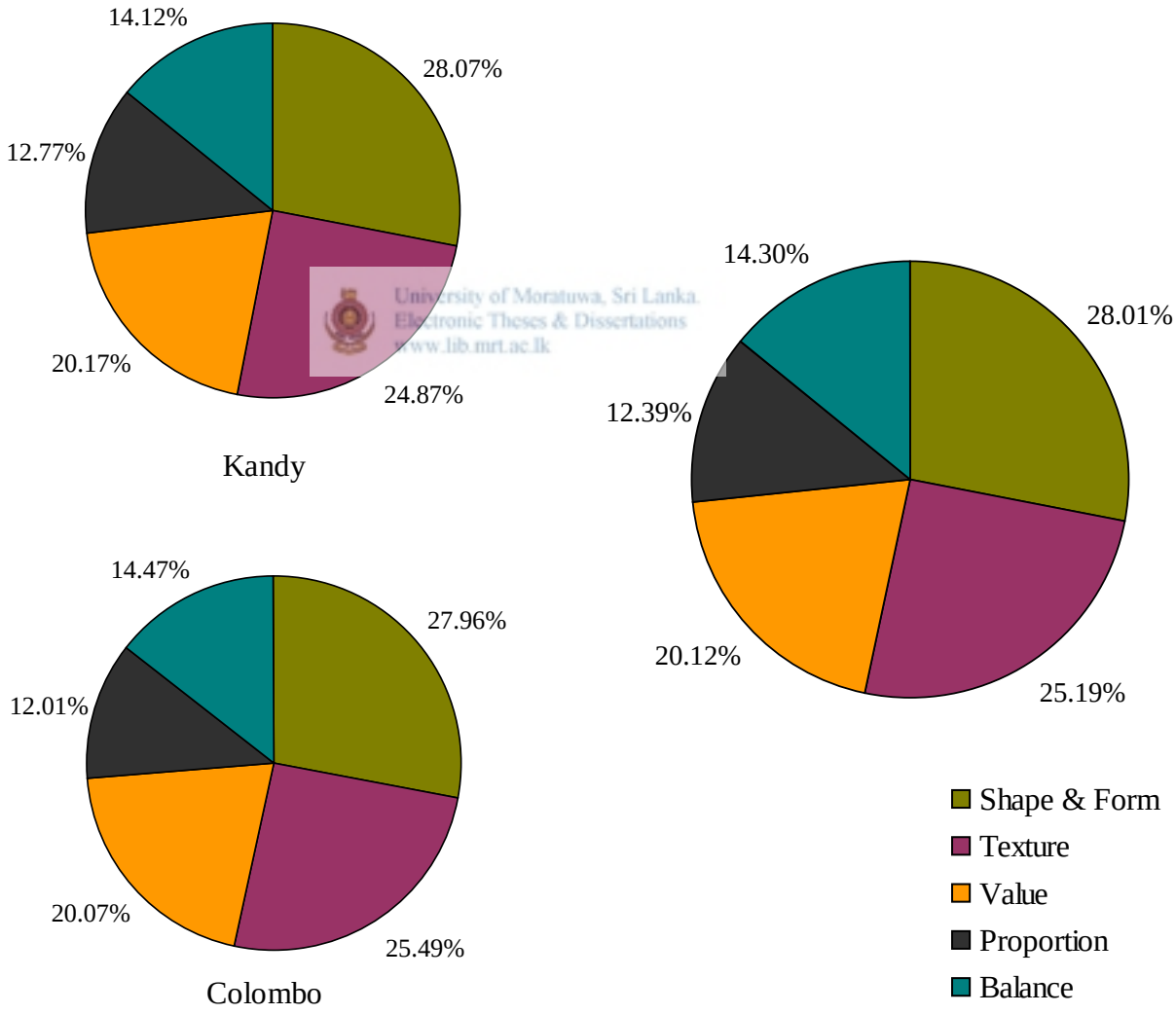


Figure 5.9: Data of Key Factors of the Survey

Above pie-chart shows the importance of the factors with regard to the selected sample *("Hattiya")*. In the rating, people of Kandy and Colombo are given similar rating. Shape & Form can be identified as most important facts of the Product *("Hattiya")*. Next important factors will be Texture, Value and Balance as they are rated at 2nd, 3rd, and 4th places. Proportion is rated as 5th, although it is the least important factor to the considered of the product.

5.2.2 Survey Data of Shape & Form

Table 5.10: Survey Data of Shape & Form

Q.No	Positive / Negative	Ranking					SH_i
		1	2	3	4	5	
2	P	0	1	5	50	4	237
3	P	0	4	6	10	40	266
4	P	2	2	8	12	36	258
5	N	4	5	4	12	35	249
6	P	2	3	9	12	34	253
7	N	0	2	4	20	34	266
8	N	4	6	12	28	10	214
10	P	3	8	18	29	2	199
11	P	0	2	8	28	22	250
12	P	1	5	8	18	28	247
14	P	3	5	15	17	20	226
15	N	2	6	12	17	23	233
17	P	6	12	10	19	13	201
18	P	6	12	15	25	2	185
39	P	1	4	15	28	12	226

Table (5.9) explained Importance of the Shape and Form of the product is shown in the table. Following calculation provides an input to analysis the design efficiency of the Shape & Form.

$$\sum SH_i \quad .= \quad 3510$$

$$\text{Number of Q.} \quad n \quad .= \quad 15$$

$$\sum SH_i/n \quad .= \quad 234$$

$$\text{Sample Size} \quad p \quad .= \quad 60$$

$$\text{Efficiency of Shape and Form} = (\sum SH_i/n)/p \quad .= \quad \mathbf{3.9}$$

5.2.3 Survey Data of Texture

Table 5.11: Survey Data of Texture

Q.No	Positive / Negative	Ranking					TE_i
		1	2	3	4	5	
19	P	3	7	9	19	22	230
21	N	4	9	13	22	12	209
23	N	6	10	12	18	14	204
24	P	2	8	3	12	35	250
25	N	6	11	7	17	19	212
26	N	5	7	8	21	19	222

This is the survey result of Texture and following calculation provides an input to analysis the design efficiency of the Texture.

$$\sum TE_i \quad .= \quad 1327$$

$$\text{Number of Q.} \quad j \quad .= \quad 6$$

$$\sum TE_i/j \quad .= \quad 221.1667$$

$$\text{Sample Size} \quad p \quad .= \quad 60$$

$$\text{Efficiency of Texture} = (\sum TE_i/j)/p \quad .= \quad \mathbf{3.6861}$$

5.2.4 Survey Data of Value

Table 5.12: Survey Data of Value

Q.No	Positive / Negative	Ranking					VA_i
		1	2	3	4	5	
20	P	12	15	16	15	2	160
22	P	8	17	8	18	9	183
27	P	6	8	13	20	13	206
28	P	0	4	9	22	25	248
29	P	6	12	13	15	14	199
30	P	2	5	10	18	25	239
31	N	3	8	12	19	18	221
32	P	0	2	12	19	27	251
33	N	2	6	19	25	8	211
34	P	5	10	15	14	16	206
36	N	3	9	11	16	21	223
37	N	12	8	12	20	8	184
41	N	5	7	11	23	12	204
43	P	2	5	21	20	12	215
44	N	2	3	14	20	21	235
45	P	2	3	11	19	25	242
46	N	2	5	17	11	25	232
47	N	2	4	19	20	15	222
48	P	4	3	16	22	15	221
49	P	3	9	12	21	15	216

Table 5.11 displays details of the factor of value. in the questionnaire survey 20 questions are used to mention the product value. Following calculation provides an input to analysis the design efficiency of the Value.

$$\sum VA_i \quad .= \quad 4318$$

$$\text{Number of Q.} \quad k \quad .= \quad 20$$

$$\sum VA_i/k \quad .= \quad 215.9$$

$$\text{Sample Size} \quad p \quad .= \quad 60$$

$$\text{Efficiency of Value} = (\sum VA_i/k)/p \quad .= \quad \mathbf{3.5983}$$

5.2.5 Survey Data of Balance

Table 5.13: Survey Data of Balance

Q.No	Positive / Negative	Ranking					BL_i
		1	2	3	4	5	
16	N	6	3	8	24	19	227
40	P	4	8	11	22	15	216
42	N	29	23	6	2	0	101

In the Questionnaire survey, there are three which are used to ask about the product Balance. This calculation shows the analysis of design efficiency of the Balance.

$\sum BL_i$.= 544

Number of Q. m .= 3

$\sum BL_i/m$.= 181.3333

Sample Size p .= 60

$$\text{Efficiency of Proportion} = \frac{\sum PR_i}{l} \Big/ p$$

Number of Q. = l

Sample Size = p

The table and figure describe the importance of selected design factors (DE / DP) in clay cooking pots *("Hattiya")*.

5.3 Summary of Five selected Design Factors of *"Hattiya"*

Table 5.15: Summary of the Analysis

Elements & Principles	Average	Weight	Observed Value	Expected
Shape & Form	3.9	28.01%	1.1	0.85
Texture	3.69	25.19%	0.93	0.76
Value	3.6	20.12%	0.73	0.61
Proportion	2.99	12.39%	0.38	0.38
Balance	3.03	14.30%	0.44	0.43
	17.21	100.00%	3.58	3.03

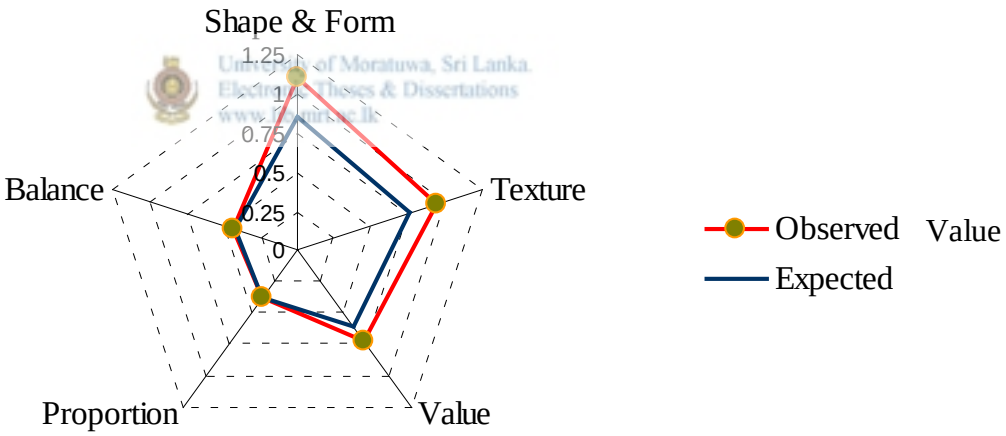
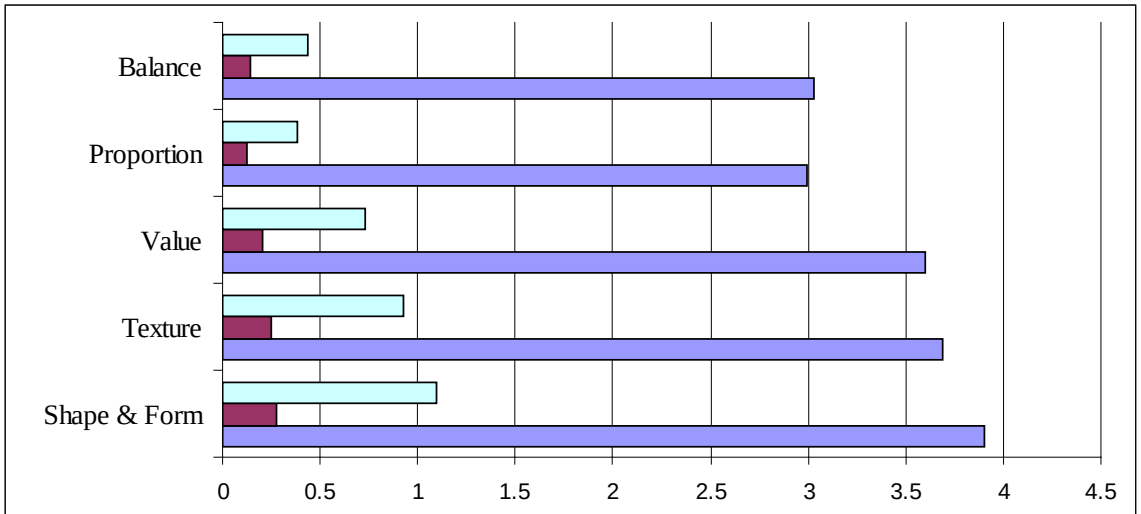


Figure 5.10: Summary of the Analysis of Five Selected Factors of *"Hattiya"*

Figure (No. 5.10) shows that the observed value (obtain trough the questionnaire) is higher than the expected value of the product.

5.4 Hypothesis Testing

Table 5.16: Importance of the Design Facts of *"Hattiya"*



	Shape & Form	Texture	Value	Proportion	Balance
Observed WA	1.1	0.93	0.73	0.38	0.44
Weight	28.01%	25.19%	20.12%	12.39%	14.30%
Avarage	3.9	3.69	3.6	2.99	3.03

Figure 5.11: Importance of the Design Facts of *"Hattiya"*

This research;

- Null Hypothesis: [H_o] → Design efficiency is an important element to product functionality of selected Earthenware cooking pot in Sri Lanka.

- Alternative Hypothesis: [H_1] → Design efficiency is not an important element to product functionality of selected Earthenware cooking pot in Sri Lanka.

Selected hypothesis testing method is Chi-Square method associate with observation value and expected value.

"The Chi-Square test is used to determine whether there is a significant difference between the expected frequencies and the observed frequencies in one or more categories."

Marben, A. F. (2012)

$$x^2 = \frac{(O-E)^2}{E}$$

O = Observation Value, E = Expected Value, X = Chi

This analysis is done with three decimal degrees. So expected value for success is taken as 0.000001.

Table 5.17: Hypothesis Model

Elements & Principles	O	E	O-E	$(O-E)^2$	$(O-E)^2/E$
Shape & Form	0.85	1.1	0.25	0.0625	0.073529
Texture	0.76	0.93	0.17	0.0289	0.038026
Value	0.61	0.73	0.12	0.0144	0.023607
Proportion	0.38	0.38	0.00	0.0000	0.000000
Balance	0.43	0.44	0.01	0.0001	0.000233
	3.03	3.58	0.55	X^2	0.135395

Degree of freedom associated with above table is 4 and relevant chi-square figured 15 %. That prove 95% of probability is to accepting Null Hypothesis. This emphasis design efficiency is an important element of functional use of product. And these results' indicate people are more aware in shape and form, rather than the other factors of the products. The observation value of that variable is higher than the researcher's expected value. On the other hand observation of proportion of the

object is equal to the expected values of the research. However it is the lowest expected element, of the other variables.

5.5 Summary

This chapter has described and analyzed the result of the particular questionnaire survey. According to the data analysis it is clearly understood that certain specific qualities have to be paid more attention, to obtain a significant development of the product (*"Hattiya"* and Lid). Thus the specific aspects such as shape, form, texture, balance and value of the product have been considered mainly, and the order of priority has also been determined in the analysis part. The experiences and the attitudes of the people have been studied for the analysis. Chi-Square analysis method has been used to test the sample.

Conclusion

Sri Lanka is a developing country in which urbanization takes place rapidly. Thus, there have been significant changes in life style of the people consequently. It has led them to have changes in their attitudes and traditions too. Numerous changes have taken place in their day today life, living patterns and also their needs and desires, have become subjected to change. Urbanization shows a direct impact on traditional way of cooking too. “Earthenware clay cooking pots” had been the main cooking utensils in traditional ways of cooking in Sri Lanka. Therefore they had played a huge role in conventional methods of cooking. As clay is an eco friendly material, it is undisputable that clay pots are good for preparing food. They are well known for their hygienic quality, too.

However, it is understood that present clay products are not in the position to cater to the needs of the people due to several drawbacks. This situation has made the people use alternative products for preparation of food particularly. It has been revealed that there are several factors such as product quality, energy efficiency problem, attitudes, and the design problems (efficiency and functionality), which have a huge effect on the earthenware vessels. It has been further revealed these factors play a vital role and if they are not considered much there will be a failure of the earthenware vessels in the modern society. The process of designing a product for the market (Design for market- DFM) is very important, when the designer’s aim is to create a product for a commercial purpose. The different mix of variables involve in the DFM process in the manufacturing process of earthenware vessels (process of clay cooking pots).

Despite the attraction for other alternative products people still prefer clay products, as they are good for health and also can be used for a prolonged period. However people always expect high quality clay products which come in good shape and form in order to use them with ease.

Hence this research has made an attempt to identify the prevailing situation of clay cooking pots and possible ways of developing the industry. It has been identified the specific features of selected product that have to be developed to achieve the aim. Data has been collected through a questionnaire survey which was carried out in selected urban areas. Number of people who were selected for the study was given this questionnaire survey. The clay cooking pot *“Hattiya”* has been used as the

sample object and the “Lid” has been used as the supportive object in this study. The clay pot *“Hattiya”* was selected as it is more commonly used than other clay cooking pots.

As design elements and design principles are key factors of a good product, the closely related aspects of a ceramic product were taken in to consideration. Therefore the aspects such as shape, form, texture, value and balance were studied relating them to the orifice, the belly, and the base of the clay product *“Hattiya”*.

Chi-Square testing method was used to test those obtained data. It has been proved through this analysis; shape, form, texture, balance and value are the most considerable aspects of a product respectively. Although *“Hattiya”* is in much use, it needs further improvements, taking shape, form, texture, balance and value as its key considerations to achieve design efficiency.

This research is focused on identifying the design efficiency of the product and several variables involved in Sri Lankan earthenware market. According to the research which has been done on the vessels *“Hattiya”* and lid, people expect more (more than 75%) efficiency out of its shape and form. In addition to these qualities people expect more from the texture and the value of those variables. The shape, form, texture, value and the balance are considerable key factors for a designer who needs to make a marketable earthenware cooking product. It has been proved that these key considerations are common to all the earthenware cooking pots, and need much attention in developing the product further. These criteria can be used to improve the quality of earthenware clay cooking pots. It will make people appreciate and adore clay products immensely.

Scope and limitations

Manufacturing limitations have to be considered mainly in applying design theories to a product as they matter a lot in this work. Particularly, technical and material limitations have to be considered and improvements have to be taken place accordingly.

Future research

In this research, key components which are required to develop clay cooking pots according to the function of them have been identified. Nevertheless, it will have to be further studied as, how these key factors can be developed making suitable for the

product functionality and a designer product. A part from this, further studies can be continued on body composition, manufacturing methods and technological development, of clay products. They are invaluable in developing earthenware clay cooking pots and also to reestablish the earthenware industry, in Sri Lanka.

REFERENCES

Alles, D.(1997). *TRADITIONAL FOODS & COOKERY DOWN THE AGES* , Facets of Sri Lanka- 2, Dreen Alles Publications.

Anderson, A. (1984). *Interpreting Pottery*. , B.T Batsford Ltd London.

Archer,B.C (1973). *The Need for Design Education*. Royal College of Art.

Boztepe,S. (2007). User value: Competing theories and models. *Internal journal of Design*, 1(2), 55-63.

Bull, P. (2000). *Design and Technology: Key stage 3- Class Book.*, Letts Educational,414, Chiswick High Road,London.

Chen, X., Shao, F., Barnes, C., Childs, T., & Henson, B. (2009). *Exploring Relationships between Touch Perception and Surface Physical Properties.* International Journal of Design, 3(2), 67-76.

Coomaraswamy, A.K. (1979). *MEDIAEVAL SINHALESE ART*. (3rd ed). United State of America.

Cooper, E. (2000). *Ten Thousand Years of Pottery*.First Publish, British Museum press, British Museum Company Ltd, 46, Bloomsbury Street, London.

David, J., Clurg, M., (2005, June 13). Copyright 1994-2011. *Digital web magazine,* Genevese.

Dewey, j. (1938). *Experience and education*. New York: Free Press.

De Silva, N. & Dissanayak, R.B, (2008), *A CATALOGUE OF ANCIENT POTTERY from SRI LANKA,* PGIAR Publication, First Publish, Postgraduate Institute of Archeology, University of Kelaniya, Sri Lanka.

Fink,A., (1995). *The survey kit 5, How to Design a Surveys*, SAGA Publications, International Educational and Professional Publisher, Thousand Oaks, London.

Fink, A.,(1995). The survey kit 8, *How to Analyze Survey Data*, SAGA Publications, International Educational and Professional Publisher, Thousand Oaks, London.

Fink, A.,(1995). The survey kit 2, *How to Ask Survey Questions*, SAGA Publications, International Educational and Professional Publisher, Thousand Oaks, London.

Frijda,N. H., (1986). *The emotions. Cambridge*: Cambridge University Press.

Fulton Suri, J.(2003). *The experience evolution: Developments in design practice. The Design Journal*, 6(2),39-48.

Gunasekara, Premathilake & Silva, R. (1971). *A Corpus of Pottery Forms Found In Sri Lanka*. Ancient Ceylon, vol.I.

1.1 Harry, K.G., Whittlesey, S.M., Harry,T.(2005). *Pots, potters, and models: archaeological investigations at the ..., Volumes 1-2*, Dept. of Transportation and Flood Control District,Statistical Research, University of Wisconsin.

Hekkert,p.(2006). Design aesthetics: principles of pleasure in product design. Psychology science, 48(2),157-172.

Heskett, J. (2002b). *Toothpicks and logos: Design in everyday life*. NewYork: Oxford University Press.

Hopper, R. (2000), *Functional Pottery-form and aesthetic in pots of purpose*. (2nd ed.). Krause publications, United States of America.

Hyperlink J., (2011, September). Principles & Elements of Design. Copyright © 1996-2011 Retrieved from *JiskhaHYPERLINK "http://www.jiskha.com/" Homework*

Idaho 4-H,(2005, Jan 31. university of Idaho, Cooperative Extension system. Retrieved from http://www.4-h.org/default.aspx

JaneAnn Stout. (4-H 634 March 2000). Design Exploring the Elements and Principles ,IOWA STATE UNIVERSITY, University Extension

Jirousek, C.(1995), Art,Design and Visual Thinking. Retrieved from http://www.char.txa.cornell.edu/media/ceramic/ceramic.htm

Makewita, M.A.G.K (2005). *Design and Functional Aspect of Clay Kitchen Utensils in Sri Lanka – with emphasis on central and southern province*, (Unpublished Bsc thesis). University of Moratuwa, Sri Lanka.

Malican,J. (2004). User studies: Finding a place in design practice and education, *Visible Language*, 38(2), 168-193.

Kempton,w. (1981). *The folk classification of ceramics: A study of cognitive prototypes*. Academic press New York.

Marben, A.F. (2012, July) *CHI-SQUARE TEST*, Statistic for the Social Sciences, Citing Wikipedia.

Margolin, V., (1997). Getting to know the user. *Design studies*, 18(3), 227-235.

Mayall, W.H (1979). *PRINCIPALS IN DESIGN*, DESIGN COUNCIL, United Kingdom, 28 haymarket, London.

Mudalige, D.(2010, October 11th). Red clay based glazed ceramic cookware enter market, Daily News, Sri Lanka.

Papanek, V. (1972). *DESIGN FOR THE REAL WORLD*, Thames and Hudson Ltd, London.

Park, Y., (2011) for the course EDC385G Interactive Multimedia Design & Production at the University of Texas-Austin.

Plamer J., Dodson M. (1996). *Design and Aesthetics, a reader*. London & Newyork, First publication, by Rontledge, 11, New Ftter Lane, London.

Redstrom,J.,(2006). Towards user design? On the shift fromobject to user as the subject of design. *Design Studies*, 27(2), 123-139.

Rice, M.P. (1987). *Pottery Analysis: A Source Book*. United States of America: Chicago University Press.

Seligman, C.G., Seligman, B.Z. (1993). *The Vedda*. Navrang, (2nd ed.), Lake house bookshop, Colombo 2.

Sentence B. (2004). *CERAMICS, A WORLD GUIDE TO TRADITIONAL TECHNIQUE*.
United Kindom , Thames & Hudson ltd, London.

Shepard, A. (1980).*Ceramic For the archaeologist.*Washington: Publication 609, Carnegie Institution of Washington.

Skibo, J.M., Walker, W.H., & Nielsen,A.E. (1995). *Expanding Archaeology*. University of Utah Press.

Somadewa,R.,(2006). *Urban Origins in Southern Sri Lanka.*Uppsala.University of Uppsala.
Thakashima, H. (2003). *Course Book, Tex for the Course in Ceramic Designing*. University of Moratuwa, Sri Lanaka.
.
Thilakasiri, J. (1994). *HANDICRAFTS OF SRI LANKA*. First Publish, Ace Printing & Packaging (pvt) Ltd, Colombo 13, Sri Lanka.

Wijesekara, N.D. (1949). *The People of Ceylon*. Colombo, M.D. Gunasena and co, Ltd.

Annexure – 1
Questionnaire Type –One

(Section – A)
Name:
Age:
Education Qualifications:
Gender:
Occupation:
Monthly Income:
No. of Family Members:

(Section – B)

1. What types of containers do you use for cooking Purposes?
   ……
   ……

2. Do you like to use clay pots for the cooking purposes? If yes why;
   ……
   ……

3. Do these products (Clay cooking pots) serve functional purposes?
   ……
   ……

4. It is believed that there is time and fuel wastage when using clay cooking pots; is this true?, But still people use clay cooking pots. Is there any reason for that?
   ……
   ……

5. People have realized the advantages of using clay pots, and they like to use them. But many of them hesitate to use them frequently. How do you respond to this situation?
   ……
   ……

6. In the past three months how often did you buy *"Hattiya"*, *"Muttiya"*, *"Athiliya"* or a Lid?
   ……
   ……

Annexure – 2

Questionnaire Type –Two

These questionnaire data are only used for internal research of the University of Moratuwa. All information obtained on the study will be kept confidential and used for research purpose only.

Information- **(Section – A)**

Name:

Gender:

Age:

<20	20-30	31-40	41-50	51-60	61<

Occupation In:

Government	Private	Self Employed	Unemployed

Education Qualifications:

O/L	A/L	Diploma	Degree	Masters	PhD

Monthly Income:

<20,00	21,000-	31,000-	46,000-	55,000

No of Family Members:

Use of Fuel for Cooking:

Wood	Gas	Electricity	Kerosene

City of residence:

Kandy		Colombo	

This questionnaire focuses on earthenware cooking pots and their purposes.

"Hattiya" is selected as a main research item in this research.

Thank you for your willingness to participate. Your cooperation is very important to the success of this study. Please answer the questions frankly and accurately. Some of the questions require written answers and others can be answered by using tick ( ). Please choose most appropriate answer to reflect your view.

(Section – B)

1. Orifice is an essential part of the *"Hattiya"*.

Strongly disagree	Disagree	Neutral	Agree	Strongly

2. It is necessary to have an unrestricted orifice to pour the curry from the *"Hattiya"*.

Not at all important	Not very important	Some what important	Very important	Extremely important

3. What is your opinion about the grip of the lip of the present *"Hattiya"*.

In good condition	Not need to develop	Neutral	Rather good	Need to develop

4. The shape of the lip is helpful for staking.

Strongly disagree	Disagree	Neutral	Agree	Strongly

5. There is enough space inside the given samples to mix the curry well;

Strongly disagree	Disagree	Neutral	Agree	Strongly

6. Select the most suitable shape for a body shape of a *"Hattiya"* from the following objects.
(underline).

7. It is easy to clean curve edges of the *"Hattiya"* properly.

Strongly disagree	Disagree	Neutral	Agree	Strongly

8. The *"Hattiya"* can be used on the gas cooker easily as its 'base' has the correct shape.

Strongly disagree	Disagree	Neutral	Agree	Strongly

9. What is the most suitable shape for a 'base' of a *"Hattiya"* underline the correct shape?

Give your reasons for your selection.

……
……
……
……
……
……

10. The ‘base’ is suitable for staking purpose, as it has a correct shape.

Extremely not good	Not good	Neutral	Good	Extremely good

11. The ‘collar’ of the *“Hattiya”* helps us to hold it easily. If the lip collar is very thick it could easily break

Strongly disagree	Disagree	Neutral	Agree	Strongly

What are your experience regarding that;

……
……
……

12. The body form helps to identify the product. (where it is *“Hattiya”, “Muttiya”, “Athiliya”*)

Not	Less	Neutral	Important	Extremely

13. The height of the collar of the present *“Hattiya”* is good for easy handling.

Strongly disagree	Disagree	Neutral	Agree	Strongly

14. The body form makes the product attractive.

Strongly disagree	Disagree	Neutral	Agree	Strongly

15. If the body form has a good finish, is handling the convenient for the user.

Strongly disagree	Disagree	Neutral	Agree	Strongly

16. The *"Hattiya"* which is presently used has a good balance.

Extremely	Disagree	Neutral	Agree	Extremely

17. The Form and the Shape of the base lead to the wastage of more fuel.

Not agree	Some what agree	Neutral	Agree	Strongly

18. Overall shape of the present *"Hattiya"* is suitable for transportation.

Not	Some suite	Some what suite	Suite	Well suite

19. Textured surface make problems in cleaning the object *("Hattiya")*

Strongly disagree	Disagree	Neutral	Agree	Strongly

20. The quality of the clay body can be recognized by the colour of the product.

Strongly disagree	Disagree	Neutral	Agree	Strongly

21. Have you ever considered the texture of the lip of the *"Hattiya"* that are used presently?

Not consider	Less consider	Neutral	Consider	Well

22. Heat absorption depends on the quality of the body surface.

Not agree	Some what agree	Neutral	Agree	Strongly

23. People consider texture of the product when they buy a pot.

Not consider	Less consider	Neutral	Consider	Well

24. Is the inside surface texture of the *"Hattiya"* is important for cooking purposes.

Not	Less	Neutral	Important	Extremely

25. The *"Hattiya"* which is presently available in market has a good texture.

Strongly disagree	Disagree	Neutral	Agree	Strongly

26. It is not very important factor to have the lip with texture to achieve grip.

Strongly disagree	Disagree	Neutral	Agree	Strongly

27. Colour gives an aesthetic value to the product.

Strongly disagree	Disagree	Neutral	Agree	Strongly

28. A healthy life can be lived if we eat food cooked in clay pots'

Not true	Not very true	No idea	True	Extremely

What do you think?

……
……
……

29. Surface decoration is important for the appearance of the product.

Not	Less	Neutral	Important	Extremely

30. In spite of the fuel wastage by cooking food in a *"Hattiya"* it makes food tasty and more nutritious.

Strongly disagree	Disagree	Neutral	Agree	Strongly

31. The colour of the *"Hattiya"* would not increase one's appetite when cooking and serving food.

Strongly	Disagree	Neutral	Agree	Strongly

32. When the *"Hattiya"* is covered by a lid, food can be cooked easily and it will also reduce the wastage of nutrients of food.

Strongly disagree	Disagree	Neutral	Agree	Strongly

33. Food cannot be served warm.

Strongly disagree	Disagree	Neutral	Agree	Strongly

34. Do you consider environmental effect of disposition, when you purchasing the product.

Never consider	Not	Neutral	Consider	Extremely

35. Ones the *"Hattiya"* is covered with the lid, the proportion is properly finished of the entire object.

Strongly disagree	Disagree	Neutral	Agree	Strongly

36. Thermal resistance is a disadvantage of earthenware clay pot.

Strongly disagree	Disagree	Neutral	Agree	Strongly

37. The present *"Hattiya"* has an appropriate weight

Strongly disagree	Disagree	Neutral	Agree	Strongly

38. Do you feel the lip of the *"Hattiya"* has been finished in order to match the body appearance of it?

Strongly disagree	Disagree	Neutral	Agree	Strongly

39. Do you think curve base adds an additional value to the heat absorption of the product?

Strongly disagree	Disagree	Neutral	Agree	Strongly

40. The lip collar balance has an effect on the quality of the entire product.

Strongly disagree	Disagree	Neutral	Agree	Strongly

41. The present *"Hattiya"* can be used in the kitchen as well as in the pantry/ to serve food.

Strongly disagree	Disagree	Neutral	Agree	Strongly

42. As the base is round of the *"Hattiya"*, it has to be kept on a mat -*"Dharanuwa"* (a*"Hattiya"* which contains food).

Strongly disagree	Disagree	Neutral	Agree	Strongly

43. Do you think by purchasing a clay pot, you help develop local industry?

Never	No	No idea	Yes	Extremely

44. What do you feel availability of clay products.

In good condition	Not need to	Neutral	Need to develop	Extremely need to

45. Is a clay pot suitable for sophisticated and dynamic life styles, in modern society?

Strongly disagree	Disagree	Neutral	Agree	Strongly

46. Using clay pots is social threat for your status.

Strongly disagree	Disagree	Neutral	Agree	Strongly

47. Property of fragility is one of main disadvantages of using clay products.

Strongly disagree	Disagree	Neutral	Agree	Strongly

48. Do you feel, serving foods in clay pots is a fashion in modern society?

Extremely	False	No	True	Extremely

49. What do you think about price of *"Hattiya"* available in the market?

Extremely not reasonable	Not reasonable	No idea	Reasonable	Extremely reasobnable

50. How do you consider the following conditions when buying cooking pots from the market? Give one to five rating.

Shape/ Form ☐

Texture ☐

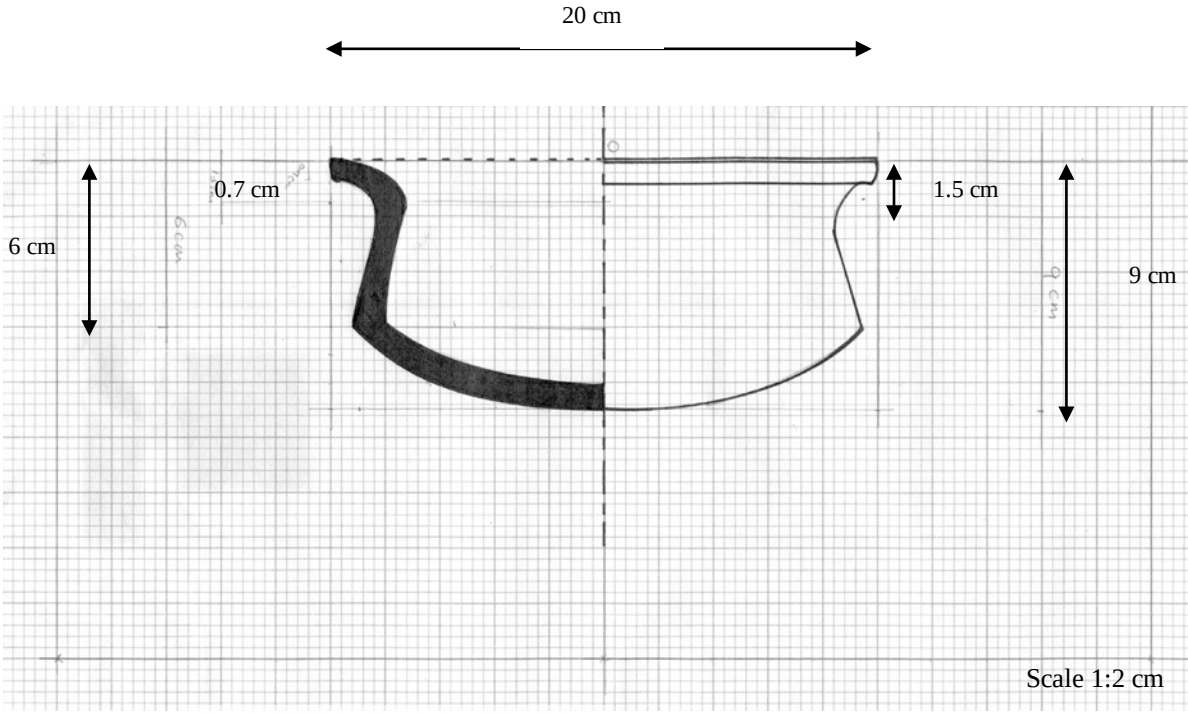
Value ☐

Proportion ☐

Balance ☐

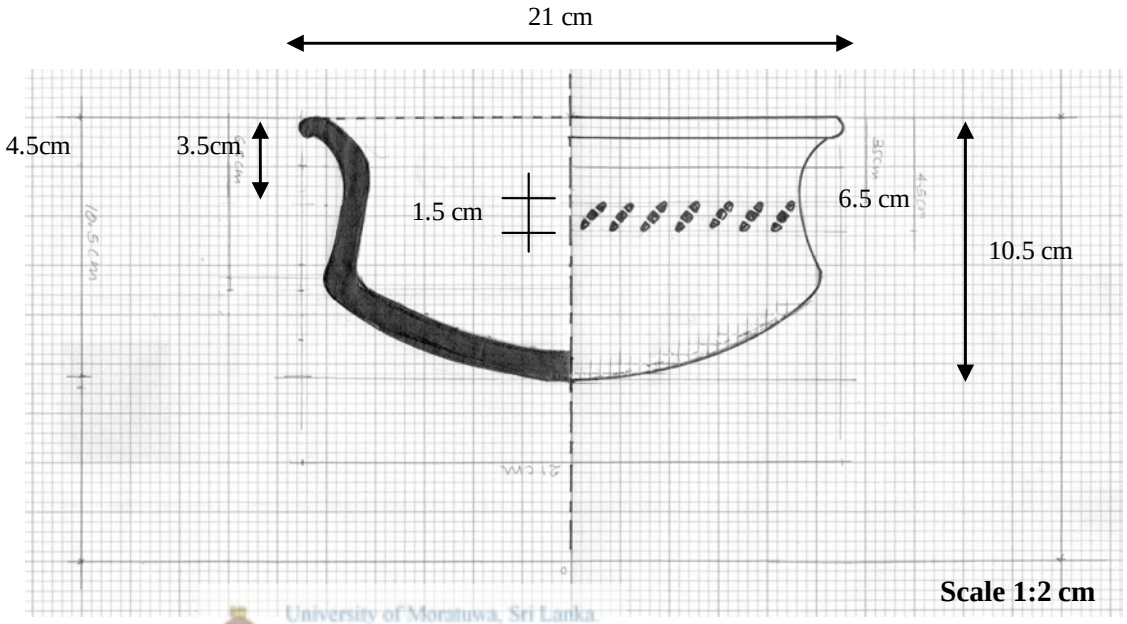
Annexure - 3

"Hattiya"
Type – 1
(Small Size)



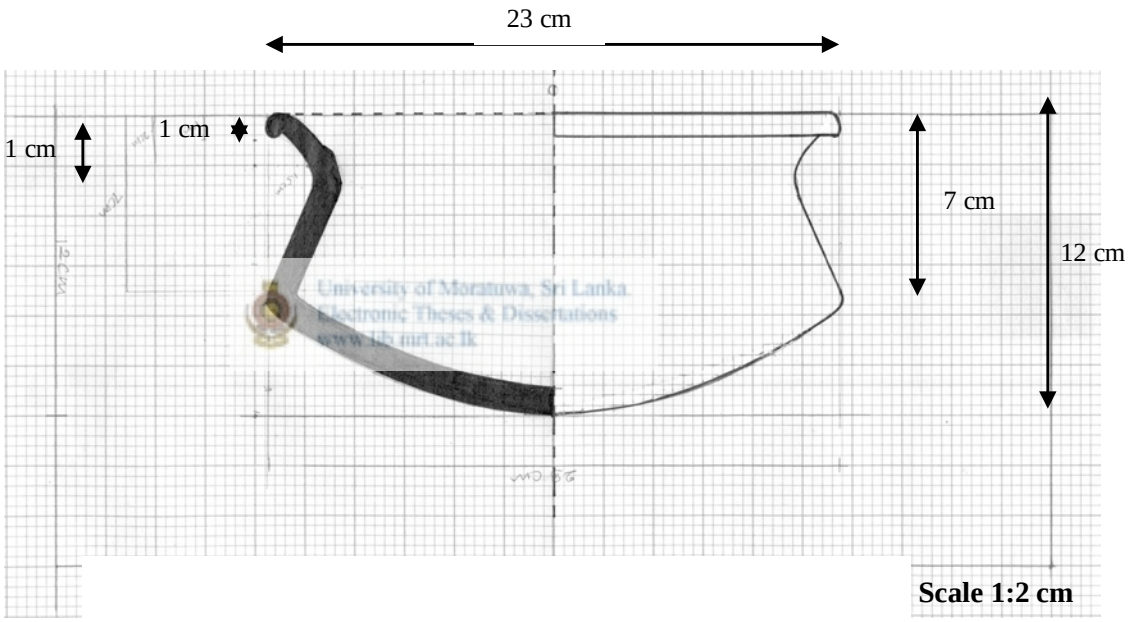
Annexure - 4

"Hattiya"
Type -2
(Small Size)



Annexure -5

"Hattiya"
Type – 3
(Medium Size)



Annexure - 6

A lid - Small Size