COST OPTIMIZATION IN ELECTRONIC TOYS MANUFACTURING AND MARKETING: A VIABLE ALTERNATIVE FOR THE WOMEN ENTREPRENEURSHIP

ABSTRACT OF THESIS
SUBMITTED FOR THE AWARD OF THE DEGREE OF
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ABSTRACT

Since decades, the advancement of toy has continued to fascinate children. Of late there has been a noticeable shift of preference for purchase of electronic toys from mechanical toys. These toys have become a source of entertainment not only for children but also for adults.

The purpose of this study is to optimize the cost of electronic toys in manufacturing and marketing. If toys are made cost effective, it would be affordable for all sections of the society as well as be able to compete in the Indian as well as at the global market.

Each and every child would like to play with electronic toys having more and more features. The more the features the toy would have the higher would be its cost. In this study, attempt has been made to identify features, modify, implement and test electronic toys which would be cost effective.

New techniques have emerged for manufacturing toys. Lately a modular approach is being adopted wherein instead of using discrete electronic components a modular approach for a particular type of toy is available which can be fitted in a modular circuit in the body or casing of a toy. Also for this expert skill is not required. Therefore even those people who do not have much knowledge of electronics can also do this job. Also these modular circuits along with simple and easy-to-understand directions are provided by the company which is also accompanied by a picture or diagram describing each step in the process. Women could be employed to do this work, from the comfort of their homes and at their ease. This could be offered as a viable alternative for women entrepreneurship. Therefore, this study focuses on cost optimization of electronic toys in manufacturing and marketing: A viable alternative to women entrepreneurship.

The study is organised into six chapters. The first chapter introduces one to the topic of research. It is divided into two main parts called Section-A and Section-B. The first section is entitled “conceptual background of cost optimization” and is organized into eight sections. It introduces the reader to the concept of cost, value engineering, cost metrics and its components, cost of production and its components. Thereafter, marketing cost is discussed which is followed by concept of cost optimization and mathematical optimization. The last part of this section presents the justifications of study.
The second part of chapter-1 that is Section-B is entitled “toy industry and market prospects”

This is divided into nine parts. It begins with an introduction of toy industry followed by a backdrop of toy industry. It traces the evolution of toy industry from the humble beginning with traditional toys to the modern electronic toys of today. Then it throws light on the Indian and global market for toys which is followed by recent trends, development and market prospects. The next section deals with an overview of Small & Medium Enterprises (SME) sector in India and also provides how the needs of toy industry are fulfilled by this sector. This sector is spread all over the country meeting the needs of different regions of India. Also it highlights the fact that the Indian toy industry is highly unorganized and branded companies are very few. It also portrays a picture of the growth of number of SMEs and percentage of rural and urban SME. Further the role that women play in toy industry is also provided in detail. It also throws light on the viability to women entrepreneur. A section is also devoted to the need of Interdisciplinary study which explains the justification of the study.

The toy industry is mainly concentrated in and around the metropolitan cities of New Delhi and Mumbai in India, and is characterized by small-scale establishments. Of late, the toy industry has been internationalized. Companies in the toy industry manufacture both electronic and non electronic toys and games. Also the world toy market is dominated by few large toy brands.

The second chapter, Chapter-2 deals with an industrial profile of toy industry. This chapter consists of five sections wherein the first section presents a profile of the major players of toy industry both at National and International level. This section also throws light on some toy companies having presence in India. A brief profile of the main players they being LEGO, Mattel, Funskool and Hamleys are also provided. Manufacturing of electronic toys and also some commonly used electronic components and their functions are taken up in the next section. The third section is about classification of toys and segmentation of toy market followed by the section of traditional versus electronic toys. The last section briefs on the challenges before Indian Toy Industry in general and Indian scenario in particular.

Chapter 3 is divided into two sections; Section-A is devoted to a review of literature and Section- B is devoted to the Indian Toy Industry.
Section A presents a review of literature which is organised into nine (9) sections wherein each section is devoted to studies on toy sector, basically electronic toys. The first section discusses studies on use of electronic toys and influence on children, followed by a section on consumer behaviour towards purchase of electronic items. The third section compiles studies on impact of advertisement on children, the fourth deals with selection of toys and determining attributes, the fifth discusses toys and children development which is followed by a section on toy and innovation. The seventh section deals with toy manufacture and cost optimization.

The review of literature above indicates that studies have been conducted in electronic goods but scarce studies have been undertaken in electronic toys. Further from studies covering electronic toys it suggests that toys do have benefits for children. These studies indicate that playing with toys help in development of children, development of language, social skill, and communication skill. Researchers contend that playing with traditional toys like dolls, trucks, blocks and similar toys encourages the creative and imaginative spark in children and also builds team spirit in them. The study suggests that simple building blocks, clay and crayons are usually much healthier for children as educational toys than the electronic educational toys.

Further it states that electronic toys and games are less effective in developing understanding and skills as compared to traditional toys. It further points out that electronic toys inhibit the healthy play and development of young children. Electronic toys and games limit the child's imagination, and may lead to addiction, aggressive behaviour and social isolation.

These studies also point to the need to bring innovation in toys as toys have a very short life cycle. It also highlights the need to optimize cost to make it affordable to the masses.

It states that there is a dearth of study on electronic toys. This study therefore intends to fill the gap. Also it suggest identification of parameters that manufacturer and marketer should keep in mind to optimize the cost of toys. The chapter concludes with an analysis of review of literature and identification of gap.

Section-B of chapter 3 is entitled “Indian toy industry”. This section consists of only two (2) sections. The first section describes the toy industry in India and competitive scenario. There are currently over 1000 toy manufacturers in the country belonging mostly to the unorganized sector. The organized sector consists of four companies who use some brand names for their toys and market them in metropolitan and large
cities. While the unorganized/cottage sector products are usually low priced, their products are mostly sold even in small towns and rural areas. The market leaders in the organized sector are Leo toys followed by polo toys, Funskool (India) Ltd., and kid stuff. It concludes that price is the main consideration in purchase of toys.

The second section compiles the list of Toy Company in India and also the list of electronic toy manufacturing company in India.

The fourth chapter of the thesis is on research methodology. Research Methodology is systematic way to solve a problem. It is actually a science of studying how a research is to be carried out. It may also be defined as the methods by which knowledge is gained. Its aim is to give the work plan of research.

It presents in detail the research methodology adopted for the study. The chapter is divided into thirteen (13) sections. It begins by defining the problem statement and the objectives of study. The research objectives of the study are:

1. To identify customers preference for criteria for purchase of toys.
2. To suggest cost optimization using linear programming.
3. To identify the key components and suggest modifications in terms of cost optimization to electronic toy manufacturers.
4. To propose electronic toy manufacture as a viable alternative for women entrepreneurship.

Other subsidiary objectives of this research are as follows:

- To implement and test some cost effective electronic toy circuits.
- To suggest some innovative ideas to make the electronic toy more attractive and appealing in the eyes of children without any change in cost.
- To provide employment opportunities to women entrepreneurs.

The research hypotheses are then listed. There are 22 hypotheses in all which were organised into two sets.

The first set refers to hypotheses relating the variables with demographic profile like age, gender, occupation, and educational qualification; while the second set considers relation between the variables. They are listed below:

Ho1: There is no significant relationship between motives for purchase of toys and occupation.

Ho2: There is no significant relationship between motives for purchase of toys and age.
Ho3: There is no significant relationship between motives for purchase of toys and gender.
Ho4: There is no significant relationship between motives for purchase of toys and qualification.
Ho5: There is no significant relationship between criteria for selection of toys and occupation.
Ho6: There is no significant relationship between criteria for selection of toys and age.
Ho7: There is no significant relationship between criteria for selection of toys and gender.
Ho8: There is no significant relationship between criteria for selection of toys and qualification.
Ho9: There is no significant relationship between motivational factor for purchase of toys and occupation.
Ho10: There is no significant relationship between motivational factor for purchase of toys and age.
Ho11: There is no significant relationship between motivational factor for purchase of toys and gender.
Ho12: There is no significant relationship between motivational factor for purchase of toys and qualification.
Ho13: There is no significant relationship between other aspects of purchase of toys and occupation.
Ho14: There is no significant relationship between other aspects of purchase of toys and age.
Ho15: There is no significant relationship between other aspects of purchase of toys and gender.
Ho16: There is no significant relationship between other aspects of purchase of toys and qualification.
Ho17: There is no significant relationship between motives behind purchase of toys and criteria for selection of toys.
Ho18: There is no significant relationship between motives behind purchase of toys and motivational factor for purchase of toys.
Ho19: There is no significant relationship between motives behind purchase of toys and other aspects of purchasing electronic toys.
Ho20: There is no significant relationship between criteria for selection of toys and motivational factor for purchase.

Ho21: There is no significant relationship between criteria for selection of toys with other aspects of purchasing electronic toys.

Ho22: There is no significant relationship between motivational factor for purchase of toys and other aspects for purchase of electronic toys.

The next section details the research design. The research was undertaken in phases. To determine the first objective of research which pertained to customer preference for criteria for purchase of toys, a conceptual model was developed and to test the model, a questionnaire was designed and administered which has been discussed in sections 4.5 to 4.9 of the chapter. The chapter also mentions the limitations of the study and tools of analysis in sections 4.10 and 4.11 respectively.

The second phase consisted of desk research, wherein linear programming was used to optimize the cost in toy manufacturing which has been discussed in section 4.11.1 of the chapter.

The third phase was experimental method wherein the researcher along with her team re-assembled toys and their circuit design with the objective of reducing costs. This has been discussed in section 4.12 of the chapter.

The fourth phase consisted of interview and discussion with entrepreneurs and marketers of toys who employed women for manufacture of toys. This is dealt in section 4.13 of the chapter.

This is followed by chapter five which is on data analysis and interpretations.

The study was undertaken in four (4) phases. Therefore the analysis has also been organised in four sections. -A, B, C and D covering each of the phases of the study, respectively.

Section A presents analysis of the proposed hypotheses using ANOVA and t-tests. In this section, each hypothesis is first listed which is followed by a table that shows the result of the administered ANOVA (or t-test, wherever appropriate). This is followed by an inference stating whether the hypothesis is supported or not supported. In the end a summary table is also provided showing the result of the test.

Section B presents analysis of the second phase of the study. In this section linear programming has been used to optimize costs. It has been presented in detail.

Section C deals with outcomes of experiments done on electronic toys in terms of costs. It is divided into three (3) parts. The first part deals with implementation and
testing of some cost effective electronic toy circuits. Four different cost effective circuits that can be used in electronic toys were implemented and tested by the researcher. These circuits are Amplified Greeting-Card Sound Circuit, LED with Light Sensor, Infrared Toy Car Motor Controller and 7 Segment Display Reference. The total estimated cost involved in the implementation of these circuits are also tabulated and provided at the end.

Part two presents outcomes of experiments done by the researcher and her team members, on modification of toys in terms of cost. There were total of 16 electronic toys which were selected randomly and experimented on. The electronic toys are analysed depending upon the toy circuitry, and redesigned with the objective of reducing cost while keeping the performance constant (that is performance of the toy would not be affected).

List of all these toys with their images for which modification has been done is also described. Change in design of toys brought about and the resultant decrease in cost is also indicated against each component presented in tabular form.

Part three presents detailed experiments conducted on electronic toys to suggest innovation in these toys but without any change in the cost.

Section D, presents analysis of Phase-IV which refers to result of interview conducted at Aligarh exhibition with the basic objective of employing women to make it a viable opportunity for promoting entrepreneurial activity among women. The population density was calculated and it has been illustrated.

This sixth and last chapter is on conclusions and recommendations of the study. It is organised into four (4) sections. The first presents findings of the study which is followed by its implications and recommendations. At the end the scope of future research is provided.

The study concludes that there exists no significant relationship between motives for purchase of toys and the various demographic profiles they being occupation, age, gender and qualification. It also found that there existed no significant relationship between criteria for selection of toys with respect to occupation, age, gender and qualification. It also showed that there was no significant relationship between motivational factor for purchase of toys and occupation, age, gender and qualification. Similar conclusions were arrived at with respect to the relationship between other aspects of purchase of toys and the various demographic profile they being occupation, age, gender and qualification.
The study further concludes that there exists a very strong and positive correlation between motive behind purchase and criteria for toy selection, motivational factor for purchase of toys and other aspects of purchasing electronic toys, a significant and positive relationship between criteria for selection of toys and motivational factor for purchase and other aspects of purchasing electronic toys and a significant relationship between motivational factor for purchase of toys and other aspect of purchase of toys. Of these the strongest relation was observed between criteria for purchase and motivational factor for purchase.

It concludes that if a toy has appeal and is purchased by a person, it would be purchased irrespective of the age, occupation, gender or qualification. These demographic factors have no influence and therefore need not be considered for design of toys.

Motive for purchase, the criteria for purchase and motivational factor strongly influences purchase decision and therefore these factors should be considered by designers while designing new toys. Therefore toy manufacturers must keep these factors in mind in new product development.

This implies that demography does not play a role in purchase of toys but overall the motivational factor for purchase could be considered for manufacture of toys.

Through linear programming it was suggested that cost could be reduced and profit increased if resources could be optimally utilized.

The implementation and testing of four cost effective electronic toy circuits shows that there were different alternative costs which gives one an option to further reduce the cost.

Experiments undertaken by the researcher and her team in 16 electronic toys also indicated that cost can be optimized without sacrificing the quality. The researcher has done sufficient work and data analysis for optimizing the cost of electronic toys. Some modifications in simple circuits of electronic toys have been suggested which can further reduce cost. The study also concludes that an assessment about the total demand of cost effective electronic toys could be made based on the population density in each year.

The study points out that the demographic profiles like occupation, age, gender and qualification have no influence on motives for purchase of toys, criteria for selection of toys, motivational factor for purchase of toys and other aspects of purchase of toys.
All the variables under study they being motive for purchase, criteria for purchase, motivational factor for purchase and other aspects for purchase show strong positive relation with each other.

In any toy company, technique of linear programming may be applied to make optimum use of resources under given constraints in such a way that maximum profit may be obtained in production of electronic toy.

It may be concluded from this research work that implementation of cost effective electronic circuits or slight modifications in electronic toys, without compromising too much on the quality and performance of the toy, would lead to cost optimization. This reduced cost toy would be more useful for the lower strata of the society, particularly the deprived children in rural areas, and would thus lead to its increased popularity and marketing in rural areas.

For innovative toy designing, there is a dire need for greater creative skill, user knowledge and technical advancement. By implementing the suggested innovative ideas in the electronic toys, the toy will appeal more to parents and children and hence the popularity and demand of these will drastically increase in the market. Because of the high demand of attracting and appealing electronic toys in the market their marketing will be high and hence with the help of mass production of these toys, cost may further be reduced.

Toy manufacturing company must make optimal utilization of existing resources because it is a very important task for electronic toy manufacturers. Linear programming will help in making an optimal decision that meets a specified objective of profit subject to various constraints and restriction.

The study concludes by pointing out how the research effort could be extended further. In other words it provides a research direction; they being:

(i) Future research could cover different segments of market that is rural and urban areas.

(ii) Future research study could cover market acceptance (that is response of market) after change has been introduced in the toys for future.

(iii) Study could cover cost of toy before modification and cost after modification.

(iv) Study could assess the benefit to women entrepreneurs as a result of this research.

(v) Future study could also calculate the actual demand for cost effective toys (for which modification/innovation has been done) based on population density of each year.
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2015
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Date: 02/02/2015

Salma Shaheen
(Name of the candidate)

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Salma Shaheen
Abstract

Since decades, toys have enthralled children. The kind of toys which fascinated children was different at different time periods. Stuffed toys, wooden toys, spring-based and mechanical toys all have had their share of attention. Of late there has been a noticeable shift of preference for electronic toys. These toys have become a source of entertainment not only for children but also for adults.

The purpose of this study is to optimize the cost of electronic toys in manufacturing and marketing. If toys are made cost effective, it would be affordable for all sections of the society as well as be able to compete in the Indian as well as global market.

Each and every child would like to play with electronic toys having more and more features. The more the features the toy would have, the higher would be its cost. In this study, attempt has been made to identify features, modify, implement and test electronic toys which would be cost effective.

New techniques have emerged for manufacturing toys. Lately a modular approach is being adopted wherein instead of using discrete electronic components a modular approach for a particular type of toy is available which can be fitted in a modular circuit in the body or casing of a toy. Also for this, expert skill is not required. Therefore even those people who do not have technical knowledge of electronics can also do this job. Also often these modular circuits along with simple and easy-to-understand directions are provided by the company which is also accompanied by a picture or diagram describing each step in the process. Woman could be employed to do this work, from the comfort of their homes and at their ease. This could be offered as a viable alternative for women entrepreneurship. Therefore, this study entitled "Cost Optimization in Electronic Toys Manufacturing And Marketing: A Viable Alternative For The Women Entrepreneurship" focuses on optimizing cost for electronic toys in manufacturing and marketing offering it as a viable alternative for entrepreneurship for women.

The thesis begins, in Chapter 1A, with a description of cost-an operational definition and concept of value engineering. This chapter also includes the discussion on various factors affecting the production cost like raw material, labour and technology. Concept of cost optimization has also been discussed at length.

Section 1B deals with back drop of toy industry which covers market capitalization, size of the industry and total contribution to the economy. This chapter also provides
brief overview of recent trends, development and market prospects. Also it discusses the scope of SMEs in toys manufacturing sector and role of women in toy industry which includes some suggestions for designing of toys so that it would be safe for kids. There is also a focus on need of interdisciplinary study because the area of toy designing is too complex and it requires the knowledge of other disciplines also.

Chapter 2 studies the details of major players of toy industry at National and International levels. This chapter also discusses the details of manufacturing of electronic toys (a typical model), commonly used electronic components, classification of toys and segmentation of toy market. Comparison of electronic and traditional toys is also part of this chapter, and it concludes that because of many technical reasons traditional toys are still better. It also concerns some challenges before the Indian toy industry related to cost of raw material, manufacturing cost and differential taxes etc.

Chapter 3 is divided into two parts-Section-A and Section-B. Section-A provides details of literature survey which includes discussion on electronic toys and influence on children, consumer behaviour towards purchase of electronic items, impact of advertisement on children, selection of toys and determining attributes. It also reviews studies on toys and child development, toy and innovation, toy manufacture and cost optimization. An analysis of each section is then provided. It concludes with the identification of the research gap.

Section B of the chapter deals with Indian toy Industry, and various electronic toys manufacturing company in India.

Chapter 4 investigates research methodologies and methods of data collection for the study. This also presents scope of study, source of data, research objectives and a list of 22 hypotheses. Methodology for development of the questionnaire and its administration is discussed. Questionnaire is divided into three parts. The chapter concludes with a mention of the limitations of the study.

Chapter 5 deals with data analysis and their interpretations, hypothesis testing and outcomes of experiments done on toys in terms of cost. Data is collected and analyzed critically. Some tools of analysis like t-test and ANOVA are used to produce the results. Emphasis is laid on linear programming and some useful results related to optimizing the cost are produced. Some cost effective electronic toy circuits are implemented, tested and possible modifications are suggested.
Chapter 6 presents conclusion drawn from the present work and provides findings, implications and recommendations for electronic toy manufacturers. Some suggestions for scope of future research related to electronic toys and women entrepreneurship are also implanted.
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**CHAPTER 5**

**DATA ANALYSIS AND INTERPRETATIONS**

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CHAPTER 6

CONCLUSIONS AND RECOMMENDATIONS

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<td>American Accounting Association</td>
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<tr>
<td>AC/DC</td>
<td>Alternating Current/ Direct Current</td>
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<tr>
<td>ACs</td>
<td>Air Conditioners</td>
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<tr>
<td>CAD</td>
<td>Computer Aided Design</td>
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<tr>
<td>CAE</td>
<td>Computer Aided Engineering</td>
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<tr>
<td>CAGR</td>
<td>Compound Annual Growth Rate</td>
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<td>CAM</td>
<td>Computer Aided manufacturing</td>
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<td>CCOS</td>
<td>Customer Concern in Online Shopping</td>
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<tr>
<td>CNC-EDM</td>
<td>Computer numerically Controlled- Electrical Discharge Machinign</td>
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<tr>
<td>CST</td>
<td>Central Sales Tax</td>
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<td>DIY</td>
<td>Do It Yourself</td>
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<td>EA</td>
<td>Electronic Arts</td>
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<td>ECSIP</td>
<td>European Competitiveness and Sustainable Industrial Policy</td>
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<td>ERP</td>
<td>Entrepreneurship Resource Planning</td>
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<td>FC</td>
<td>Fixed Cost</td>
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<td>FM</td>
<td>Frequency Modulated</td>
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<td>GDP</td>
<td>Gross Domestic Product</td>
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<td>HCI</td>
<td>Human Computer Interface</td>
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<td>HIT</td>
<td>Henson International Television</td>
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<td>ITI's</td>
<td>Industrial Training Institute</td>
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<td>ITMT</td>
<td>Institute of Toy Making Technology</td>
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<td>JCB</td>
<td>Joseph Cyril Bamford</td>
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<td>LCD</td>
<td>Liquid crystal diode</td>
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<td>LDR</td>
<td>Light Dependent Resistor</td>
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<td>LED</td>
<td>Light Emitting Diode</td>
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<td>MGM</td>
<td>Metro-Goldwyn-Mayer</td>
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<td>Abbreviation</td>
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<td>MSE</td>
<td>Medium Scale Entrepreneurship</td>
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<td>Micro Small and Medium Enterprises</td>
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<td>NCR</td>
<td>National Capital Region</td>
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<td>Non dominated Sorting Genetic Algorithm</td>
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<td>Polyvinyl Chloride</td>
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<td>Power Waterhouse Corporation</td>
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CHAPTER 1
SECTION A
CONCEPTUAL BACKGROUND OF COST OPTIMIZATION

This section is organized into eight (8) parts. It begins with an introduction to concept of cost, followed by concept of value engineering, cost metrics and its components, cost of production and its components. Fifth part discusses marketing cost followed by concept of cost optimization and mathematical optimization and the last part presents the justifications of study.

1.1 Cost-An Operational Definition

The committee on cost concepts and standards of the American Accounting Association (AAA) defined cost as follows. “Cost is a foregoing measured in monetary term incurred or potentially to be incurred to achieve a specific objective”. The term cost is a generic term purposely defined and used in a variety of ways so as to include all the various types of cost. The term “cost” itself is without any significant meaning and therefore, it is always advisable to use it with an adjective, phrase or modifier that will convey the meaning intended.

The relation of profit is very simple. The product is manufactured at minimum possible cost and sold at maximum possible price. This invokes managers to go deep down in the ocean of cost and come up with a notion of the cost in general and optimal cost in particular.

Before optimising any phenomenon first of all one has to understand that very phenomenon of cost. So one should have a thorough understanding of cost because “COST IS A FACT”.

Cost has been always a major concern in all human activities. It receives more and more importance and attention as long as society and technology advances. Concepts of cost are universally applicable. A visitor in a strange place or in a distant country can bargain the prices by using simple economic principles. Cost is a simple phenomenon but a harsh fact which is understood everywhere in the world.
In advancing technology of today an accurate estimate is necessary to win the contract. An under estimate is a threat to the survival of the company itself.

In a nutshell, cost optimization is desired product of operation research where engineering skills and business experience are utilized along with scientific principles to the problems of cost, like cost control, profitability analysis, planning and scheduling. It also helps managers and engineers in decision making and designing.

The cost involved in marketing of product is then discussed. The concept of cost optimization and the different methods for optimizing of cost is then elaborated upon. The chapter concludes by highlighting the justification for research.

The problem of identifying and eliminating unwanted cost while improving function and quality can be done by using concept of value engineering. Value engineering helps to increase the value of products, satisfying the product’s performance requirements at the lowest possible cost [Owler and Brown 1971].

1.2 Value Engineering- Concept and Applications

Value engineering can be defined as a systematic and organized approach to provide the necessary functions in a product at the lowest cost. Value engineering promotes the substitution of materials and methods with less expensive alternatives, without sacrificing functionality. It is focused totally on the functions of various components and materials, rather than their physical attributes.

Value may be defined as the ratio of functions to cost. From the expression given below it is clear that value can be increased by either improving the function or reducing the cost. The primary tenet of value engineering is that the basic functions be preserved and not be reduced as a consequence of pursuing value improvements [SAVE 2007].

\[
\text{Value} = \frac{\text{Functions}}{\text{Cost}}
\]

Value is the needed or required performance at minimum cost. The meaning of the needed performance is what the customer expects. If it is less than the desired performance, one should focus on eliminating the waste caused due to overdesign, such as costly material, high factor of safety in design etc.

In the above expression, function is expressed as units of performance and cost is expressed as a monetary unit (such as Rs., $, etc.) related to expenditure of resources. Therefore, value is expressed as a relationship of what a product (or service/system) accomplishes and at what cost.
The main purpose of value engineering is to achieve a product's target cost, by the following measures.

(i) Identifying improved product designs that reduce the product's cost without sacrificing its functionality.

(ii) Eliminating unnecessary functions that increase the cost of product.

Value engineering requires the use of functional analysis. This process involves segregating a product into its many elements. For example, in the case of automobiles, the function might consist of style, comfort, performance, reliability, quality, attractiveness and other aspects. A price or a value for each element is determined, which reflects the amount the customer is willing to pay for the product. In order to obtain this information, companies generally conduct surveys and interviews with the target customers. The total of the values for each function gives the estimated selling price from which the target profit is deducted to derive the target cost. The cost of each function of a product is compared with the benefits perceived by the customers. If the cost of the function exceeds the benefits to the customer, then some of functions should be eliminated, modified to reduce its cost, or enhanced in terms of its perceived value so that its value exceeds the cost.

Therefore, value engineering is a technique applied to analyze all the aspects of an existing product or component to determine the minimum cost necessary for specific functional requirements [Poudel 2009].

Value engineering techniques can be applied to any product process procedure system or service in any kind of business or economic activity including government, health care, industry, construction and in the service sector. Value Engineering focuses on those value characteristics which are deemed most important from the customer point of view. Value Engineering can achieve substantial impressive savings, much greater than what is possible through conventional cost reduction exercise even when cost reduction is the objective of the task.

Value engineering methods need engagement of the entire cross functional team in order to provide real value to a project solution. These methods require focusing on the characteristics that are most important from the client’s point of view. Together, the team works through a creative process that takes eight methodical steps, including:
(i) **Orientation:** The purpose of orientation phase is to refine the problem. Throughout the preparatory activities, a close working relationship between the study team leader and the manager sponsoring the project contributes significantly to a successful outcome.

(ii) **Information:** Depending upon the project requirements, the team goes through a phase of discovery and information gathering in order to develop a high-level development plan, procurement plan, and sequencing and phasing plan.

(iii) **Function:** Together, each team stakeholder takes a more detailed look at the project solution through the lens of each discipline, i.e. design, civil, structural, electrical, mechanical, construction, etc. Each discipline will refer to the design and architectural solution, building systems, site requirements, functional specifications, initial cost estimates, conceptual project schedule and budget requirements to craft a project approach.

(iv) **Creativity:** While each stakeholder is forming their approach to a project based upon the envisioned requirements, each discipline has the opportunity to identify challenges and potential feasible solutions to these challenges. There are areas where the team may be able to offer design solutions or provide reduced cost alternatives that do not sacrifice the design intent or the integrity of the structure's function. Each discipline should have a creative approach for solving problems, reducing cost, and improving performance and quality requirements.

(v) **Evaluation:** Each discipline should prepare a forecast for project expenditures following a creative approach. The approach should aim to maintain a cost limit, as defined in the conceptual budget. An evaluation of alternative design solutions coupled with cost benefit analysis will be helpful for identifying areas where one can achieve the best value. Feasibility studies are also helpful for identifying a realistic project approach for achieving all of the elements. In addition, construction cost plans should also be developed.

(vi) **Recommendation:** Once each stakeholder provides an evaluation, the team needs to consider all aspects of the project, hammer out possible solutions and make recommendations based upon a collective evaluation of alternatives, cost benefit analysis, and feasibility.

(vii) **Implementation:** Project decisions for implementation are made once a collective set of recommendations are offered. This is where the rubber meets the road and the project begins to take shape.
(viii) **Validation**: Once the project is about to complete, it is a good practice to circle back and measure the overall effectiveness of the team's ability to collectively conceive a more holistic design solution, identify a series of areas that need to be addressed to achieve the solution, create function, reduce cost and improve performance and quality.

When a project team believes in a creative and collaborative value engineering effort, there would be lower overhead and material costs, improved quality management and efficient resource allocation. In this way the means and methods are planned and hence more simplified thus enabling in an overall reduction in paperwork and decreased staffing costs. These results provide overall project efficiencies and, more importantly, greater value for project expenditures [McDonald 2013].

Value Engineering is useful because of following main reasons:

- Lowering operational & maintenance costs
- Improving quality management
- Improving resource efficiency
- Simplifying procedures
- Minimizing paperwork
- Lowering staff costs
- Increasing procedural efficiency
- Optimizing construction expenditures
- Developing value attitudes in staff
- Competing more successfully in marketplace.

-Value Engineering also helps in learning the following:

- Improvement in career skills
- Separate "Symptoms" from "problems"
- Solve "root cause" problems and capture opportunities
- Become more competitive by improving "benchmarking" process
- Take command of a powerful problem solving methodology to use in any situation [INVEST 2014].

1.3 **Cost Metrics - Factors Affecting the Cost**

Before starting any business it is very important to consider the various factors which will affect the cost of production in the long run. The factors which influence the cost of production are listed as under:
Entrepreneur has to decide about the site of the work, the nature of production, scope, the size of the plant and the size of the market that will be served. All these decisions are of irreversible nature which cannot be altered easily.

Generally there are three types of factors which influence the cost of production e.g. location, scope and size. A detailed analysis of these factors would help the entrepreneur to earn maximum profit by reducing the costs. The details of these factors are as follows:

1.3.1 Location
Before taking any decision of location for setting up a new unit, nine M's have to be considered i.e. Material, Money, Motive power, Men, Market, Management, Machinery, Means of transport and Momentum of early start. The success of the new enterprise very much depends on the selection of appropriate site. In the selection of the site the following factors also play an instrumental role i.e. cost of fixed assets like land and building for setting up the factory, topography of the area, the possibilities of future expansion etc.

(i) Availability of Raw Materials
The site should be selected at such a place where the raw materials are easily available and long lasting. There should be an easy approach to the place of raw materials. For instance, Iron and Steel industry in Bihar, textile factories in Gujarat and Maharashtra, Jute works in Bengal owe their success to the easy availability of raw materials. It reduces the cost of transportation.

(ii) Nearness to the Market
It is not only sufficient to manufacture a product successfully, it is also equally important that the output should find ready market and that the product is sold at a price to yield reasonable profit. This is possible only when the market is not far away. Nearness of the market ensures less transportation cost and minimum wastage.

(iii) Nearness to Source of Operating Power
Fuel for working the machinery is required by every industry. And an industrial area cannot be developed, if the region has no rich fuel resources. These days coal, hydro-
electricity and oil etc. are the various available sources of power. Coal is the cheapest source of power, but it involves high transportation costs because it is very bulky.

(iv) Transportation
Cheap and efficient means of transportation is required for every manufacturing industry. This is essential for the movement of both raw materials from the source of supply to the factory and finished products from the factory to the markets or the centers of consumption.
Therefore, the location of the plant should be at a place where adequate transport facilities at cheaper rate are available.

(v) Finance
Without the availability of adequate capital, no productive activity is possible. Stock Exchanges, Banks and other similar institutions help in capital acquisition and expansion of industry by providing financial help as and when required.

1.3.2 Scope
The scope of make and buy activities of the firm should be planned before hand. The plan may be revised from time to time in deciding about the scope. The following points should be taken into consideration in this regard.
(i) All the processes involved in the production be carried in the factory or some have to depend upon contract basis.
(ii) The firm would specialize in production or depend upon other firms.
(iii) The marketing of the product be organized by the firm itself or it will depend upon other agencies for marketing.
(iv) The raw material procurement policy.
(v) The after-sale service to the consumers will be undertaken by the firm itself or the firm enter into some agreement with other firm for this important responsibility.
(vi) The techniques to be followed in production. Which parts have to be manufactured in the factory itself and for what parts factory will depend on other firm?
(vii) All the connected goods with the main product be manufactured by the firm itself and the business scope be expanded.
The firm has to think twice on the above problems before setting up the unit. We should keep in mind that the unit cost in producing and distributing of the product or service should be the lowest and the changes of making maximum profits are the brightest.

1.3.3 Size
Actually the success and efficiency of the firm also depends on its actual size. To ensure maximum profitability, the size of the firm should be optimum. Optimum size is important because this results in the lowest production cost and maximum efficiency. If the size of the firm is optimum, all the managerial, technical and marketing factors are well balanced.
The optimum size of the firm is not fixed but keeps on altering with improved techniques of production and managerial experience [Agarwal 2014].

1.4 Cost of Production - Raw Material, Labour and Technology
A production cost may be defined as the cost that the entire process will take in manufacturing an item, good or producing a service. Both raw material and labour cost are included in production cost. It also includes cost of technology. To find out the cost of production per unit, the cost of production is divided by the number of units produced. A company that knows how much it will cost to produce an item, good or render a service will have a clearer picture of how to better price the item or service and what will be the total cost to the company.
If costs are too high, these can be decreased or possibly eliminated. Production costs can be used to compare the expenses of different activities within the company. In production, there are two different types of cost i.e. direct costs and indirect costs. For example, direct costs for manufacturing an electronic toy are materials such as the plastic, metal or labour incurred to produce the toy. Indirect costs include overhead such as rent, salaries or utility expense [Investopedia 2014].
There are some key elements that should be considered in the production costs like Purchase of raw machinery, Insurance charges, Interest on capital, Wages of labour, Building rent, Advertisement expenses, Installation of plant and machinery, Payment of taxes, Wear and tear of building and machinery.

**Formula for Computing Production Costs**
The general formula used for computing production cost is:
Production cost per item = Fixed Cost (FC) + Variable cost (VC) / No. of units produced

For calculating production cost the important steps involved in computation of production cost are:

(i) Find out the fixed cost. Fixed cost is a cost which does not change in total for a given time period despite wide fluctuations in output or volume of activity. Examples of fixed costs are rent, property tax, advertising, insurance etc. These fixed costs originate because of contractual obligation and management decision. They accrue with the passage of time and not with the production of the product or the job. This is the reason why fixed costs are expressed in terms of time such as per day, per month or per year and not in terms of unit.

(ii) Estimate the variable costs. These are the costs that change with a change in the quantity of production or volume e.g. materials, parts, assembly labour, sales commission etc.

(iii) Add the fixed costs to the variable costs and divide this number by the number of units produced, will give the production cost per item.

The major components of cost raw material cost, labour cost and technology cost are discussed below.

1.4.1 Raw Material Cost

Raw material may be defined as the products of primary sector industries (sector of an economy making direct use of natural resources), intended for use as inputs to production. In the majority of cases the finished product of one company is the raw material for another company. For example sheet steel may be the finished product of the steel rolling mill, but the raw material of a metal cutting works. Similarly, the finished product of a wool-spinning mill becomes the raw material of the weaving mill.

In toy industry the major raw material are plastic, resins, paperboard, fabricated metal, zinc alloy, fabric, and electronic components. Depending on the toy, companies may be sensitive to price fluctuations in the plastic and oil-based resin markets. Some companies source almost all components from third parties. Large companies may have contracts for key toy parts.

For plastic dolls, the raw materials are made from vinyl, which is also known as polyvinyl chloride (PVC). Major resin producers supply PVC compounds, which is
the world's second largest selling thermoplastic next to polyethylene. The basic building block of PVC is vinyl chloride, which is converted to PVC by a suspension process. All PVC must be compounded prior to use. Rigid compounds consist mostly of resin i.e. 85-90%, whereas flexible PVC contains 40-60% resin. Other additives include stabilizers, plasticizers, processing aids, lubricants, pigments, and fillers. Some toys like doll bodies are also made of polyethylene - a derivative of ethylene and a colourless, flammable gas. This gas is subjected to elevated temperatures and pressures in the presence of a catalyst, which converts the gas into a polymer. In addition to that various paints to make facial features, nylon for the hair, and cloth and thread for the outfits are the examples of other raw materials used in doll making [www.madehow.com].

1.4.2 Labour Cost
The production cost of any product also includes the labour cost. In production cost, the factor of labour cost or the cost of a labour requires most careful thought. It provides problems of major importance and on the solution of these, the success of any enterprise must largely depend. One of the chief objectives of the production manager should be reduction in labour costs, and much guidance to this end may be secured from a suitably organized costing system. Low wages do not necessarily mean low costs- in fact, it is now widely recognized that efficiently organized factories may have the highest wages, and yet have the lowest wage costs. A moment's reflection will be sufficient to grasp how this may come about. A firm using rather old-fashioned methods, and with only a moderately effective organization, may pay its 100 employees at the rate of ₹ 30/- per hour, and in a week of 44 hours there may be 4,000 pieces produced. The labour cost per piece in this case will be:

\[(100 \times 44 \times 30) / 4,000 = ₹ 33\]

With better organization and more up-to-date machinery the firm might be able to obtain this result:

\[(90 \times 44 \times 40) / 6,000 = ₹ 26.4\]

Many schemes for remunerating labour have been devised with a view to increasing productivity, but they have not been uniformly successful. The attitude of workers is of great importance, and every wage system should be thoroughly explained to them, and be capable of being understood by those of average
intelligence. Unless and until their co-operation is secured, full advantage of the system will not be obtained, indeed, it could not be implemented at all [Owler and Brown 1971].

1.4.3 Technology Cost
The production cost of any product also depends upon the technology used. For example in toy making process various moulding techniques are involved like Blow- or Injection-moulding which uses air or pressure to force heat plastic into shapes, like dolls and action figures. Die-casting moulds heated metal into shapes, like cars and trains. Spray painting adds colour to toys and components. Companies use various printing processes to produce game boards and game components. Producing toys like dolls and stuffed animals is labour-intensive, and may require sewing, stuffing, or hand painting. Companies may source toy components from multiple third party manufacturers, and assemble a toy at a separate facility. For example, a company may buy a doll’s body parts from a vendor, then assemble, paint, dress, and package the doll at a separate facility.

Different moulding technologies, which are used in toy making (as research focuses on toy industry) process are discussed below.

1.4.3.1 Plastic Moulding Technology
Plastics are synthetically produced non-metallic compounds. It can be moulded into various forms and hardened for commercial use. Plastic moulding products can be seen everywhere. Examples are jars, protective caps, grips, toys, plastic tubes, bottles, chairs, cases, accessories, kitchen utensils and a lot more. Even the keyboard and the mouse are made through plastic moulding.

In the processing of plastic moulding, the molten liquid plastic is inserted into a pre ready shaped mould, for example the mould of a bottle. It will be then allowed to cool. After required cooling, the mould will be removed to reveal the plastic bottle. In exactly the similar manner, head and complete body of plastic dolls, other plastic toys and outer plastic casing for electronic toys can be made.

Plastic moulding can also custom-mould a wide variety of plastic products including: garden pots, cabinets, office trays and boxes, barriers, barricades and traffic signage and displays for product and marketing promotions. Here are basic definitions of various methods of plastic moulding.
(a) Injection Moulding Technology

One of the major methods of moulding plastics is Injection moulding. Plastic is fed through a screw and heated. The melted plastic at the end of the screw is injected into a cooled mould. The halves of the mould are opened when the plastic is cool and solid and then the product is removed. This allows for the formation of very complex items, and so injection moulding is used for the formation of a wide variety of products. These can be used to mass produce toys, bottle caps, kitchen utensils, and cell phone stands to name a few.

(b) Blow Moulding Technology

Blow moulding is very much similar to injection moulding, except that hot liquid plastic pours out of a barrel vertically in a molten tube. The mould closes on it and forces it outward to conform to the inside shape of the mould. When it is cooled, the hollow part is formed. Examples of blow moulding products are containers, bottles, and tubes. Equipments needed in setting-up a blow moulding business are relatively higher than injection moulding [Morris 2005].

1.4.3.2 Toy Assembly-Toy Making Also Involves Assembly of Parts

Toy assembly jobs can be of several kinds. There are some mechanical, electrical or battery operated toys that will be made to assemble. Assembling of any kind of toy is easy because of the support toy companies will be providing.

For toy assembly, each kind of toy has its own pattern that is followed. For mechanical toys, assembly would usually consist of screwing of parts and gluing of cases. For some mechanical toys, like friction and winding powered toys, pliers, long nose and screw drivers are the most common tools used in its assembly.

With battery operated toys, soldering of parts, screwing and gluing of cases are usually part and parcel of the assembly work. This work includes cutters, pliers, and lead solders. The use of simple analog or digital multimeter is also used in testing and assembling of battery operated toys. Toy makers are generally looking forward for workers of toy assembly at their own homes because of cost considerations and to improve the profit.

Our directories of toy companies looking for people for toy assembly at home are quite many and they are all good paying companies. Toy companies included in our
directories are very glad for their inclusion since they are in urgent need of additional people for toy assembly at home.

For a woman stuffed toys assembly under toys product category will be most appropriate because it involves cutting and sewing work.

It can be concluded that for entrepreneurship in any other field requires many steps for example in designing and stitching it is necessary to have designers and various machines to start the entrepreneurship. But for assembly of electronic toys women can assemble various types of electronic circuits by sitting at home and do the job because electronic circuitry needed are already available with simple, easy-to-understand directions. Therefore, for women entrepreneurs' assembly of electronic toys would be the better and easy option [Steven 2014].

1.5 Marketing Cost
The marketing cost or cost of marketing is defined as the total cost associated with delivering goods or services to customers. Marketing cost may include expenses involved in transferring title of goods to a customer, the distribution of the product to points of sale, storing goods in warehouses pending delivery, promoting the goods or services being sold.

Marketing cost is an important factor in the business because it helps to figure out practical aspects to achieve the business marketing goals.

Marketing cost generally covers the cost for advertising, public relations and promotions. Each amount varies depending upon the size of the business, how much the competition is advertising and its annual sales.

In addition to the above factors, overall marketing cost also includes web site development, design and printing costs for all print materials, such as newsletters, brochures and press release, direct mail costs, trade shows and any other special events needed.

1.6 Concept of Cost Optimization
The principle of optimisation or alternative selection or decision making was realised by Romans, centuries ago. Optimisation has its root from the household where an Athenian house wife manages her budget for frugal comfort with limited resources to provide the best possible food, clothing and shelter for her family. It permeates to large organisation or in every human activity also. Thus, human mind is always
confronted with problem and so many solutions come to his mind but he always selects optimal one.

Thus, optimization seeps into society and technology fabric beyond the vision of common human eyes.
Thus the first phase is recognition of problem and second phase is decision making or in other words selection of the best action. The two steps taken together is called optimisation.
Thus one can conclude that optimisation has two broad orientations: one is managerial and second is mathematical or engineering. The present work is focussed on both managerial aspect as well as engineering aspect.

1.7 Mathematical (Engineering) Optimization

In broader sense optimization is basically determination of extreme values over some range.

Thus in any business either one maximises the profit or minimise the loss. In classical mathematical optimization, one is not much interested in physical interpretation of result but in engineering and management without physical interpretation result is not of much use.

There may be situations where mathematics gives certain extreme values which are sluggish for practical purposes. Now, if one examines Figure 1.1 it is found that there can be several maximum or minimum in a region. These values may not correspond to feasible values. Mathematical extremes happen at point where slope is zero. It is true when function is continuous but in practice it may be an inflection point.

Maximum and minimum point which are not highest and lowest values are called local optimal point or relative minima or maxima. Point A is a local maxima. Thus it is evident that highest and lowest values may not correspond to mathematical optima, even then critical analysis of mathematical optima is a pre-requisite for the study of optimization.
Figure 1.1 Different types of extreme values

In any optimization process problem formulation is an important step. This is a major source of error if objective or goal is not clear. After obtaining the result, critical review involves.

(i) Whether the solution is feasible or realizable.

(ii) The solution is really an optimal one.

(iii) In what manner optimal value or how sensitive is the optimal value with respect to variation in independent variables.

The optimal point may not be global minima or maxima. It may be saddle or quasi saddle point such as point B in Figure 1.1 or it may be local maxima such as point A. Insight into the sensitivity of the optimal solution is essential. The analyst should be well versed with the relative importance of different critical parameters which has bearing on the result and simultaneously insignificant parameters should be dropped.

In the last half century, so many methods and procedures have been developed as mathematical cost optimization techniques depending upon the type of problem. In general all the methods can be broadly classified into three groups.

- Analytical
- Graphical or Tabular
- Incremental
1.7.1 Analytical Method for Cost Optimization

The function

\[ y = f(x) \]

is to be optimised. The solution is straightforward as it involves only one variable. The point where minima or maxima are possible is given by relation

\[ \frac{dy}{dx} = \frac{d[f(x)]}{dx} = 0 \]

For using analytical method it is essential that a formulation is possible in \( x \) and \( y \). The relation may be exact physical, mathematical, empirical or a combination of these. In optimization, how the relation was obtained is not important; but existence of a relation is necessary.

If the function \( y = f(x) \) is NOT continuous then it will be treated on a piecemeal basis. Sometimes function can take integral values only e.g. number of stories in a building but discrete relationship cannot be handled by classical method.

Problems involving discrete variable should be treated by the calculus of finite difference or a tabular analysis can be done. In certain situation, function of discrete variables can be differentiated, treating it as a continuous function but the solution obtained needs careful investigation.

In analytical method sign of second derivative points towards minimum or maximum. If second derivative is zero then result is inconclusive. If it is an even derivative and is positive for \( x = x_1 \) then it is minimum. At last if it gives negative value for \( x = x_1 \) then it represents maxima.

However in practice, it is very rare that a test beyond the second derivative is needed. Another way is to calculate the value of \( y \) in the neighbourhood of \( x = x_1 \) and make a table or plot to observe the behaviour of \( y \) at the \( x_1 \).

1.7.2 Graphical Method for Cost Optimisation

A function

\[ y = f(x) \]

is to be optimised within certain range of \( x \). A Table or a plot of the function is drawn which may be like Figure 1.1.

A plot or tabular presentation of data gives picture of the objective function at a glance. It differentiates mathematical maxima and minima, possible highest and
lowest values and location of inflection points. It also helps in sensitivity analysis of
the optimal value.

Graphical method becomes difficult for more than one variable but it is applicable for
n variable also. To study one variable, keep (n-1) variable as constant and vary the
nth. It will show effects of nth variable immediately on the function.

In the graphical method one searches the optima. On the other hand in analytical
method the search can be avoided or reduced to some extent. However, analytical
method should always be coupled with graphical or tabular data for a thorough
analysis. Of course one cannot deny that analytical methods give expression in
compact and ready to use form.

1.7.3 Incremental Method for Cost Optimization

Incremental method is very natural or instinctive or very fundamental in essence. The
process is very simple; a variable is changed a little and its effect is determined or
noticed by observation as to whether the change is advantageous or not.

This method is suitable for trial by experiment where uncertainty in individual
observation is involved, and trials are repeated to know probable values by means of
statistical analysis. Incremental method is basically, an analysis about a particular
point. It is equally applicable to analytical or tabular data. It can also be very well
used for continuous as well as discrete variables [Jelen and Black 1983].

1.8 Justification of Research

Cost is a vital consideration for any industry. In toy industry, innovation is a must as
toys have very short product life cycle. Along with innovations, comes the increment
in cost. Therefore any innovation should be brought about with consideration of cost
in mind. Therefore, cost optimization becomes a central issue for toy manufacturer.

With this focus in mind, this endeavour seeks to indentify elements of marketing as
well as productions, that is to identify attributes preferred in toys and incorporate
these in product design (toy design and manufacture) to increase its marketability and
also keep cost low and achieve the twin objective of increased sales and low cost.
CHAPTER 1
SECTION B
TOY INDUSTRY AND MARKET PROSPECTS

This section is organized into ten (10) parts. It begins with an introduction of toy industry followed by a backdrop of toy industry. The third part discusses the Indian and global market for toys which is followed by recent trends, development and market prospects. The fifth part presents an overview of Small & Medium Enterprises (SME) sector in India and gives the growth of number of SMEs and percentage of rural and urban SME. The sixth part provides the scope of SMEs in toy manufacturing sector. The seventh part describes the role of women in Toy Industry followed by a part on viability to women entrepreneur. The ninth part is on need of Interdisciplinary study which explains the justification of the study.

1.9 Introduction

Toys up to 1970's can be broadly classified as stationary, hand motion and gear train based, driving energy from coiled spring or spring. Major breakthrough happened in late seventies with advent of microelectronic, microprocessor, and Light Emitting Diode (LEDs) and Liquid Crystal Diode (LCDs).

The main concentration of toy industry is in and around the metropolitan cities of New Delhi and Mumbai in India, and is characterized by small-scale establishments. Of late, the toy industry has been internationalized. Today the uses of toys are unlimited but in ancestral generation toy was only a source of entertainment for children. Now a days they are used for play and education by children and for decorations by adults. Toys are also being used for entertainment as well as indirectly help child development.

Plastic toys, along with soft toys (mainly dolls) and board games, make up about 80% of the Indian market in value terms. The change that is discernible is the decline in importance of board games (other than puzzles), which involve play by a group of children. Those in the grade argue that, with smaller family size today and the growing practice of both parents working, there is little scope for board games, which families used to traditionally play together. And also another reason is, today children do not mix or interact much with children of their neighbours and therefore, they do
not have any group or friends to play with. The emphasis these days is much more on toys, with which a child can play on his/her own because of nucleus family system in urban India [UNIDO report 2005].

A well defined pattern of toy demand is observed in India. Usually demand in this direction is guided by the festivals. Toy sales in India have well defined seasonal patterns coinciding with the festival season. Generally, the time period is from July to November in Northern India (Diwali and Durga puja) while in Maharashtra (Ganesh chaturthi) festival is the high season. So Indian toy market faces temporal variation in demand but in the month of December international market is on its full bloom because of Christmas. So toy manufacturers never face feast or famine type business situation.

Toy purchasing decision in India often involves three individuals simultaneously, namely the child, who will use the toy, the mother, who is more concerned with safety aspects and space needed for play etc. and the third is the father who controls the strings of the purse. This family purchasing decision is primarily governed by price which happens mostly in the case of household purchasing which is guided by budget rather than specification based decision. The import of cheap and novel toys from China has quenched the toy craving of masses. These have mostly been unbranded and low priced popular toys.

Toy industry is predominantly confined to the sector of small scale Industries and is spread all over the country meeting the needs of different regions of India. The Indian toy industry is highly unorganized and branded companies are very few like Funskool, Hotwheel, Lego, Barbie, Disney, Fisher-Price, Step2 Noddy and Bob the Builder.

The country's toy industry is all set to get a technological facelift. The Toy Association of India (TAI) has tied up with IIT-Delhi and IIT-Bombay, in an effort to work on common platforms for research and development of educational toys. The collaboration would see the IITs and TAI working on product lines and designs and enable access to the IITs design facilities and infrastructure for TAI [Mohan 2006].

1.10 Backdrop of Toy Industry

During the long, hot and dreary summer break, building blocks, stuffed toys, rattlers, pull carts, stackers, dolls, train sets and various other toys are the child's best friend. Interestingly these products have varied range of traditional Indian toys that are
slowly coming back into vogue, courtesy a makeover. Earlier there was time when a clay dancing doll from Panruti (Tamil Nadu), shapes of animals, birds, and musicians from Lucknow (Uttar Pradesh) or a leather horse from Gwalior (Madiya Pradesh) could amuse a child for hours. Today, however, the markets are brimming with a wide variety of factory-manufactured toys of different brands.

As time passed the Lego took place of simple wooden building blocks. Like the stackers could be used to recognize similar objects, the 'pallankuzhi' (traditional board game played in South India) shown in Figure 1.2 and Figure 1.3 helps sharpen mental calculation abilities for children and then the abacus improves mathematics. These days different toys are recommended for different age groups. Thus children between one and five years usually amuse themselves with stackers, while pre-schoolers can take their first steps towards accounts with the help of a colorful abacus. Some Indian Non-Governmental Organization (NGO's) have taken the lead in reviving the traditional toy-making industry by creating toys that are a take-off on the traditional ones, but with a strong emphasis on finish, design and quality. One such example is that of Maya Organic. For many decades in India the small town had thrived on the earnings of the making of toys. Capitalizing more on the knowledge and skill of the artisans and after studying market trends, and the NGO has developed a brand of wooden educational toys called Moogli toys.

Figure 1.2 Pallankuzhi Board Game - 1
Source: http://mobers.ru/12054-pillankuzhi.html
Indian Toy industry is large and growing continuously. Therefore, there is a need for more organized approach to face the challenges of distribution and marketing. Usually many of these toys are imported through Dubai and Malaysia. Although, the Chinese toy market is flooding the domestic market; Indian markets still have design or modification in some toys that reflect Indian taste and culture.

Indian Toy Industry is fragmented, region based, and largely unorganized. Also the market is very small compared to the population and per capita income. The Toy business is generally based on constant innovation and one needs to be always abreast with the changing tastes of the customers and competitor's strategy to produce new innovative toys for survival in the market. The Indian Toy Industry has shown a healthy growth rate since the last four or five years. The market is growing at 15% to 20% per annum, which is a sound situation and it is further estimated to grow for at least five or six years. The reduction in prices of the products would contribute to increase in the sales because Indian market is highly price sensitive.

Across the world the toy Industry is highly fragmented. Also there is no excise imposed so the figure of production would not be available. The four major players who have global operations are Mattel, Lego, Hasbro, and Bandai. Mattel Toys are the largest toy manufacturers in the world. Here are some details of Indian toy
industry in terms of market capitalization, size of the industry and total contribution to
the economy.

1.10.1 Market Capitalization
More emphasis on quality and innovation along with Indian taste has helped both
children and profit margins. According to analysts at Maya Organic, such toys easily
account for approximately ₹200,000 to ₹250,000 of their business each month. Table
1.1 gives the overview of Indian toy industry.

1.10.2 Size of the Industry
For the Toy Industry in the world, UK is ranked 1st and India has been ranked 8th in
terms of spending money per child. An Indian kid from an average income group
today spends ₹250 to ₹300 on a toy.

1.10.3 Total Contribution to the Economy/ Sales
The producers are mostly based in the Delhi, Mumbai, Northern State of Punjab, Uttar
Pradesh and Haryana, also some in the southern state of Tamilnadu and in other
clusters across India's central states. India has 35-40 crores manufacturing base out of
which Delhi especially Noida rules 30 crore of markets and Mumbai rules the other
10 crore market. The grey market and other small-unorganized sectors dominate the
rest of the markets.

| Size of the Industry | Indian Toy Industry’s market size is about ₹2500 crores
| Geographical distribution | where 10% constitutes the organized sectors and 90% constitutes the unorganized sector. |
| Geographical distribution | Mumbai, Kolkata, Chennai, Bangalore, Punjab, etc. |
| Output per annum | Indian Toy Industry is estimated at ₹800- ₹1200 billion
| which is dominated by approximately 1250 small and
| very small producers scattered across the country. |
| Percentage In World Market | The Indian toy industry is estimated at about 850 million
| US dollars and until now has generated only 0.5 per cent
| of the global market. |
| Market Capitalization | Currently the Indian Toy Industry stands at ₹1500 crore
| and is set to grow at 25 % due to rising demand from
| India and abroad. |
1.11 Indian versus Global Market

As of today there are about 800 Indian games and toy manufacturers, exporters and suppliers in the small sector of India, with a turnover of nearly US$ 2.5 billion. This includes manufacturers of soft toys, children puzzles, electronic toys, toy cars, educational games, rattles, dolls, plush toys, computer games and brain teasers. It is estimated that, the total toys and games market in India stands at around ₹ 2500 crore, of which ₹ 250 crore is in Chennai. Table 1.2 gives some important parameters and their details in Indian market.

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Parameters</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Total market size</td>
<td>₹ 2500 crore</td>
</tr>
<tr>
<td>2.</td>
<td>Duties and Taxes (Excise Duty)</td>
<td>12.5%</td>
</tr>
<tr>
<td>3.</td>
<td>Market Structure (Organized sector)</td>
<td>35%</td>
</tr>
<tr>
<td>4.</td>
<td>Market Structure (Unorganized sector)</td>
<td>65%</td>
</tr>
<tr>
<td>5.</td>
<td>Global Export Contribution</td>
<td>0.4%</td>
</tr>
<tr>
<td>6.</td>
<td>Central Sales Tax (CST)</td>
<td>4%</td>
</tr>
<tr>
<td>7.</td>
<td>Governing Body</td>
<td>Toys Association of India (TAI)</td>
</tr>
</tbody>
</table>

Indian toy volumes are very low compared to European and American games and toy markets. This is mainly because toy buying is a relatively urban phenomenon. Most toy manufacturers are from the unorganized sector, who in turn sell their toys and games to big traders who market these toys. For toys and games the total export market is around ₹ 18 crore. The main reason for low export volumes is the quality norms abroad. For export, toys have to conform to the European standards EN 71 norms. This standard specifies the safety requirement for toy. In addition to this, the toys have to be non-toxic and safe to sell abroad.

There are three major players in the Indian toy industry namely Mattel, Lego and Funskool. In India, the toys and games that are available are a mix of both fun toys and educational tools. They include dolls, puzzles, electronic games, handmade toys, soft toys, board games and computer games. Indian wooden toys are of good quality and comparable to international standards. The demand for fun toys is greater than that of educational toys since parents usually prefer buying educational toys for their children.
In terms of toy sales worldwide, the top 3 countries are US, China and Japan and their respective sales are US$ 21.5 billion, US$ 4.9 billion, and US$ 5.8 billion. Other countries with a significant toy seller include Germany, Brazil, France, India, Australia and Canada. Though the recession influenced toy sales, the sector did witness growth of about 3.6% with sales reaching US$ 80 billion.

China which is world's largest toy manufacturer and exporter makes 2/3 of the world's toys. In 2009, the export value of Chinese toys was US$ 7.8 billion. Shanghai, Guangdong, Shandong Zhejiang and Jiangsu are the foremost production and export bases for toys in China, accounting for more than 90% of the annual sales of Chinese toys.

In European and American market, China's plush toys enjoy a large share of the total sales. But the low prices are also responsible for a low profit margin. However, it entails high labour costs and therefore manufacturing costs are pretty high. Wooden toys also have a significant share (of 10%) and plastic toys are suffering due to the continuously rising price of raw materials, quality and safety issues. China's intellectual toys too have a broad prospect, but relevant standards need to be released so as to guarantee the healthy development of the market.

In 2009, in pace with the upgrading of technology, the toy export industry has witnessed several changes: developed countries have diverted their demands of toys to toys which are adult toys, high-tech electric toys, intellectual and educational toys from traditional medium and low-grade products like plastic toys and stuffed toys. Electronic toys and online toys produced with high and new technology have become the recent development orientation [Ukessays 2014].

For survival in the toy market, there is a need of constant innovation and to produce new innovative toys. This is because of the relatively short product life cycles and competition for children's preferences with other products. Variety counts a lot for any toy industry, since a child wants to see variety in toys.

For toy manufacturers, innovation is key element in the business model. This is because innovation focuses on introducing novelties. Novelty may consist of completely new toys having a new concept or functionality for example interactive toys; or it may introduce new themes and updated concepts, such as board games and other toy system like Lego, or Playmobil [ECSIP 2013].
Indian companies are not involved in manufacturing of electronic toys but having their contribution in designing of electronic components and assembly of toys. For improving technology and quality standards, funding is also required. In addition, sufficient amount is required for brand building, which is a challenging task for Indian manufactures in view of the size of the industry. Brand building is an expensive option and requires deep pockets. Returns on investment have to be spread at least over 5 years. One even requires being financially strong in order to face international competition, so these funding programs with the help of associations will definitely prove to be a growing point for the industry. In addition to this, with the advent of multi-format retailing and mall concepts taking place in the country the reach of toys is increasing [Gifts and accessories 2005].

1.12 Recent Trends, Development and Market Prospects
Recalling the old memories of childhood, when elaborately dressed wooden dolls and humble clay dolls were very popular. But as time passed the Barbie dolls have replaced these dolls. Few years back the popular toys were colourful wind-powered toys like windmills and kites, small steam-propelled boats, mechanical toys like giant-wheels, trains and drum-beating rabbits, little plastic and metal cars and vans that were friction-powered. In the friction powered toys, the mechanism of pull back and rush forth was involved. These were the fanciful toys of our child-hood, which were available to buy from neighbourhood stores, street peddlers and temple-side vendors. Those were lot of fun, but apparently are not so exciting for today’s children. With the change in time, today’s toy shops look more like science labs. Even the simplest toy is a bump-and-go robot, which was very difficult and costly to mass-manufacture a decade ago. This is possible only because of Inter-disciplinary research, reducing manufacturing cost, easier availability of components, and increasing scientific temper amongst children. The rising affluence of the educated class are fuelling the demand and supply of advanced educational and entertaining toys. These toys are electronic and robotic toys for example Lego Mindstorm’s NXT 2.0 Intelligent Brick, WowWee’s Robopanda, Tomy’s iSobot, Sony’s Rolly and Outdoor toys like aero-modelling kits etc. The components used for these toys are family of ICs, sensors, actuators and processors [Vikram 2014].

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Similarly, in the area of comics, plays and stories trends have changed and some of the recent characters that appear in Marvel Comics are Spider-Man, the X-Men, Wolverine, the Fantastic Four, Iron Man, the Hulk, Thor and Captain America etc.

Another series of comics these days are known as vine comics in which some famous characters are Batman and Punisher. Similarly, for power play comic story the well known characters are Ando, Astolith, Kest, Sala, Dalek, Emperor and Daleks.

Types of toys available in the Indian toy market are wooden, metal, paper, fabric, and Do it yourself (DIY) toys (containing arts and craft toys) that are manufactured mostly by the cottage industry. However, out of these the metal toys are considered to be sharp toys which are harmful for children and a hindrance in their safety that is why these toys are known to be slowly losing its popularity. Another popular category of toys seen today are educational toys and activity toys which help build the mind and body of the child. There are also soft toys, electronic toys, and board games like chess and monopoly. Toys these days are popular not only with kids but adults have also entered this field through the medium of sports and games. Today many sports and games are been played by the adults at national and international levels representing their country and nation [Gifts and accessories 2005].

Remote-controlled cars are another great innovation in the electronic toy industry. Though cars are one of the first vehicles that could be controlled by remote, the toy companies eventually created boats and airplanes that could be controlled with a remote.

Indian toy industry is developing and progressing gradually in the domestic as well as global market. A report by India's National Productivity Council (NPC) suggests and emphasizes that toy-manufacturing industry of the country is still in the nascent stage of development and will need more support and attention from the government to upgrade its research and development facilities and technologies. The Indian toy market is worth over ₹10,000 crore, with the domestic industry contributing only 30%. The remaining demand is met by Chinese imports. The industry is also seeking fast implementation of a NPC recommendation that two exclusive zones be set up in Mumbai and Delhi. The government had reportedly acquired five acres of land in Greater Noida for setting up a research and development centre, following recommendations by the NPC in 2009. However, the project is yet to take off.

Some of the recent developments of Indian Toy industry are as follows:
(i) Today the Indian Toy Industry is worth around ₹ 4,000 crore, with ₹ 1,500 crore from the organised sector and ₹ 2,500 crore from the traditional sector.

(ii) The study of Toy Association of India shows that the share of local manufacturers in the domestic market has gone down to around 60% from over 90% five years ago, although the ₹ 1,300 crore markets have been growing by 20% a year. Because of this, several local manufacturers are forced to stop production and import and hawk Chinese toys.

(iii) The Indian Home Entertainment has the licensee for Walt Disney Studios, Twentieth Century Fox, Metro-Goldwyn-Mayer (MGM), Henson International Television (HIT) Entertainment, Shringar and Merchant Ivory Productions among others while Excel Interactive is a leading gaming company which markets and distributes games from world leaders like Electronic Arts (EA) and Disney Interactive Studios.

(iv) Indian Toy Industry is heralding the inclusion of a new label. My Baby Excels, which began its operations recently is the sister concern of Excel Home Videos and Excel Interactive. Excel Home Videos are the largest home entertainment company in the English movie category [Indianmirror 2014].

The Indian market is vastly different from that of overseas, where toys are bought as a child's development aid, i.e. they are considered to be equivalent to books. But in India the scene is different. Content and quality are the major drawbacks here. The amount of toys spent per child in India is also very low as compared to other developed economies. The metros and 'A' category towns account for most of the branded purchase and sell even at higher price points. Also the market is highly price sensitive and items above ₹ 200 fall in the category of planned purchase and not impulse buying. In 'C' and 'D' category towns, unbranded and lower quality toys sell at average price points of below ₹ 100. However, the trend is slowly changing but still it will take a few years more [Gifts and accessories 2005].

The Indian toy industry has shown quick strides in terms of export and production in the past one decade. It is estimated that the industry volume is US$ 1 billion in the organized sector and about US$ 1.50 billion in the unorganized sector. Small sector are having more than 1000 units and even a large number in the cottage industry. With the lowering of tariff barriers, the market is open and the Indian industries are facing the challenge of ensuring their competitiveness in a sector where both distributors and multinational competitors are concentrated and offer cheaper products.
which are mainly from the South East Asian Countries. According to an estimate, the
global market of toys will go up. Therefore, the Indian toy industry has an opportunity
to put itself on the world map. If Indian toys are keenly based on the latest technology
and are marketed properly, they can have a major share of the world market.

For development and growth of a successful marketing it is important to have an
understanding of the market for the good or the service. A market consists of people
who have willingness to buy, the need to buy, and sufficient purchasing power. The
marketplace is heterogeneous with varying purchase power and differing wants. The
heterogeneous marketplace can be divided into many homogeneous customer
segments along several segmentation variables. A market segmentation may be
defined as the division of the total market into smaller relatively homogeneous
groups. Products seldom succeed by appealing to everybody. The reasons are simple;
not every customer is profitable nor worth retaining; and not every product appeals to
every customer. Hence the organizations look for a fit between their competencies
and the segment's profitability. The identified segments are then targeted with clear
marketing communications. Such communications are referred to as positioning of the
product or service in the mind of the customer so as to occupy a unique place. This
involves identifying different points of differentiation and formulating a unique
selling proposition. In today's marketplace, differentiation holds the key to marketing
success.

The segmentation of the market is necessary to analyze the market in depth and
ensure maximum focus for a particular marketing strategy. For example, a similar
marketing strategy cannot be employed for all the customers when one is analyzing
the toy market. Market segmentation will help to segment the market based upon
customer's income, and for each income band adopt the unique strategies.

1.13 An Overview of SME Sector in India

SMEs in Indian context may be defined as investment in plant and machinery is not
more than ₹ 5 crore / 1 million US$ (For manufacturing SMEs). India is a growing
service economy and thus provides an opportunity for SMEs growth and achieve
balanced growth. SMEs can in fact become the engine that sustains growth for long-
term development for India. When growth becomes stronger, SMEs gradually assume
a key role in industrial development and restructuring. They can satisfy the increasing
local demand for services, which allow increasing specialization, and furthermore
support large enterprises with services and inputs [Ramarao and Jyothi 2014]. Table 1.3 gives an overview of SME sector in India.

**Table 1.3 SME Sector in India**

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Parameters</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Employs</td>
<td>73 million people</td>
</tr>
<tr>
<td>2.</td>
<td>Manufacturing output</td>
<td>45%</td>
</tr>
<tr>
<td>3.</td>
<td>GDP (Gross Domestic Product)</td>
<td>8%</td>
</tr>
<tr>
<td>4.</td>
<td>India’s Exports</td>
<td>40%</td>
</tr>
<tr>
<td>5.</td>
<td>No of Enterprises</td>
<td>26 million</td>
</tr>
</tbody>
</table>

SMEs have been the backbone of the Indian economy. SMEs employ close to 40% of India's workforce and contribute 45% to India’s manufacturing output. SMEs play a critical role in generating millions of jobs, especially at the low-skill level. The country's 1.3 million SMEs account for 40% of India's total exports. SMEs in India, due to their low scale and poor adoption of technology, have very poor productivity [Goyal 2013].

SMEs sector in India also produces more than 6000 products ranging from traditional to hitech items. It consistently registered higher growth rate than the rest of the industrial sector. SMEs play a critical role in generating good opportunities for both self employment and wage employment. The small and medium units in the country have contributed 40% towards creation of jobs after the economic slowdown, and 10 lakh jobs each year. SMEs are equally responsible towards making living conditions better for their employees and their families.

There is a steady growth of SME sector in India. This may be because there are many firms that prefer to stay small, un-incorporated, unregistered and in the unorganised sector so that they can avoid taxes and stiffing regulations. India has the second largest number of SMEs at 48 million in the world. Figure 1.4 shows the growth of number of SMEs in million.
Figure 1.4 Growth of number of SMEs

Source: http://articles.economictimes.indiatimes.com

It has been found that number of SMBs in urban areas is more than the rural areas.

Figure 1.5 shows the percentage of SMEs in urban and rural areas in India.

Figure 1.5 Percentage of SMEs

Source: http://articles.economictimes.indiatimes.com

Table 1.4 shows the contribution of Micro Small and Medium Enterprises (MSMEs) in India's Industrial production and Gross Domestic Product (GDP).
Table 1.4 Contribution of MSME’s in India’s Industrial Production and GDP

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Year</th>
<th>Contribution of MSMEs (%) at 1999-2000 in</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Total Industrial Production</td>
</tr>
<tr>
<td>1.</td>
<td>2004-2005</td>
<td>38.62</td>
</tr>
<tr>
<td>2.</td>
<td>2005-2006</td>
<td>38.56</td>
</tr>
<tr>
<td>3.</td>
<td>2006-2007</td>
<td>45.62</td>
</tr>
<tr>
<td>4.</td>
<td>2007-2008</td>
<td>45.24</td>
</tr>
<tr>
<td>5.</td>
<td>2009-2009</td>
<td>44.86</td>
</tr>
</tbody>
</table>


Another noteworthy feature of the MSME sector in India is that about 45.2% of the enterprises are located in rural areas, thus offering a great potential for rural development and for reducing the strain on urban infrastructure.

SMEs are dominant players in some of India's major export sectors, including textiles and garments, leather products, sports goods, gems and jewellery, and handicrafts, among others.

Mumbai is one of the major SME cluster in India and it produces mainly plastic toys, hosiery, packaging materials, and readymade garments.

1.14 Scope of SMEs in Toys Manufacturing Sector

The role of SMEs in toy manufacturing is like the nurseries for entrepreneurship and innovation. They are widely dispersed across the country and produce a diverse range of products and services to meet the needs of the local markets, the global market and the national and international value chains.

Recently, SMEs sector has become a vibrant and dynamic sector of the Indian economy. SMEs also play a vital role in providing large employment opportunities at comparatively lower capital cost than large industries. It also helps in industrialization of rural and backward areas and hence reducing regional imbalances. In general this sector contributes significantly to the socio-economic development of the country.

In order to cater to the large requirements of plastic and rubber toys, SMEs can provide facilities such as rapid prototype development and manufacturing machines, Computer Aided Design/Computer Aided Manufacturing/Computer Aided
Engineering (CAD/CAM/CAE) mould design system, Computer Numerically Controlled- Electrical Discharge Machining (CNC-EDM) and wire cut and other needed tool room machines.

The SMEs can also help toy manufacturers by participating in International Fairs/exhibitions related to toys in order to show case their products, to learn more about new products launched by other manufacturers and finally enhance exports of toys from India.

From the point of view of safety, some SMEs have installed metal detector to ensure Toy safety i.e. no broken needle part accidently goes into soft toys.

The Indian toy industry largely consists of SMEs. The major toy producing units/clusters are located in Delhi. Around 50% of the toy units are in Delhi and National Capital Region (NCR), 35% are in Maharashtra while the remaining 15% are scattered all over the country. The toy industry in India is concentrated mainly in the small and cottage sectors, with about 4000 manufacturers in all.

1.15 Role of Women in Toy Industry

Women Entrepreneurs may be defined as the women or a group of women who initiate, organize and operate a Business Enterprise. Government of India has defined Women Enterprises as an enterprise owned and controlled by a woman having a minimum financial interest of 51% of the capital and giving at least 51% of employment generated in the enterprise to women. Like a male entrepreneur, a woman entrepreneur has many functions:

(i) Exploring-Starting New Enterprise.
(ii) Introduction of Innovations.
(iii) Administration and Control.
(iv) Coordination.
(v) Undertaking Risks.
(vi) Providing Effective Leadership.

There are some important factors which may be prove useful for developing a woman entrepreneur.

(i) Encouraging Women’s participation in Decision-Making.
(ii) Vocational Training to be extended to Women Community that enables them to understand the production process and production management.
(iii) Skill Development in Women’s Polytechnics and Industrial Training Institute (ITI’s).

(iv) Making provision of Micro-Credit System and enterprise credit system to Women Entrepreneurs at Local Level.

(v) Organizing gender sensitization programmes.

(vi) A Women Entrepreneurship Cell (WEC) should be set up to handle the various problems of Women Entrepreneurship in all states [Lal and Badrinarayan 2011].

Women are playing instrumental role in toy industry. This is because in any toy industry there is too much of work in designing and development of toy which can be done effectively and efficiently by women. This is because the work includes stitching, cutting, sewing and stuffing, embroidery and colour painting. Also for doing these work, women have good taste and aesthetics as compared to men. Women can suggest much better colour combination which would be attractive for their kids. Mothers can understand and advice better which colour would be appealing for a baby girl or a baby boy and also the range of colours that are generally prepared for kids.

Since women are involved more closely in the child’s development and growth than men; therefore, women have got the chance to observe and monitor the manner in which kid’s play with the toys. As a result, women can give better idea and suggestions which would be helpful in modification and designing of toys.

One good example in toy industry where involvement of women will greatly be appreciated is in designing and modification of the toys related to baby girl. Some popular toys for girls are kitchen set, doll houses and Barbie dolls. Girls are usually attached to their dolls and share with them their deepest wishes, sorrows, and joys. Barbie dolls that portray an unrealistic and potentially damaging view of the woman’s body. Women can bring transformation in the body shape of Barbie dolls so that she has a more human-like and average body type. Similarly, for other toys like kitchen sets and doll houses, female engineers can give much better suggestions because of their experiences in household accessories.

Another area where role of women is important in toy industry is the factor of safety for their beloved kids. This is because women are more concerned about the safety aspect of a toy and therefore they can think more and suggest better about the safety features of a toy. For example, it is suggested that toys should be made with renewable, recyclable and natural material rather than synthetics like plastic. Dolls and dolls clothes, and soft toys should be made from organic fabrics. The paints used
in toys should have natural and non-toxic material rather than lead content. Even some large companies and branded toy companies are using lead in the paint because of which parents are too worried, and they do not know which toys to trust. Women who are working in toy industries may take care of the material used and make valuable suggestions like to make the toys completely safe for children, some vegetable-based dyes can be used. Women can also lay emphasis on manufacturing and designing green toys in which there are no harmful chemicals and solvents are involved.

Institute of Toy Making Technology (ITMT) provides training for designing of toys. It also employs only women.

It is a government-supported registered society. This institute runs training courses for the unemployed women from the Northeast. These courses include toy manufacturing and toy business. The institute can also extend support for making of toys at ITMT, (which was set up in 2001 and about 150 girls are trained every year). Later, these girls find work at the production centers set up in their states as employment generation projects. At present there are six production centers. Every production centre generates up to 2,000 stuffed toys per day on an average.

Now ITMT is also in the process of setting up production centers in Uttar Pradesh, Haryana and Tamil Nadu. The toys made are exported to Middle East, Australia, Canada and the USA. Toy exporters have tied up with the production centers through the intervention of ITMT [Menon 2009].

The West Bengal government has also joined hands with ITMT and the Central government to establish a toy-making unit in Haldia, where some 100 women are involved. Another such unit is coming up at Chandrakona, geared to provide employment to another 40-odd women.

The women those who are working at these units are first trained, and after that they start earning on a regular basis. ITMT, also helps them to market their products. These women, who hail mostly from below the poverty line families, get a lifeline, with their monthly earnings varying between ₹2,500 to ₹5,000 [Ghosal and Sengupta 2009].
1.16 Why it is Viable to Women Entrepreneur

Most of the women strongly feel that happy family life is the most important unit of our society. All housewives have commitment towards their family. They are finding difficulty in going out and do their work especially when kids are small. There are many women from different sections of the society having talent of stitching, embroidery and sewing. These women are also having sewing machines at home and also spare time. For some manufacturing activities, they can collect material along with instructions and carry work to home and finish it in their convenient time.

Many women from financially weaker sections are facing difficulties in running and managing their homes because of money constraints. Recently the trend of working at home has steadily become popular. Now day's home workers are in great demand and are needed immediately by many established, reputable, large and small companies. Assembly of electronic and stuff toys at home can provide a way out to work from the comfort zone of home and earn good money.

These companies can offer women to work at home and pay by the hour or by the piece, pay a commission or a percentage of the profits. Women can take the advantage of this excellent opportunity to earn extra money and make their future bright.

This will also help the companies to compete with foreign manufacturers. This is because cost of employing women is low.

In this way unemployed segment of the female community have found gainful employment through work at home by doing assembly of various products from various companies.

Assembly of these toys will not be difficult for women to perform because this work does not need much technical knowledge and experience. Moreover, for assembling they need to read and follow the given instructions. The assembly instructions are prepared in the most understandable and simple way. They are illustrated step by step. Usually, picture or diagram accompanies each step.

The area of toy manufacturing and marketing is a viable alternative to women entrepreneur. Therefore, more and more women from different sections may be encouraged to get into this business. In India, the strength of female engineer is increasing day by day. These female engineers can take active part in manufacturing of toys by designing Printed Circuit Boards (PCBs) and making use of computer graphics for toy designing.
1.17 Need of Interdisciplinary Study (Purpose of this Study)

In the modern curriculum of research, interdisciplinary approach has become necessary and challenging technique. This approach provides expansion and flexibility and also opens up new areas of research. But it is time consuming because it involves collaborative teamwork. With the help of interdisciplinary approach, which is a combination of two or more academic disciplines, something innovative can be created by crossing boundaries and thinking across them.

Interdisciplinary approach encompasses elements from industrial design, graphic design, animation and human psychology and interaction, sociology and management domains. The Interdisciplinary approach is important in basic toy design management because it includes play theory of colour and composition, cognitive ergonomics, aesthetics, material/media technology, study of forms.

The problems of real world are too complex, so no single discipline can resolve the issues adequately. This approach will not only help in accelerating scientific discovery but will also provide traffic results.

Toy designers play an important role in the entertainment and education of children. Toy designing has much scope because toys are vital to a child's development and growth. Toy designing is a culmination of two qualities - creativity and ability to understand children or user needs. The work of toy designing starts with sketching, drawing, or making a computer model of the concept, deciding how to make each component and then creating a prototype of the toy. Toy designers keep two important market sectors in mind i.e. children, who play with it and those customers who are collectors of toys. The present study aims at knowing the views of toy purchasers and experimenting the new cost effective designs. The complexity of toys can vary, from simple dolls which have no movable parts to complex mechanical sets with configurable moving parts. Toy designers create different kinds of toys like puzzles, computer games, board games, remote-control cars, stuffed animals, infant toys, and dolls etc.

For designing toys, designers need to be well aware of the market trend for toys and also the needs and wants of the different age groups. Toy design is multidisciplinary in nature. It revolves around the elements of product design, animation and human psychology. For this field knowledge of mechanical drawing, graphic design, and color usage is essential for success. Toy designers work with child experts in determining the requirement of each age level and create toys suited for each group.
The success of toy designers depends on their ability to understand the market and develop entertaining, beautiful, imaginative and safe toys [Education and carrier 2014].

Interdisciplinary approach widens up the scope of the study. It increases the span of the boundaries to cover broader spectrum of the product development including design development, production and operation.

Today the holistic approach taken in system engineering focuses on analyzing and eliciting customer needs and requires functionality in early development cycle.

The present study aims to integrate the technical know-how and models of engineering with management approaches to evaluate the cost factor that plays a key role in promotion of the electronic toys industry.
CHAPTER 2
INDUSTRIAL PROFILE

This chapter consists of five (5) sections. The first section is about major players of toy industry at the national and International level. This section also includes some toy companies having presence in India. The second section discusses manufacturing of electronic toys and some commonly used electronic components and their functions. The third section is about classification of toys and segmentation of toy market followed by a section of traditional versus electronic toys. The last section presents challenges before Indian Toy Industry.

2.1 Major Players of Toy Industry- National & International
The toy industry is mainly concentrated in and around the metropolitan cities of New Delhi and Mumbai in India, and is characterized by small-scale establishments of late, the toy industry has been internationalized. Companies in the toy industry manufacture both electronic and non electronic toys and games.
The world toy market is dominated by few large toy brands which are listed in the Table 2.1.

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Name of company</th>
<th>Name of country</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>LEGO</td>
<td>Denmark</td>
</tr>
<tr>
<td>2.</td>
<td>Mattel</td>
<td>USA</td>
</tr>
<tr>
<td>3.</td>
<td>Hasbro</td>
<td>USA</td>
</tr>
<tr>
<td>4.</td>
<td>Nintendo</td>
<td>Japanese</td>
</tr>
<tr>
<td>5.</td>
<td>Playmates</td>
<td>USA</td>
</tr>
<tr>
<td>6.</td>
<td>McFarlane Toys</td>
<td>USA</td>
</tr>
<tr>
<td>7.</td>
<td>Fisher Price</td>
<td>USA</td>
</tr>
<tr>
<td>8.</td>
<td>Bandai</td>
<td>Japanese</td>
</tr>
<tr>
<td>9.</td>
<td>Kenner</td>
<td>USA</td>
</tr>
<tr>
<td>10.</td>
<td>Playskool</td>
<td>USA</td>
</tr>
</tbody>
</table>

Table 2.1 Top 10 Toy Companies
2.1.1 Toy Companies in India

(i) Lego

Lego is world’s sixth-largest manufacturer of toys. This company is based in Denmark and was founded in early 70’s. Lego toys are very popular in Europe and North America. The Lego's company's main aim is to "inspire and develop the builders of tomorrow", and all products are based on the underlying philosophy of learning and development through play. It is the Lego philosophy that "good quality play" enriches a child's life- and lays the foundations for later adult life. There are approximately 4000 different elements in the Lego range plus 58 different Lego colors. Each element may be sold in a wide variety of different colors and decorations, bringing the total number of active combinations to approximately 8000 [Lego group 2011].

(ii) Mattel

Mattel is recognized as one of the hundred most trustworthy U.S. companies by Forbes magazine. Mattel has been in India since 1985. The Mattel Company is a $6 billion company and their market share in India is around 20 percent. Mattel toys (India) Private Limited is a subsidiary of Mattel, Inc. The company of Mattel is the worldwide leader in the manufacturing, marketing and design of toys and family products. The Mattel family is composed of such best-selling brands as Barbie, the most popular fashion doll ever introduced, Hot Wheels, Polly Pocket, Matchbox, Radica and Fisher-Price brands [Justfun group].

(iii) Funschool

Funschool is the third largest producer of toys which was set up in 1987. Funschool is the joint venture between the Indian tyre giant MRF, and Hasbro a worldwide leader in children’s and family leisure time entertainment products and services, including the design, manufacture and marketing of games and toys ranging from traditional to high-tech. Funschool has a market share of 30% [funschool 2013]. The vision of Funschool Company is to help every child grow into a successful human being. The range of products of Funschool is a blend of art and science. Products are aesthetically created with exciting designs and colors that would delight children. They are scientifically thought out in a way that improves various skills and functions. For

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example, shape recognition, hand-eye coordination, and problem solving skills, reflexes and colors.

(iv) Hasbro Inc.

Hasbro is an American multinational toy and board game company which formerly was known as Hassenfeld Brothers. It is one of the largest toy makers in the world. The corporate headquarters is located in Pawtucket, Rhode Island. The majority of its products are manufactured in East Asia. In the 1940s, it produced doctor and nurse kits, its first toys, and modeling clay, becoming primarily a toy company by 1942. In 1964, Hassenfeld Brothers produced the G.I. Joe toy, which they termed an "action figure" in order to market the toy to boys [Hasbro, Inc. history 1997].

The Table 2.2 gives the summary of shares of various brands in the Indian Toy Market:

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Name of brand</th>
<th>Percentage share in Indian market</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Funskool</td>
<td>30%</td>
</tr>
<tr>
<td>2.</td>
<td>Mattel</td>
<td>20%</td>
</tr>
<tr>
<td>3.</td>
<td>Hasbro</td>
<td>9%</td>
</tr>
<tr>
<td>4.</td>
<td>Lego</td>
<td>4%</td>
</tr>
<tr>
<td>5.</td>
<td>Bandai</td>
<td>4%</td>
</tr>
<tr>
<td>6.</td>
<td>Leap frog</td>
<td>3%</td>
</tr>
<tr>
<td>7.</td>
<td>others (Misc.)</td>
<td>30%</td>
</tr>
</tbody>
</table>

Source: SME Times News Bureau, Aug. 2013

2.2 Manufacturing of Electronic Toys

Electronic toys are fun and entertaining and help in expanding children's knowledge. Some electronic toys are educational that can be played for long periods of time. These electronic toys teach children and provide mental exercise that enhances their skills.

Electronic games are also helpful to parents because they provide alternatives for the real products which are quite expensive, costly and hard to replace, like cell phones and digital cameras. By buying their kids electronic toys they are able to save their belongings (products) things from being broken or played with. Kids love to play with technology and it gives them a feel of having grown up.
Indian market is having different types of electronic toys. Some of the popular electronic toys among Indian children are hand-held video games, video games used with T.V., toy radios, walkie-talkie sets, musical toys etc.

Electronics and embedded computer chips have added another dimension to the interactions that can occur between children and their toys. Electronic toys are blurring the lines between play and learning by involving children in interactive activities. Inside electronic toys there are sensors which respond to sound, squeezing, speech, touching, movement, and in some cases, the toys even communicate among themselves. Thoughtfully designed toys can provide experiences that would otherwise be unavailable to many children. For children, two essential things that should be kept in mind are safety and reliability. For example, toys that run from one or two 1.5 volt penlight cells are generally completely safe to operate because such a low voltages can not give the user an electric shock.

In order to ensure an effective entry into the toy market, given below is a list of tricks to tackle these issues one at a time.

2.2.1 Components of Electronic Toy

Electronic components are the basic building blocks which help in complete functioning of electronic devices. Various types of electronic components are used in toys and each one of them is having specific purpose. Table 2.3 covers many electronic components needed to design working systems. In toy designing, a circuit is to be designed first to perform the required functions and then test prototypes to show the circuit performs as intended. The electronic toy design should be reliable and cost effective. The product must also be manufactured at a reasonable cost to allow a competitive retail price within its category and to ensure a profit. A rough prototype or working model of invention will help to determine its cost-effectiveness. A prototype is also important for presentation purposes specially if the product is to be sold to a toy manufacturer. The more complete the product is, the more willing a manufacturer is to buy the product. Some prototypes, such as those for board games, can usually be made at home, but some toys, such as those requiring custom-made molds or pattern designing, may require professional input.

Generally, the simpler the technology, the less expensive the item will cost to produce [TIA 2014].
<table>
<thead>
<tr>
<th>S. NO.</th>
<th>Names of component</th>
<th>Functions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Plugs and sockets</td>
<td>Connectors for linking groups of components together</td>
</tr>
<tr>
<td>2.</td>
<td>Terminals</td>
<td>Metal contacts used to connect wires</td>
</tr>
<tr>
<td>3.</td>
<td>Wires and cables</td>
<td>Conductors that are used to connect components</td>
</tr>
<tr>
<td>4.</td>
<td>Printed circuit boards</td>
<td>Insulating boards with conducting patterns that support and interconnect components.</td>
</tr>
<tr>
<td>5.</td>
<td>Resistors</td>
<td>Devices that control the amount of current that flows.</td>
</tr>
<tr>
<td>6.</td>
<td>Capacitors</td>
<td>Devices that store electrons as electric charge.</td>
</tr>
<tr>
<td>7.</td>
<td>Inductors</td>
<td>Devices that oppose the flow of alternating current by storing energy as a magnetic field.</td>
</tr>
<tr>
<td>8.</td>
<td>Diodes</td>
<td>Restrict the flow of current, and this property is useful in AC/DC convertors, audio applications etc.</td>
</tr>
<tr>
<td>9.</td>
<td>Transistors</td>
<td>Solid state switches that control the flow of electrons. It can also be used in amplifiers.</td>
</tr>
<tr>
<td>10.</td>
<td>Switches</td>
<td>Mechanical devices that make or break connections between components.</td>
</tr>
<tr>
<td>11.</td>
<td>Light Emitting Diodes (LEDs)</td>
<td>Semiconductor device that emits infrared or visible light when charged with an electric current. Visible LEDs are used in many electronic devices as indicator lamps.</td>
</tr>
<tr>
<td>12.</td>
<td>Integrated Circuits (ICs)</td>
<td>Collections of transistors, conductors and other electronic components that are typically fabricated in Silicon.</td>
</tr>
<tr>
<td>13.</td>
<td>Transducers</td>
<td>Devices such as loudspeakers and motors that transform electrical signals into physical properties such as sound, pressure, position, or movement.</td>
</tr>
<tr>
<td>14.</td>
<td>Sensors</td>
<td>Devices such as microphones, temperature sensors, and accelerometers for sensing physical properties and generating an electronic representation.</td>
</tr>
<tr>
<td>15.</td>
<td>Wireless Transmitters</td>
<td>Devices that use infrared or radio frequency signals to send information.</td>
</tr>
<tr>
<td>16.</td>
<td>Wireless Receivers</td>
<td>Devices that detect infrared or radio frequency signals that convey information.</td>
</tr>
<tr>
<td>17.</td>
<td>Wireless Transceivers</td>
<td>Devices that performs the function of both transmitter and a receiver.</td>
</tr>
<tr>
<td>18.</td>
<td>Memory Chips</td>
<td>This is a semiconductor chips that store large amounts of information.</td>
</tr>
<tr>
<td>19.</td>
<td>Microprocessors</td>
<td>Chips containing millions of transistors organized to perform computing operations.</td>
</tr>
</tbody>
</table>

In addition to the various electronic components used in toys, there are some testing tools required in manufacturing of toys. These tools are as follows:
(i) **Digital Multimeter**: This meter is used for measuring AC/DC voltages, current, resistance, circuit continuity and values of electronic component used in the circuit.

(ii) **Signal Generators**: This is used to generate various signals having different shapes and frequency. Such as sine wave, triangular wave and square wave etc. These signals are used as input signals for circuit testing.

(iii) **Power Supplies**: This is to provide input power to the test circuit. It may provide different range of Alternating Current/Direct Current (AC/DC) voltages and currents.

(iv) **Logic Probes**: This is for injecting and observing digital signals at various points in the circuit [Scot2004].

The trends of remote controlled (RC) toys are gaining ground in the market these days. Remote controlled toys include trucks, aero planes, cars, playing machines and other equipments. For these toys basic electronic principle remains the same but there are differences in their mechanical assembly.

It has been found that mostly children prefer RC toys because they are fascinating and give lot of excitement. Market survey also shows the high popularity and consumption of RC toys. Therefore, a typical model and manufacturing process of RC toys is discussed in detail. These toys consists of four main blocks namely transmitter, receiver, motor and power source. Figure 2.1 gives the detail of flow chart for a signal transmission in transmitter and receiver. Receiver, decoder, motor drive and the Motor 1 and Motor 2 are located on RC car.

![Figure 2.1 Flow of signals in Transmitter and Receiver](http://embedjournal.com)
(i) **Transmitter:** This block of RC toys are used to send radio waves to the receiver.

(ii) **Receiver:** It contains an antenna and electronic circuit. The circuit is inside the body of the toy which actually receives the radio signal sent by the transmitter. Once the receiver receives the signal, it activates motor inside the toy as commanded by the transmitter.

(iii) **Motors:** By using radio waves, transmitter sends the control signal to the motor. This control signal then drives the motor to cause a specific action such as wheels to turn, operate propellers and steer the vehicle etc.

(iv) **Power Source:** The power source for RC toys is generally a rechargeable battery pack. Normal batteries may also be used.

Apart from this, RC toys manufacturing process also involves the assembly of electronic circuits, electromechanical hardware parts, mechanical assembly and other sub assembly parts according to the design of the specific toy. The electronic assembly needs the printed circuit boards (PCBs) as the base on which the desired circuit of a toy can be assembled which may include various electronic components like Integrated Circuits (ICs), resistors, capacitor, inductors, Transistor and diodes etc. The electromechanical assembly includes hardware such as switches and connectors. Finally the electronic assembly along with electromechanical, mechanical assembly and Light Emitting Diodes (LEDs) are assembled and housed in a plastic or fiber car casing [MSME 2010]. Figure 2.2 shows the implementation of RC toy car on the bread board using various electronic components and their connections.

![Figure 2.2 Implementation of RC Toy Car](www.engineersgarage.com)
Literature shows that most of the electronic toys are not manufactured in India but merely imported, and that too at price-points that make them the preserve of the elite. Although not into manufacturing, Indian companies are involved in the designing of components and assembling of such toys throughout various factories in India. Many of the companies that are popular when it comes to high-tech toys are from the Far East, as they have been able to come up with new technologies even within toys. There is Companies like United Agencies, Milton Bradley, Playmate and Mayur Exim are the ones that are involved in the assembling of these toys in India.

Unfortunately in Indian toy manufacturing companies, there is no focus in the area of variety, innovation, technological advancements and R&D work especially for electronic toys. This is the main reason; India is lagging behind others. This research work will be helpful up to some extent in this regard.

2.3 Classification of Toys and Segmentation of Toys Market
A toy can make a big impact on child’s life. All toys are designed for a specific age and to encourage the development of children. Most parents seek assistance in selecting the right toys at the most ideal stage of their child’s development. Toys provide children with creative outlet and encourage them to use their minds and their muscles.

Toys with sounds and music that react to the child’s action are good for babies, as they begin to match voices with different facial expressions mainly from being fed, held and nurtured. Babies develop their skills through soft book, rattle or play gym, all toys that encourage them to reach and grasp.

Children at the age of 1 or 2 are the most important stage in a child’s development. This is the time for developing independence and important social skills. Most preschoolers love and enjoy dramatic plays such as puppets, balls, wagons, riding toys and art materials.

Toys help children to stimulate their mind and develop cognitive and language skills. It also helps children encourage movement and motor muscles. Older children can benefit from interactive plays that also promote language, social and physical development.

Electronic toys always entertain children because of its light and sound features. Some electronic toys should be accompanied by positive reinforcement from parents. This is one reason why some experts prefer non electronic toys like clay, traditional
toys, blocks etc. Non electronic toys help our child to develop their creativity and provide them the opportunity to learn shapes, colors and numbers. There are some children toys that impact the child's behavior. There are toys like the kitchen toys, a medical play set or a tool set; these are great toys because they encourage responsibility and build self-esteem. Broadly the toys can be classified into four general categories as given under. Here are also some examples under each general category of toy.

(i) Traditional Toys
Traditional toys are the toys with which generations and generations have played and grown up. In this category, over the years the growth is being consistent. Category of traditional toys is essentially stagnant with 6296 manufacturers. Because of late consumers tastes are rapidly shifting from traditional games to video games. Under this category the toys are:
Action Figures & Accessories (G.I. Joes)
Building Sets (Lego Sets)
Dolls (Barbies)
Games & Puzzles (Monopoly)
Plush (Soft Toys)
Vehicles (HotWheels)

(ii) Video games
This is one of the fastest growing categories of toys. Since there is a shift in the nature of customer preferences, many companies in the toy industry have started to place more emphasis on video game products. For example, Mattel, the world's largest toy manufacturer has entered the video game industry in 2006 to keep up with the changing face of the toy industry.
Youth Electronics (PS2, X-Box)
Gaming Parlours (Jammin, TimeZone)
(iii) Casino Games
This industry has noticed a change in consumer's preferences towards electronic casino games such as slot machines. As a result, manufacturers of electronic video games have benefitted, while manufacturers of more traditional casino games suffered. Slot machines were introduced by casino games manufacturers which have ultimately benefitted the video game industry.

4. Accessories and Others
Includes traditional games including sports items and educational toys for infants, which is also a fast growing industry [Sehgal 2010].
Apart from the four general categories of toys, detailed classification of toys with examples are given in Table 2.4.
<table>
<thead>
<tr>
<th>S. No.</th>
<th>Types of toys</th>
<th>Examples</th>
<th>Toy Image</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Stuffed animals</td>
<td>Beanie Babies, Build-A-Bear Workshop, Care Bears, Pillow Pets, <strong>Pound Puppies</strong>, Sock monkey, Squawkers McCaw, Teddy bear, Webkinz.</td>
<td><img src="image1.png" alt="Image" /></td>
</tr>
<tr>
<td>2.</td>
<td>Action figures</td>
<td>B-Daman, Digital pet, Evel Knievel Action Figure, <strong>G.I. Joe</strong>, Gumby, He-Man, Jumping Jack, Kenner Star Wars action figures, Lara, Playmobil, Stretch Armstrong, Teenage Mutant Ninja Turtles, Smurfs, Toy soldier, Transformers, Weebles, Xevoz.</td>
<td><img src="image2.png" alt="Image" /></td>
</tr>
<tr>
<td>3.</td>
<td>Cars and radio controlled</td>
<td>Corgi toy cars, Dinky toy cars, Hot Wheels toy cars, Matchbox cars, Micro Machines, Model cars, Radio-controlled aircraft, Radio-controlled boat, <strong>Radio-controlled cars</strong>, Slot cars, Tonka Toys, Walkie-Talkies.</td>
<td><img src="image3.png" alt="Image" /></td>
</tr>
<tr>
<td></td>
<td><strong>Spinning toys</strong></td>
<td>Chinese yo-yo (Diabolo), Frisbee (1950s), Gyroscope, Hula hoop (1950s), Magnet Space Wheel (Whee-Lo), <strong>Pinwheel</strong>, Top, Yo-yo (1930s onwards).</td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---------------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td><strong>Model building</strong></td>
<td><strong>Model aircraft</strong>, Model car, Model railway, Carpet railway, Lionel Trains.</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td><strong>Sound toys</strong></td>
<td>Noise makers, Synthesizer, <strong>Toy piano</strong>, Toy rattle, Whistle.</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td><strong>Science and optical</strong></td>
<td>Chemistry set, Etch A Sketch, Kaleidoscope, Magic 8-Ball Magna Doodle, Sea Monkeys, Spinning top, View-Master, Wooly Willy, <strong>Zoetrope</strong>.</td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td></td>
</tr>
<tr>
<td></td>
<td>10. Puzzle/assembly</td>
<td>Jigsaw Puzzle, <strong>Mr. Potatohead</strong>, Puzzle, Rubik's Cube Tangrams.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>11. Physical activity and dexterity</td>
<td>BB gun, <strong>Bicycle</strong>, Big Wheel, Bilibo, Bungee balls, Contact juggling (Acrylic Ball), Devil Sticks (Juggling Stix), Footbag (dirt bag</td>
<td>hacky sack,), Juggling clubs, Jump rope, Laser Tag, Marbles, Moon shoes, Pogo stic, Radio Flye, Roller Skates, Slip 'n Slide, Soap-box cart, Space Pets, Toy weapon, Water gun.</td>
</tr>
<tr>
<td></td>
<td>Category</td>
<td>Toys</td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>-----------------</td>
<td>----------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Executive</td>
<td>Easy Button, <em>Newton's cradle Pin Art</em>.</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Games</td>
<td>Barrel O' Monkey, Candy Land, Chutes and Ladders, Clue, Concentration (aka Memory), Connect Four, Dominoes, Dungeons &amp; Dragons, Game Boy, Hungry Hungry Hippos, Life, Mad Libs, Mattel Auto Race, Monopoly, Mouse Trap, Nintendo Entertainment System, <em>Ouija Board</em>, Pong, Risk, Rock 'Em Sock 'Em Robot, Scrabble, Simon, Trivial Pursuit, Twister, Uno.</td>
<td></td>
</tr>
</tbody>
</table>
2.3.1 Segmentation of Toys Market

There are various ways in which the toy market has been segmented. Some of these are:

(i) Gender segmentation

Here, toys are made according to what fits a particular gender. For example, there are toys that are suitable for boys like water guns and cars, while others are suitable for girls like teddy bears and dolls.

(ii) Size segmentation

There are some toys in the market that are quite large and macro in nature. One such example is a house which a child can play in. Then there are some that are small in size.

(iii) Segmentation based on special features

Some toys have something unique in them like those ones that can record, play music or make specific moves while others are simply ordinary and have no special features added on to them.

(iv) Segmentation based on type

There are some toys that are made after influential people in children's lives like cartoon characters (Dexter, Simpsons and Mr. Poodle), pop singers like Britney Spears and Jessica Simpson or action figures like Spiderman and Superman. They are some that are based on animals or things. For example mobile phones, bears, dogs, balls, musical instruments etc. [Articles 2010].

2.4 Traditional Versus Electronic Toys

Good toys are the toys that engage, but the best toys are those that actively engage a child mentally, physically, emotionally, and socially. When it comes to the point of discussion between electronic and traditional toy, hours may go on in discussion. This is debatable. The classic play has a beautiful versatility. At any point children can choose to change the purpose of the toy and in so doing the nature of the play. With traditional toys children are the ones in charge, not the toy. They can choose either to play alone or with others. Moreover, their whole bodies are involved. And also if a child is playing with a traditional block, he or she will learn how to control small muscles and how to coordinate eyes and hands to stack and balance the blocks.
Children can also develop mathematical concepts by sorting the blocks by size and shape and figuring out what number of blocks are needed to fill the space. With traditional toys, a child can also learn fundamental principles of physics, learning to predict cause-and-effect by discovering how high the blocks can be stacked before they fall. With this process child will gain self-control, self-confidence and independence. When building a block castle together, girls and boys are learning to work cooperatively, sharing, taking turns, and interacting as a team.

Another useful feature of traditional toys is that it gives us and our little angel the quality time that one spends with him or her. By playing with one's youngster, one share some moments that will nurture the relationship and also help in teaching the child family values. In contrast to this, spending hours and hours in front of computer games for kids will isolate him from other members of the family.

Coloured traditional toys are helpful in enhancing the visual acuity of a child as well as his sense of touch. Designed to stimulate the brains, these toys are colourful, movable and textured [Circa 2012].

In another example, by pretending in the process to be castle builders or a prince and a princess, a child acquires through imaginative play important social skills that will serve them well later in life. Electronic toys cannot offer all that to our kids. Parents always want best for their little ones. And when it comes to play, allowing him or her to have fun with traditional toys may be good for him/her. Therefore, it is suggested that children should be encouraged to also play with non electronic toys [Stanek 2012].

But because of ever increasing demand of electronic toys in games industry it is necessary to lay emphasis on electronic toys.

Many of the computer games these days are quite challenging, creative and thought-provoking. The electronic toys do require batteries and are chock-full of inviting lights, sounds, and action. They include not only enhanced sounds and flashing lights but also additional features such as pre-recorded tunes, mixer functions and touch screen technology.

An electronic version of traditional board games and memory skill games are also available. Some electric toys include model train and car racing sets, cars, boats and aircraft controlled by infrared remote control handsets, while the latest 'flying toys' can be flown indoors or outside, controlled by an iPhone, Android handset or tablet computer. There are also electric toys incorporating glow-in-the-dark elements, LED
light-up effects and infra-red sensors and controllers. Kits that include light and touch sensors allow children to create various kinds of electronic circuit and build toy intruder alarms, water sensors or metal detectors [Feuilherade 2013].

The electronic toys engage children in their play, and teach all sorts of cognitive skills from counting to singing to identifying shapes and colours to deducing cause and effect.

Electronics are by nature pre-programmed and simply cannot provide the same open-ended play opportunities as traditional toys. For example, a computer-generated block-building exercise may challenge a child to build a particular structure. But how can it replicate the physical and very sensory activity of placing and positioning wood blocks, through experimental trial-and-error, and exploring just how high you can build a tower before it topples over – and then experiencing the sheer delight of the blocks finally crashing to the floor.

2.5 Challenges before Indian Toy Industry

Here are some key challenges in toy industry, in general as given below:

- Due to fickle nature of children, changes in young children population and faster maturity of children, the target market is continuously changing.
- Dependency on foreign toy manufacturers especially for electronic toys.
- Tough competition from electronic entertainment.
- High failure rates of new toys and short life cycle of toys.
- Potential channel conflicts and with major retailers such as Walmart and Target.
- Highly fragmented market with diverse product and brands.

2.5.1 Indian Scenario

With particular reference to India, The following challenges are of importance:

(i) Raw Material Costs

India has always maintained better quality of traditional toys but because of increase in raw material costs, their manufacturing cost is also increasing. This is because majority of traditional toys consists of plastic resins. For plastic resins one of the key components is petroleum, which reached to high price all the time. The continuous rise in petroleum prices will have negative impact on manufacturing costs. Any
further increase in petroleum prices may be a potential disaster for the traditional toy industry.

Another difficulty is Chinese toy maker spends an average of ₹ 35 per kilogram while an Indian manufacturer spends ₹ 65 per kilogram for raw materials [Sehgal 2010].

(ii) Manufacturing Cost

The Indian toy industry today faces stiff competition from toy manufacturers in China or Chinese toys. Chinese toys are available at a fraction of the cost of Indian toys because prices of plastic raw materials in India are higher than China by approximately 25% (₹120/kg in India vs. ₹ 90/kg in China) that leads to higher manufacturing cost of plastic toys.

In addition to that the Indian toy industry manufacturers are facing different kinds of challenges from their clients, for examples, fluctuated forecasting, rigorous quality control, narrowing profit margin and complicated material reimbursement and approval scheme. Those issues are not easy to handle by the manufacturing enterprises and also are unfulfilled requirements from existing major Entrepreneurship Resource Planning (ERP) systems [e-Jing technologies 2012].

(iii) Differential Taxes

Electronic toys are not manufactured in India because Indian toy manufacturers face a major challenge from the differential tax structure on electronic and non-electronic products. In accordance with the present tax structure, government imposes Value-Added Tax (VAT) at 5% on non-electronic toys, while electronic toys attract VAT at a much higher rate of 12.5%. Industry analysts say the differential tax structure has been a stumbling block for domestic players, as electronic toys are more in demand [Basak 2012].

(iv) Changing Consumer Preferences

Nowadays, customers prefer electronic games as compared to traditional games. Because of this changing trend, there is intense competition from electronic toys and this is not beneficial for the traditional game equipment manufacturers.
CHAPTER 3
SECTION A
LITERATURE SURVEY

This chapter presents a review of studies. It is organised into nine (9) sections. The first section discusses studies on use of electronic toys and influence on children, followed by a section on Consumer Behaviour towards Purchase of Electronic Items. The third section compiles studies on Impact of Advertisement on Children, the fourth deals with Selection of Toys and Determining Attributes, the fifth with Toys and Children Development, followed by a section on Toy and Innovation. The last section deals with Toy Manufacture and Cost Optimization. The chapter concludes with an analysis of review of literature and identification of gap.

3.1 Electronic Toys and Influence on Children

It is believed that electronic toys and games are less effective in developing understanding and skills than are artifacts that young children can handle. But some researchers claim that electronic toys produce limited and repetitive interactions that inhibit the healthy play and development of young children. Researchers contend that playing with dolls, trucks, blocks and similar toys encourages children to be the "creators and controllers of their play" and helps "parents play in imaginative give-and-take ways with their infants and toddlers" [Levin and Rosenquest 2001].

Many parents do believe that toys that are considered "old-fashioned" are actually better for children's development than flashier electronic ones. In a 2007 Science Daily article, psychologist Kathy Hirsh-Pasek says that, "Old-fashioned retro toys, such as red rubber balls, simple building blocks, clay and crayons are usually much healthier for children than the electronic educational toys that have fancier boxes and high cost". Electronic toys may be more expensive than the classic rubber ball or wooden stacking cups, but parents want to make sure that their child has ostensibly the best toys and keeps up with the latest in technology so that they do not fall behind their peers. But Hirsh-Pasek explains that the “overarching principle is that children are creative problem-solvers; they’re discoverers; they’re active. Electronic toys tend to dictate the action, whereas child can take charge (and exercise his or her imagination) when the toy in question is more of a blank slate” [Colon 2013].
Electronic toys and games limit the child’s imagination, and may lead to addiction, aggressive behaviour and social isolation.

Researchers have explored whether children who play with electronic toys play less creatively or imaginatively than children who play with more traditional toys — blocks and dolls, paper and crayons — that do not involve electronics. Although there is insufficient research to provide a clear answer, the concerns do not seem to be justified [Bergen 2004], [Plowman et al. 2010]. In one experiment, 6–8 year-old children displayed the same reasoning skills and performed similarly (required the same number of moves for the solution) whether a task was in the form of a board game or a computer game [Ko 2002]. A review [by Russ and Dillon 2011] found no decrease in children’s imagination or creativity in the period 1985-2008. The study found that imagination in play and comfort with play significantly increased over time. There was no evidence of change in organization of the story or in overall expression of affect in play. Among 12-year-old children videogame playing was strongly related to creativity [Jackson et al. 2012]. Even though children have less time to play, cognitive processes that occur in play continue to develop.

In a 2001 study published in "Contemporary Issues in Early Childhood", researchers Diane Levin and Barbara Rosenquest noted that the children they observed interacting with electronic toys engaged in “limited and repetitive” activity. The children also became accustomed to electronic toys and expected all of their playthings to offer electronic amusement. As Levin and Rosenquest note, that when children become used to toys that channel them into acting in a certain way, they begin to expect all toys to tell them what to do and toys that are open-ended can seem boring and uninteresting. This can have a long-term effect on how children play and the kind of learners they become. Their study of children’s interactions with electronic toys “has left us worried, worried enough to conclude that all those involved with promoting the healthy play and development of very young children need to take heed and develop strategies for counteracting the problems that may arise.”

Despite the potential hazards, it needs to be seen as to why so many children are still playing with electronic toys. According to Linda Crowe, an Associate Professor in the School of Family Studies and Human Services at Kansas State University, electronic toys are appealing to adults; they think these are really exciting toys as all do wonderful things. But electronic toys remove the opportunity for social interaction and in many respects may inhibit creativity. The toy provides the fantasy and removes
the opportunity for a child to mentally produce something hypothetical or imagined. Crowe is also concerned about the effect of such toys on children’s brain development. She compares the neurological impact it has on children when they are watching flashing lights and electronic toys as compared old-fashioned play toy. Often the outcome is in the form of shorter attention span. Susan Swanson, who works for the Excellence Learning Corporation and has been an arts educator in Monterey County, California schools, voices similar concerns. According to her, electronic toys do not encourage dramatic play and expresses concern as to what impact it would have on children who are used to having a quick electronic fix and who think things happen at the push of a button. Parents can go to the other extreme too, of course. “I live near Berkeley,” Swanson says with a chuckle, “and you can find stores there where the only toys are those made entirely out of recycled tires or natural fibers.”

Tech toys are here to stay, of course, in large part because anxious parents fear denying their children any novel advantage. According to Crowe parents believe that this is a way for their child to be ready for the academic setting and one cannot blame parents for that. But she encourages parents to limit their children’s use of such toys and to offer more traditional toys (such as building blocks, trains, and dolls) that encourage open-ended, creative play. Children also make their play preferences known, and they are often refreshingly low-tech [Rosen 2007].

A new study by Michaela Woolridge and Jennifer Shapka is the first to examine how electronic toys affect the way mothers and toddlers play together, compared with how they play with traditional, tech-free toys.

Twenty-five highly-educated mothers and their toddlers (average age 20 months) were filmed playing for ten to fifteen minutes with three traditional toys - a board book; the Shape & Sort it toy; and a plastic farm set. And then they were filmed playing for the same length of time with three electronic versions of those kinds of toys - an electronic book, from Touch and Teach Busy Books; the Fisher-Price Cookie Shape Surprise; and the Funderful Roll along Safari plastic toys with flashing lights, music and activating buttons. For half the mother-child pairs, it was the electronic toys that were played with first.

The videos were analysed by two independent coders who were trained to look for important aspects in the way mothers play with toddlers. The results showed that when mums played with a toddler with electronic toys, they were less responsive, less
educational in their play style (for example, providing fewer labels, less often expanding children's words etc), and slightly less encouraging.

In past research, these factors in mother and child playing style have been linked with development taking place late in the child, for example in terms of language development. In the case of the poorer teaching scores when playing with electronic toys, the difference from the conventional toy play time was substantial and could "have very real implications," the researchers said. In contrast, the type of toy - electronic or conventional - made no difference to the ratings of the mothers' warmth whilst playing.

Woolridge and Shapka think that one reason mothers play differently with electronic toys is because they are noisy and so interrupt or deter mothers and children from communicating with each other. Another factor is that mothers seem to tend to try to use the electronic toys in the way they were designed, which put a constrain on their play skills. They showed a lot more creative use of the conventional toys, initiating more make-believe play with them.

Rather than demonising electronic toys, it is worth remembering that electronic toys might well have benefits of their own. Moreover, it might be productive to inform parents how to make the most of the new toy gadgets without completely forsaking their traditional pretend-play skills. As the researchers said - "perhaps parents can ... be taught how to mediate manipulative and interactive products to more positively support their infants' and toddlers' development and learning" [Wooldridge and Shapka 2012].

*The review of literature suggest that electronic toys affect development of children in terms of language development, communication skill, creativity, social skill to name a few.*

3.2 Consumer Behaviour Towards Purchase of Electronic Items

Bashir, in the year 2013 undertook a study entitled 'Consumer Behaviour Towards Online Shopping of Electronics in Pakistan'. According to Kuester (2012), consumer behaviour is the study of individuals, groups or organisations and the processes they use to select, secure and dispose of products, services, experiences, or ideas, to satisfy needs and the impacts that these processes have on the consumer and the society. The objective of the study was to understand consumer behaviour in online shopping of electronic goods especially in Pakistan. Primary data was collected for the purpose
using a questionnaire which was administered by visiting respondents in person as well as by email. The focus was on purchase of electronic products which was picking up fast in Pakistan but not at the pace it was picking up in USA or UK. He concluded that price, time saving and convenience were the major factors identified. He concluded that the major barriers for online shopping were safety issues as the consumers were not willing to share financial and personal information.

Wan (2009) concluded that online shopping reveals three main dimensions in the process of online purchasing. These were human computer interaction (HCI), behavioural and consumerist orientation. Human computer interaction covered design of the website, interaction, easiness to learn, and other issues related to the characteristics of the website. Customer concern in online shopping (CCOS) investigated human behaviour and its attributes that influence online shopping decisions. He concluded that the main concern was trust between the consumer and the online retailer. Under consumer characteristics, consumers' personal traits (that is individual characteristics) such as demographics, personality, his tradition, culture and profile were found to be of paramount importance. Beyond these characteristics, technology awareness, computer literacy, comfort level in online shopping and past experience were also important parameters.

Baji and Sekhar (2013) studied consumer behaviour towards purchase of electronic goods, and concluded that the behaviour pattern of consumers is more or less similar to each other with reference to various parameters like quality, preference, and decision making; but difference was noted with respect to price and the method of distribution used.

Consumer buying behaviour in Consumer Durable Industries was studied by Khatri (2014) in India. The objective of the study was to understand the changing markets and mindsets and identification of the critical success factors for the consumer durables industry with a focus in India. He undertook survey of dealers and also resorted to secondary sources for many information. In his study consumer electronics included TVs, LCD and audio systems while consumer appliances included refrigerator, washing machine, Air Conditioners (ACs), microwave oven, vacuum cleaners, dish washer to name a few. It concluded that immense opportunities existed in the rural markets which could be efficiently tapped, while the urban markets indicated a replacement market. Opportunities existed because of easy availability of finance as well as increase in income level with more disposable income.
Study undertaken by Power Waterhouse Corporation (PWC) revealed that because of the economic downturn majority of household had made a cut in their spending and had also deferred their purchase of household durables (electronics), personal durables (clothing) and indulge (coffee) and services. This was based on a survey of 100 households.

The review of literature above indicates that studies have been conducted in electronic goods but not in electronic toys.

3.3 Impact of Advertisement on Children

Khandai and Agarwal (2012) studied the impact of Television Commercials upon the purchase behavior of urban population with a focus on Indian children. The children's market is a ₹ 5000 crore market (110 million) and forms a very important segment for marketers and advertisers. He undertook the study with the objective of measuring the impact of TV commercial on brand preference and final purchase decision of children's market. The study covered health drinks, fast food and shoes. The methodology adopted was survey method. The study concluded that TV commercials have a large impact on brand preference and purchase behaviour of children. He further concluded that reference group and parental influence had less impact.

The review of literature above indicates that studies have been undertaken with a view to ascertain its impact on children but no study covered toys.

3.4 Selection of Toys and Determining Attributes

Pawlowski and Thomsen study had the objective of ascertaining attributes that influenced selection of toys for parents for children with disabilities. The children formed two groups; those with mental disability only and those with mental as well as physical disabilities. The study was undertaken in Denmark. It focussed on use-benefit of toys and value - benefit of toys. The study was empirical in nature and used interview methodology. The study concluded that there was a difference in motives and values between the two sub groups. For those with only mental disability, family care was the instrumental value while security was the terminal value. For those with mental as well as physical disability, importance was given to capability and economic consciousness. Reference group was found to be of great importance for both groups- parents in the same situation and professionals in the same field. The most important factors was found to be safety and development.
The study suggests that toys do have benefits for children with disabilities.

3.5 Toys and Children Development

Play is a form of exercise that increases co-ordination, flexibility, and precision in movement. Infants and toddlers first explore objects to become familiar with them, and as mastery is achieved, they play with objects in a light hearted way. There has been abundant research to state that play during early childhood is necessary for humans to reach their full potential. Physical features of toys, particularly their novelty and responsiveness to the child's movements, influence interest and duration of play. Toys help develop the ability to sustain attention to objects, events, and tasks. Attention span during play depends almost solely on the type and number of toys available [Moyer and Gilmore 1955].

Research was undertaken by Goldstein (2010) with the objective of determining the relationship of play with mind and body. His research confirmed that children's self initiated play nurtures overall development and not just cognitive development (that is learning to name colours, numbers or shapes). He further concluded that there exists three types of benefit of play-emotional behavioural benefit, social behavioural benefit and physical benefit of play.

Availability of toys in infancy is related to a child's intelligence quotient at three years of age. Bradley (1985) and Elardo et al. (1975) concluded that children with access to a variety of toys were found to reach higher level of intellectual achievement irrespective of sex, race or social class.

Driscoll and Carter (2009) in his study concluded that the availability of toys intended for social play increased social interactivity in disabled children in an inclusive preschool level.

Elkind (2007) and Fisher et al. (2011) studied the relationship between children development and growth into responsible citizens. They concluded that though play was important for the development of children to convert them into responsible citizens, opportunities and encouragement for free play were increasingly limited. Therefore there is a need to re-introduce play into early childhood.

Levine et al. (2011) examined the relationship between children's play with puzzle at an early age and development of spatial skills. He concluded that individual differences in spatial skills emerged prior to pre-school entry.
Goldstein (2012), Brown (2009), Else (2009), Smith (2010) undertook a study to determine the relationship between child’s cognitive ability and sequence of play development. The study was empirical in nature. He concluded that the sequence of play development which extends from solitary exploration to sensorimotor play to pretend play correlates with children’s cognitive abilities.

Fisher (1985) studied the effect of preference for advertised toys on children in different age groups and concluded that it was easier to persuade a 5 year old as compared to a 8 year old to prefer certain toys after having viewed advertisement for these toys. The study adopted an observational technique wherein the responses were noted among different age groups.

Vance et al. (2003) undertook a study using the observation method as a research technique. The objective was to identify the impact particular stereotyped toys have on young children, the complexity of play and how the behaviour may influence child’s cognitive development and to ascertain the toys that would be most appropriate for use in play assessment sessions. They concluded that higher level of play complexity was only manifested when children played with female stereotyped toys.

*The review of literature suggests that playing with toys help in development of children, the more they are exposed to toys greater the development in them.*

3.6 Toys and Innovation

The study was carried by European Competitiveness and Sustainable Industrial Policy (ECSIP) Consortium with the objective of analysing the performance and capacities of Europe toy sector in order to get a clear view of the sector’ competitiveness in a global perspective. The study concluded that as toys have a very short product life cycle and has to compete for children’s preference with other products, innovation is very important. For toy manufacturers, innovation could mean a number of things—new toys with new concept, or functionality, such as interactive toys, new themes or updated concepts. Innovation further relies on two aspects-(i) investment in advertisement as well as (ii) investment in technological research and development (R&D). Therefore, for a company to bring about innovation it has to be willing to invest in innovation and spend money for the innovation to occur.

*The review suggests that innovation is the need of the hour as toys have very small product life cycle and this necessitates financial investment.*
3.7 Toy Manufacture and Cost Optimization

Shaheen and Ahmad (2013) in their study state that cost is a major concern for all manufacturers and also for manufacturers of toys. They illustrate the use of linear programming for optimal resource allocation and produce toys cost effectively. They conclude that if produced cost effectively, it would result in an increase in sale and at the same time become affordable for children of the middleclass families.

Alam (2011) undertook a study with the objective of developing a framework for optimizing design of small, low cost, light weight toy submarine for recreational purpose. His study concludes that Non-dominated Sorting Genetic Algorithms (NSGA-II) and Infeasibility Driven Evolutionary Algorithms (IDEA) could be used for cost optimization.

Yam (2007) undertook a research with the objective of identifying knowledge elements of quality assurance in product design and development process within toy industry. His research helped develop an expert system (called IEDOT) for optimization of toy design and has helped to reduce cost, time for production and improved quality.

Oliver et al. (2007) in their study found that even in the digital age Lego the toy manufacturer could retain a strong hold over the market. But to attain this it has to continuously innovate. Its focus on innovation and commitment to quality was achieved only with total disregard to cost which could not sustain in the long run. Therefore cost control and optimization is a critical issue even for toy manufacturers.

The study concluded that it had to be conscious of cost escalation which was brought about by innovation and therefore a company should focus on cost control on every aspect of the value chain from sourcing to manufacture as well as distribution.

*These studies point to the need to focus on continuous innovation to stay relevant and also to focus on optimizing cost.*

3.8 Analysis of Literature Review

The review of literature above indicates that studies have been conducted in electronic goods but not in electronic toys, studies suggest that use of toys lead to development of children, and suggests that use of toys do have benefits for children. Further studies also indicate that innovation is needed in toys industry as they have very small product life cycle and this necessitates financial investment. These studies also point to the need to optimize cost to make it affordable to the masses.
3.9 Identification of Gap

There is a dearth of study on electronic toys. This study therefore fills the gap. Also it suggests identification of parameters that manufacturer and marketer should keep in mind to optimize the cost of toys.

India is having almost no contribution in manufacturing and designing of electronic toys. Also there is no emphasis on future scope of toys in the market and what type of advanced toys will be preferred by the customers in the near future. In India there is hardly any R & D work going on for innovation and upgrading of toys. The Indian toy industry is at the mercy of technology for the limits it can go to. Therefore, various methods of optimizing cost of toys have been suggested and discussed at length in this research work.
CHAPTER 3
SECTION B
INDIAN TOY INDUSTRY

This section consists of two (2) parts. The first part describes the toy industry in India and competitive scenario. The second part compiles a list of Toy Company in India and also a list of electronic toy manufacturing company in India.

3.10 Toy Industry in India

India has a great potential to increase production of quality toys to satisfy the growing needs of middle and upper class families. The market currently is so underdeveloped that it is difficult to predict the size of the untapped market in India. Marketing inputs are lacking and the trade is still dominated by wholesalers.

The toy industry in India is a recent phenomenon. Till early 1980's Indian toys had not been in a position to expand substantially even in the domestic market. The toy market is currently dominated by small unorganized sector which has a market share of 71%, foreign made toys having market share of 11% and the remaining 18% is occupied by the Indian made branded toys such as LEO or POLO toys etc. Therefore only a small percentage is in the organized sector.

The Indian toy industry is no way comparable to the toy industry in foreign countries. For instance, in USA, every year some 4000 new products are offered by 800 US firms three months before Christmas. In contrast, Indian toy companies offer about 70 products in one year. Indian toys have not been able to compete in the International market because of low quality and low standard of safety.

In recent years the market has been influenced by changing consumer tastes, with children opting for more sophisticated video games and electronic toys. Children are also becoming increasingly accustomed to changing toys more frequently. This means toy and game manufacturers are obliged to introduce new products on a regular basis, and focus on innovation and technological advancements.

Market growth is being fuelled by video, console and computer games. The industry is also benefitting from a growing adult consumer base as this group takes a greater interest in games as a popular leisure pursuit. Industry players are focusing their marketing efforts on older children and adults; small children are no longer the industry’s main target.
The toy market is divided into a variety of sectors; the division being based on age of children and the type of toy. There are different sectors with toys aimed for babies under one year old; children aged 1 to 3 years and pre-school children comprising of 3 to 5 year old. There is yet another sector catering to need of children of school age of 5 years and upwards. Additionally the toy market is broken down into categories of toys. Research has shown that maximum toy purchases (in terms of quantity or number of toys) is for children falling in the age group of 2 to 4 years and maximum toy purchases (in terms of value or money spent) is for children falling in the age of 6 to 8 years. Toys sold in the market to children aged between 9 to 11 years tend to be more sophisticated. Some of these games need access to the Internet and most involve more complex programming. The other feature of this age group is that the ‘buyer’ tends to switch to the child from the parent. This does not mean that the child pays the money; but that the child drives the buying decision, though always subject to the budget and final say of the parent. The current trend in toy sales is towards electronic toys and computer assisted learning. Many of these electronic toys are highly developed to be attractive to children. Sales of traditional toys and games have achieved relatively low growth in the European market over the last 10 years, whereas electronic toys and merchandise from popular films and TV programmes have seen reasonable growth. Merchandise from films and TV programmes are licensed to toy manufacturers or toy retailers that can achieve high short-term profits depending on the licensing arrangement and the volume of sales. However, fashion trends are difficult to predict and toy retailers can be left with large volumes of unsold inventories if the toys are unpopular or less in demand than anticipated. The toy market is highly seasonal and is dominated by the pre-Christmas sales period. Typically, around 30% to 55% of toy sales occur in the fourth quarter of the calendar year (October to December).

It is necessary for the companies which create the designs, (whether the product is a toy, a range of clothing or a computer chip), to ensure that the design is protected by registering the design for Intellectual Property Rights (IPR’s). However, in many instances small changes can be made so that ‘copies’ of the design do not breach the IPR. Legal protection of IPR’s is becoming increasingly important in today’s global markets, where resources are sourced in one area of the world, manufactured into finished products in another area (principally in China and other Asian countries) and then sold in other geographical markets. Most toy retailers procure a range of products
from many different toy companies. There is a wide range of companies, from small to very large multi-national companies, which operate as toy design and distributing companies. These companies design, patent or license the toys and then outsource the manufacture to specialist toy manufacturers. Most toy companies outsource the manufacture of toys. Contracts are usual in the industry and would normally include clauses concerning design quality, delivery schedules and penalties for breach of contract. The toy companies then sell their products to toy retailers. There is also a large discount market for toys where toys of inferior quality are sold. The retail prices in this market are often 50% less than in the conventional markets.

At the toy fairs, buyers may assess and choose which of the new toys may achieve high sales. The toy fairs attract a wide range of exhibitors that are launching new toys, both large listed companies and small companies. The level of sales achieved by many toy companies will often depend on orders generated from buyers attending these international toy fairs. Therefore, it is important that prototype toys and marketing literature is ready in order to meet the requirements of these global buyers at the start of each calendar year [CIMA 2013].

The Indian toys & games market had total revenues of $2.3bn in 2012, representing a Compound Annual Growth Rate (CAGR) of 9.2% between 2008 and 2012. The activity toys segment was the market's most lucrative in 2012, with total revenues of $359.4m, equivalent to 15.9% of the market's overall value. The performance of the market is forecast to decelerate, with an anticipated CAGR of 7.7% for the five-year period 2012 - 2017, which is expected to drive the market to a value of $3.3bn by the end of 2017[Report linker 2013].

3.10.1 Competitive Scenario

There are currently over 1000 toy manufacturers in the country belonging mostly to the unorganized sector. The organized sector consists of four companies who use some brand names for their toys (loosely called modern toys) and market them in metropolitan and large cities. While the unorganized/cottage sector products are usually low priced, their products are mostly sold in small towns and rural areas. The market leaders in the organized sector are Leo toys (16%) promoted by Blow Plast Ltd., followed by polo toys (15%) and new entrants in 1988 being Funskool (India) Ltd., promoted by MRF Ltd., and kid stuff.
These companies prefer to go in foreign collaborations as it obviates the need to design toys on their own for a market whose behaviour is uncertain. The volume of production in most of the units is not large enough to produce economies of scale and so the cost of production is high.

The target market for most of the firms is middle and upper income group. According to a research done by Funskool, most of the toys are for kids in the age group of 2-5 years (31% of sales) with a particular skew towards the male child (60%).

Both Leo and Polo and of late Funskool have brought about certain standardization in the toy industry. Most small manufacturers neither mention the price on the package nor the age group for which it is meant. Leo made up for its initial weakness in its product mix with a tie-up with Mattel, bringing in Barbie Doll for girls and hot Wheels for infants.

The manufacturers from the unorganized sector produce low priced toys but their finish is crude and of poor quality. The producers fulfil two roles:

(i) At the lower price end of the market they cater to the demand of lower income group by providing toys made from recycled plastic or tin.

(ii) At the middle price range the unorganized sector provides cheaper and crude copies of the toys marketed by the big firms.

Ever since the early 1980's the toy industry in India has been flourishing. But no systematic investigation has been done about the market behaviour [Ramanuj Majumdar 1991].

A study on potential categories of toys in Chennai city shows that (38%) of the customers prefer Price and Quality as shown in Table 3.1. Branded toys are preferred as they are non-toxic. Teethers were bought by 35% of the customer in the infant category. Pull-along toys were preferred by 30% of customers in the preschool category. (66%) of the fast moving item in creative category is Clay. In games category 90% of the customers buy Board games. In Board games segment, 52% of the customers prefer Business game. In an outlet majority of the share in sales specifically belonged to Games. Although multiple brands are available most of the market was dominated in sales by local brands and also some of the imported products (like Chinese products) majorly because of low price.

- Vehicle toys such as cars/trucks are preferred by boys. Teddy bear, Barbie, Dolls are preferred by girls. Criss-Cross-Crash from the brand of Hot Wheels
a bridge construction toy which includes cars and road tracks are presently gaining interest in the market.

- Companies can introduce a new range of toys on various categories in the names of Power Rangers, Scooby-doo, Tom and Jerry, Mickey Mouse, Incredible, Batman, Spiderman, Nemo, Cars, Dinosaur, Harry Potter, Zoo Zoo (Vodafone), transformers, the major character names played in television channels and also in the films which are found to be most influential and also loved by children.

- Survey indicates that the new and fast moving toys are the air-filling toys, electronic toys, soft toys, wooden toys, play sets (Doctor Set, Kitchen Set, Train Set, Car Set, Penguin Set etc.)

From the survey, it is found that local brand toys and some imported brands (Chinese) toys contribute more sales due to its cheap price and also contributes more margin to the retail outlets. Branded toys are preferred as they are of high quality and non-toxic. The following categories of toys have more potential in the market (as indicated by the results of survey and also from the literature survey). These were: Infancy – Teethers, Preschool – Pull along, Creative – Clay, Games – Board games, Board games – Business game, Air filling toys – Air sofa, Air tubs. Based on the study, price was found to be the major reason for purchasing toys. Most of the companies have come up with promotional offers as tie-up. A total of 125 respondents were analysed and results are compiled in Table 3.1.

Table 3.1 Shows Influencing Factor for Purchasing [Thariq and Rahman]

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Reason</th>
<th>No. of respondents</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Price</td>
<td>47</td>
<td>38</td>
</tr>
<tr>
<td>2.</td>
<td>Availability</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>3.</td>
<td>Features</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>4.</td>
<td>Style</td>
<td>23</td>
<td>17</td>
</tr>
<tr>
<td>5.</td>
<td>Quality</td>
<td>47</td>
<td>38</td>
</tr>
<tr>
<td>6.</td>
<td>Packaging</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>7.</td>
<td>Total</td>
<td>125</td>
<td>100</td>
</tr>
</tbody>
</table>
3.11 List of Toy Companies in India

After sufficient literature survey it has been found that, in India there are many toy companies which include electronic toy companies as well. Table 3.2 and Table 3.3 shows the details of these companies along with their complete addresses and websites.

Table 3.2 List of Toy Company in India [Indiamart 2014]

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Company name</th>
<th>Address</th>
<th>website</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Suyash Enterprises</td>
<td>Bonsaii, 91 Supreme Center, Iti Road, Aundh, Pune, Maharashtra - 411 007 (India)</td>
<td><a href="http://www.bonsaii.in">http://www.bonsaii.in</a></td>
</tr>
<tr>
<td>2.</td>
<td>Cell Point Communication</td>
<td>No. 107/195, Dr. Besabt Road, Royapettah Chennai, Tamil Nadu - 600 014, India</td>
<td><a href="http://www.bizzduniya.com">http://www.bizzduniya.com</a></td>
</tr>
<tr>
<td>3.</td>
<td>Profit Shopping</td>
<td>103, Ashok Mohalla, Nangloi, New Delhi, Delhi - 110041, India</td>
<td><a href="http://www.profitshopping.in">http://www.profitshopping.in</a></td>
</tr>
<tr>
<td>4.</td>
<td>Rex Fashions</td>
<td>39, Luz Church Road, Mylapore, Chennai, Tamil Nadu - 600004, India</td>
<td><a href="http://www.rexfashions.in">http://www.rexfashions.in</a></td>
</tr>
<tr>
<td>5.</td>
<td>Badshah Tech Toyz</td>
<td>Habib Gargh Road Saharanpur, Uttar Pradesh - 247 001, India</td>
<td><a href="http://www.indiamart.com">http://www.indiamart.com</a></td>
</tr>
<tr>
<td>6.</td>
<td>Aggarwal Enterprises, Delhi</td>
<td>Room No. 302, RG Complex-II, Sector-14, Rohini, Near Prashant Vihar Delhi - 110 085, India</td>
<td><a href="http://www.esuppliersindia.com/aggarwal">www.esuppliersindia.com/aggarwal</a></td>
</tr>
<tr>
<td>S. No.</td>
<td>Company name</td>
<td>Address</td>
<td>website</td>
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<td>11.</td>
<td>United Overseas Limited</td>
<td>229a, Sathyamoorthy Road, Ramanagar, Coimbatore, Tamil Nadu - 641009 (India)</td>
<td><a href="http://www.blazelead.com">http://www.blazelead.com</a></td>
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<tr>
<td>12.</td>
<td>Robin Impex</td>
<td>6 Madvi Plot, Rajkot, Gujarat India</td>
<td><a href="http://www.21food.com">http://www.21food.com</a></td>
</tr>
<tr>
<td>14.</td>
<td>Roboteck</td>
<td>Iamington road, mumbai, Maharashtra - 400007 India</td>
<td><a href="http://www.hudku.com">www.hudku.com</a></td>
</tr>
<tr>
<td>15.</td>
<td>Di Teck Pvt. Ltd.</td>
<td>L-18, KIRTI NAGAR, NEW Delhi 110015 India</td>
<td><a href="http://search.gmdu.net">http://search.gmdu.net</a></td>
</tr>
<tr>
<td>16.</td>
<td>C-com electronics</td>
<td>A-1, Mehendra Park, OPP New Fruit Market. G. T Karnal Road, Delhi - 110033 India</td>
<td></td>
</tr>
<tr>
<td>17.</td>
<td>Toyeez</td>
<td>D-114, Ind Estate, Baikampady, Mangalore, Karnataka - 575 001, India</td>
<td><a href="http://www.asklaila.com">http://www.asklaila.com</a></td>
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<td>18.</td>
<td>Asian Agencies Delhi</td>
<td>2486/1, 2nd Floor, Vidya Nand Market, Teliwara Chowk, Sadar Bazar Delhi - 110 006, India</td>
<td><a href="http://dir.indiamart.com">http://dir.indiamart.com</a></td>
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<tr>
<td>19.</td>
<td>L T Olympia Sports</td>
<td>504, Linking Road, Opp MC Donalds, Khar West Mumbai, Maharashtra - 400 052, India</td>
<td><a href="http://www.indiamart.com">http://www.indiamart.com</a></td>
</tr>
<tr>
<td>21.</td>
<td>Kits N Spares</td>
<td>D 88/5, Okhla Industrial Area, Phase-1, New Delhi, Delhi - 110020, India</td>
<td><a href="http://www.eleb2b.com">http://www.eleb2b.com</a></td>
</tr>
<tr>
<td>S. No.</td>
<td>Company name</td>
<td>Address</td>
<td>website</td>
</tr>
<tr>
<td>-------</td>
<td>-------------------------------------</td>
<td>-------------------------------------------------------------------------</td>
<td>----------------------------------------------</td>
</tr>
<tr>
<td>1.</td>
<td>Toy Zone Impex Pvt. Ltd.</td>
<td>F-1159-F - Phase III, Ind State, Bhiwadi Dist. Alwar, Rajasthan</td>
<td><a href="http://www.toyzone.in/">http://www.toyzone.in/</a></td>
</tr>
<tr>
<td>2.</td>
<td>Hully Gully Games</td>
<td>705, Akik Complex, Opposite Rajpath Club, Near Pakawan Dinning Hall, S  G Road, Bodakdev, Ahmedabad - 380054</td>
<td><a href="http://www.hggames.com">www.hggames.com</a></td>
</tr>
<tr>
<td>5.</td>
<td>Fun2learn.Com</td>
<td>1st cross, Vinaya Marga, Siddarthanagar, Mysore - 570011</td>
<td><a href="http://www.fun2learn.com">www.fun2learn.com</a></td>
</tr>
<tr>
<td>6.</td>
<td>Amrik Singh &amp; Sons</td>
<td>Sadar Bazar, Delhi, Towel Market, Sardar Nagar, Ahmedabad - 382475</td>
<td><a href="http://www.justdial.com/Ahmedabad/Amrik-Singh-Sons">http://www.justdial.com/Ahmedabad/Amrik-Singh-Sons</a></td>
</tr>
</tbody>
</table>
CHAPTER 4
RESEARCH METHODOLOGY

4.1 Introduction
In any research, there are various procedures, schemes and algorithms involved. The method used by a researcher in a research study is known as research method. They are essentially planned, scientific and value-neutral. They include theoretical procedures, experimental studies, numerical schemes, statistical approaches, etc.

A systematic way to solve a problem is known as research methodology. It is actually a science of studying how a research is to be carried out. It may also be defined as the methods by which knowledge is gained. Its aim is to give the work plan of research. This chapter presents the research methodology adopted for the study. This study is mainly focused on cost optimization in manufacturing and marketing of electronic toys. It is divided into thirteen (13) sections. It begins with an introduction that revolves around the theme of research, followed by problem statement. The scope of study, sources of data and research objectives follow. The hypotheses are then listed. The next section details the research design which elaborates on the selection of sample from the target population. The chapter also details the methodology followed for development of the questionnaire and its administration. Tool of analysis are also mentioned. The chapter concludes with a mention of the limitations of the study.

4.2 Problem Statement
Toys when manufactured do not have features (e.g. safety, educational value, instructions to play etc.) desired by the purchaser (be it parents, guardian) and often prices charged are also too high. Therefore, before manufacture if such aspects are identified and communicated to manufacturer, it would increase its appeal and help in the process of manufacture as well as marketing of the toy.

4.3 Scope of Study
Since decades, the advancement of toy has continued to amaze both kids and adults. One of the best types of toys is the electronic ones. These toys not only entertain kids for hours and hours but at the same time they can be entertaining for many grown-ups as well.
The purpose of this study is to optimize the cost of electronic toys in manufacturing and marketing. This is because toys should be made at minimum possible cost to compete in the Indian as well as at the global market. Electronic toys are the most fascinating types of toys for kids of today's world. This is because of their light and sound features.

Each and every kid would like to play with electronic toys having more and more features. Of course, toy with many features will be more expensive and hence many kids from financially weaker section would be deprived from playing with these toys. Therefore, in this study, attempt is made to modify, design and develop some electronic toys which would be cost effective.

After literature review, it has been found that in India there are almost no electronic toy manufacturing companies because of many technical reasons. With the development of new technology there is always ample scope for improvement or modification in conventional toys as well as development of totally new toy. So there is ample scope for developing new specific toy industry in India.

According to new techniques instead of using discrete electronic components a modular approach for a particular type of toy is available. It is very easy to fit in that modular circuit in the body or casing of the toy because that does not involve any expert hand. Therefore even those people who do not have much knowledge of electronics can also do this job. Generally, modular circuits along with simple and easy-to-understand directions are provided by the company. Also for the convenience of the assembler usually, a picture or diagram accompanies each step in the process until the end of the instruction material. Woman can do this work at their own pace and return the completed items for payment. Hence, it is possible that many women sitting at home can be engaged to do this job from their home and at the same time they can look after their children and can do the household work. Women can stay in their comfort zone and do this useful job easily. Therefore, for women there is no need to go out or travel from one place to another. By doing this, their social and economic status can be improved and also assembly of toys can be more cost effective and hence will improve the profit.

In recent years, microchip technology and electronic features in design and development of electronic toys have had a major impact on the toy industry and electronic learning toys have been a major growth category. It is also expected that in near future, demand of electronic toys in Indian market will increase fast. Hence there
is wide scope for new entrepreneurs to venture into this research. Electronic toys will increase their share in the market. Therefore, in this study emphasis is given to electronic toys. Because of taxation policies of government, many manufacturers have stopped manufacturing electronic toys. Value-Added Tax (VAT) charges for electronic toys are much more than on regular toys. Therefore, this study can suggest some tips for reducing the cost of electronic toys in manufacturing and can thus help the manufacturers in optimizing the cost up to some extent. The beneficiaries of this study are the manufacturers of electronic toys. For this study, the experiments have been done on large number of old and new electronic toys. For some of the toys instead of optimizing the cost, suggestion has been made for creating novelty so that more number of children and adults can be attracted and hence marketing can be improved. If demand of any toy in the market is more, mass production of that toy will further reduce the cost and finally fetch more profit to the electronic toy manufacturers.

4.4 Research Objectives

The research objectives of the study are:

1. To identify customers preference for criteria for purchase of toys.
2. To suggest cost optimization using linear programming.
3. To identify the key components and suggest modifications in terms of cost optimization to electronic toy manufacturers.
4. To propose electronic toy manufacture as a viable alternative for women entrepreneurship.

Other subsidiary objectives of this research are as follows:

- To implement and test some cost effective electronic toy circuits.
- To suggest some innovative ideas to make the electronic toy more attractive and appealing in the eyes of children without any change in cost.
- To provide employment opportunities to women entrepreneurs.

The study was conducted in phases. To determine the first objective of research, customer preference for criteria for purchase of toys, a conceptual model was developed; questionnaire designed and administered which has been discussed in sections 4.5 to 4.10.
The second phase consisted of desk research, wherein linear programming was used to optimize the cost in toy manufacture which has been discussed in section 4.11.1. The third phase was experimental method which is detailed in section 4.12. The fourth phase consisted of interview and discussion with entrepreneurs and marketers of toys who employed women for manufacture of toys which is discussed in section 4.13.

4.5 Development of Conceptual Model

A conceptual model has been developed keeping the dimensions in mind. This has been dramatically presented in the following page. Figure 4.1 gives the detailed conceptual model.
Ho15: There is no significant relationship between other aspects of purchase of toys and gender.
Ho16: There is no significant relationship between other aspects of purchase of toys and qualification.
Ho17: There is no significant relationship between motives behind purchase of toys and criteria for selection of toys.
Ho18: There is no significant relationship between motives behind purchase of toys and motivational factor for purchase of toys.
Ho19: There is no significant relationship between motives behind purchase of toys and other aspects of purchasing electronic toys.
Ho20: There is no significant relationship between criteria for selection of toys and motivational factor for purchase.
Ho21: There is no significant relationship between criteria for selection of toys with other aspects of purchasing electronic toys.
Ho22: There is no significant relationship between motivational factor for purchase of toys and other aspects for purchase of electronic toys.

4.7 Research Design
The research is exploratory in nature wherein survey methodology was adopted for the research endeavour.

4.8 Questionnaire Development
Questionnaire poses a structured and standardized set of questions, either to one person or to a small population, or most commonly to respondents in a sample survey. Structure here refers to questions appearing in a consistent, predetermined sequence and form. The sequence may be deliberately scrambled, or else arranged according to a logical flow of topics or question formats. Survey research is a commonly used method of collecting information about a population of interest. There are many different types of surveys, several ways to administer them, and many methods of sampling. There are two key features of survey research i.e. questionnaires and sampling.

For this study a sequential process was followed for the design of questionnaire. Questionnaire is given in Annexure- A.1. First, from earlier studies features were identified which form important criteria for purchase of toys. This was followed by
in-depth interview. In-depth interview was conducted with parents who had children below age of 14 years to identify what they desire the toys to possess. The questionnaire was also pre-tested which reviewed length, format, clarity, usage of words, and a final version was generated with minor modifications and suggested changes being incorporated.

4.8.1 Structure of the Questionnaire

Information for the study was obtained with the help of two methods i.e. questionnaire and experimental methods. Here the questionnaire method has been adopted for collecting and analyzing data. The questionnaire is structured and undisguised. It has a mix of 5-point likert scale, multiple choice and also some open ended questions.

This questionnaire consists of three sections. The first section deals with personal information (demographic profile) of respondents. The second section consists of multiple choice questions to compare the main criteria and sub criteria of toys. The third sections contain some open ended questions to find out the attitude towards buying toys. This section also contains questions in which respondents express their degree of agreement for each of the alternatives.

4.8.2 Content Validity of the Questionnaire

For ensuring content validity the questionnaire was pre-tested with specific groups of parents (working, home makers, academicians, etc.) to ensure that the questions had clarity and were in lines with the objective of research.

4.9 Administration of Questionnaire

Two methods were adopted for administering the questionnaire. The first was contacting in person and second was through email.

Questionnaire was distributed in Aligarh city in the University (to academicians and home makers) in select residential areas of Aligarh. Selection of Departments in University and selection of residential areas was purely based on judgement of researcher. Therefore, methodology adopted was convenience and judgemental. These respondents were contacted personally by the researcher.

Questionnaire was also sent by e-mail to the addresses on the researcher's e-mail list (address book) as well as connections on Linkedin profile. For this, first a list of
addresses of these were made and the questionnaire was sent to all of them. Therefore, the methodology adopted in this case was census sampling.

Reminders in person were made to the respondents. A total of 224 questionnaires were distributed. Finally, 118 filled in questionnaire were received. Out of these only 84 were found to be usable.

The response rate is 70% approximately. A response rate of 25% is considered desirable for survey findings [Yu and Cooper 1983], [Malhotra and Grover 1998].

As per Gupta, minimum sample size required is based on number of question items in the questionnaire.

Minimum sample size required = four times the number of question items [Gupta 2003].

As number of questions in questionnaire used by researcher is 16. Therefore, response rate of 64 is satisfactory.

4.9.1 Target Respondents

The target respondents for any research may be defined as the correct group of people for gathering the right information related to the study. This will help in collecting information which will have dramatic effect on the meaning of the information collected. Mainly, the target respondents for this research work are all those who can purchase toys which includes parents and guardians. But the study restricted to only those parents who have children and guardians who have niece and nephew belonging to the age group of 14 years or less. These target respondents are from different occupations such as Professionals/Business/Home maker/others. In this case, respondents are also having wide range of qualifications which include technical/professional graduate/ non-technical graduate/post graduate/others. Another important variable, annual income is also considered.

4.9.2 Sampling Technique

Sampling technique may be defined as the technique in which a subgroup of the population is selected to answer the survey questions and the information collected can be generalized to the entire population of interest. Sampling has been done for many areas like Aligarh (personal contact), Mirzapur, Kanpur, New Delhi and Lucknow (by mail and also in person).
4.9.3 Sample Size
The main purpose of sampling is to reduce the error with smallest sample size of the population without losing usability as well as increasing the reliability. As per Gupta, minimum sample size required is four times the number of question items in the questionnaire.
As number of questions in questionnaire used by researcher is 16, total number of respondents as per the formula given above should be 64, adhering to the above mentioned thumb rule.

4.9.4 Data Collection Method
For this research work, data has been collected through structured questionnaire method and interview method. For distribution and filling up of questionnaire among the respondents both the ways of filling up in person and leaving the questionnaire with the respondents to be filled up later on have been followed. Also, the instructions for filling up the questionnaire were provided to the respondents.

4.10 Limitations of the Study
1. The study is limited to geographic region of north wherein responses were taken from city of Aligarh, Kanpur, Mirzapur, New Delhi and Lucknow.
2. Period of survey was March 2014 to Sept 2014.
3. Quality of survey is subject to level of cooperation, level of understanding as well as opinion of respondents.

4.11 Tools of Analysis
In this research work, the tools used for analysis are t-test, ANOVA test, and linear programming.

4.11.1 Concept of Linear Programming - A Passage to Cost Optimization
For optimizing the cost of a product in general or electronic toys in particular, there are various approaches which can be applied. These approaches are Genetic Algorithms, Artificial Neural Network, Fuzzy Logic and Linear Programming to name a few. The working principle of this technique is described here.
Every organization faces the problem of allocation of resources. The resources include men, machine, material, capital, information etc. Most of these decisions are
made subject to constraints. For example, production from a factory is limited due to capacity constraints, and an organization faces working capital constraints and technical constraints. If the time span involving a decision is long, then many of these constraints can be avoided by changing resources, adding more capacities, borrowing more funds etc. However, if the available resources cannot be expanded, then optimal utilization of existing resources becomes very important task for the organization.

Linear programming is one of the most versatile, popular and widely used quantitative techniques. A linear programming model offers an efficient method for determining an optimal decision (or an optimal strategy or an optimal plan) chosen from a large number of possible decisions. The optimal decision is one that meets a specified objective or management, subject to various constraints and restriction [Kapoor 2003].

To illustrate, an example is taken wherein Mohan, Mohsin and Murly are three friends Mohan owns a toy machine $M_1$, Mohsin owns a toy machine $M_2$ and Murly owns a toy machine $M_3$. They own their own shop in a technical market.

They applied the concept of synergy, took an industrial shed on rent and installed their machines.

After passage of time they evolved an empirical relationship that they mostly receive two types of toys "A" and "B" respectively. Their machine capacity and number of products produced $X_1$ of type A and $X_2$ of type B are governed by following relation:

\[
\text{Machine } \begin{align*}
M_1 & : X_1 + 2X_2 < 720 & \text{Eq. 4.1} \\
M_2 & : 2X_1 + X_2 < 780 & \text{Eq. 4.2} \\
M_3 & : X_1 < 320 & \text{Eq. 4.3}
\end{align*}
\]

The inspection of these relations show that individual machine can be run in full capacity just by adjusting $X_1$ and $X_2$ in such a manner that satisfy three relations separately.

The inspection of first relation shows that chances of full capacity utilization is more for machine $M_1$ if $X_2$ is produced more as compared to $X_1$. The maximum number of $X_2$ can be produced is 360 and this is possible when production of $X_1$ is nil.

The inspection of second relation shows that $X_1$ should be produced more as compared to $X_2$. The maximum number of $X_1$ can be produced is 390 and this is possible when production of $X_2$ is nil.
The inspection of third relation shows that $X_1$ should be produced up to maximum limit irrespective of $X_2$. The maximum number of $X_1$ can be produced is 320 and has no bearing on the production of $X_2$.

To have a congenial relationship it is obligatory upon the syndicate that every machine owner should get some job. The ideal condition will be that all the machines run at full capacity.

Now it is to be examined that, what is maximum production capacity of a particular product of each machine, only then decision can be taken regarding fixation of number of units produced of product $X_1$ and $X_2$ by any machine as shown in Table 4.1.

<table>
<thead>
<tr>
<th>Maximum Production Capacity Of a Machine</th>
<th>Product $X_1$</th>
<th>Product $X_2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$M_1$</td>
<td>720</td>
<td>360</td>
</tr>
<tr>
<td>$M_2$</td>
<td>390</td>
<td>780</td>
</tr>
<tr>
<td>$M_3$</td>
<td>320</td>
<td>$X_2$ does not need any operation on machine $M_3$</td>
</tr>
</tbody>
</table>

An entrepreneur entered in the market and said that he had capacity to sell as much as all the three could produce. Entrepreneur realizes from his business experience that his profit is guided by the relation:

$Z=60X_1 + 40X_2$

The entrepreneur will adjust the value of $X_1$ and $X_2$ in such a manner that his profit is maximum. Such situation will take place when production of $X_1$ and $X_2$ is at full capacity, as he has said that he has potential to sell any number of units $X_1$ and $X_2$ produced. Thus the problem reduces to adjustment of production $X_1$ and $X_2$.

The approach to the solution is very simple. There are three relations and unknowns are only two. So any two relations will give the value of unknowns but these values have to satisfy the third relation. So the strategy will be: determine the value of $X_1$ and $X_2$ and test these values in third relation. Now two things will happen either the values of $X_1$ and $X_2$ will satisfy the third relation or third relation is violated. If third relation is satisfied then solution will be called a feasible solution for the given set of constraint equation.

If third relation is not satisfied then value of $X_1$ and $X_2$ should be so adjusted that third relation is satisfied.
Since constraint equations are three and unknowns are two i.e. three pairs of simultaneous equations, will be formed. Solution of these equations will give 3 sets of $X_1$ and $X_2$ and all these three sets are to be tested and modified on third relation which was not the part of the pair. The extremum values of $X_1$ and $X_2$ are adopted that will keep all the three machines working.

The graphical representation of the given relations is shown in Figure 4.3, 4.4, 4.5 and 4.6.

![Graphical representation of Eq.4.1](image1)

**Figure 4.2** Graphical representation of Eq.4.1

![Graphical representation of Eq.4.2](image2)

**Figure 4.3** Graphical representation of Eq.4.2

![Graphical representation of Eq.4.3](image3)

**Figure 4.4** Graphical representation of Eq.4.3.

![Extremum solution at point of Intersection](image4)

**Figure 4.5** Extremum solution at point of Intersection

### 4.12 Experimental Methods

Competition is an inherent part of free or capitalistic economy. To compete with the rival, it is obligatory upon the company to modify their product to cause product differentiation and reduce cost by incorporating new technologies and new materials. This study suggests implementation and testing of some low cost electronic toys circuit.
4.12.1 Implementation of Low Cost Electronic Toys Circuit

Inside some low cost electronic toys, especially those toys based on sound, there will be a need of small and cost optimized circuit which can easily be fitted in the casing or body of the toy. If these circuits cannot be customized much by planning and programming, but still these circuits will be cheap, quick to design and easy to cut down to a bare minimum and can easily be embedded in a garment of a toy. Some low cost electronic toy circuits in this work are amplified greeting-card sound circuit, LED with light sensor, infrared toy car motor controller and 7 segment display reference. For implementing each circuit various electronic components are used and circuit is implemented on a piece of Printed Circuit Board (PCB) and then tested for its working. After testing the circuit the total cost involved in its implementation is tabulated and presented.

4.12.1.1 Amplified Greeting-Card Sound Circuit

This sound circuit is implemented for amplifying various sound sources. For example, it can amplify the sound coming from circuits inside the toys that make sound (toy piano, singing greeting cards, recording and playback modules), as well as sound made by generating frequencies by using a microcontroller such as the ATtiny (An ATtiny 8-pin microcontroller which has 5 Input/Output (I/O) pins to create a 7-segment display) or an arduino board (The Arduino is a microcontroller board based on the ATmega168 (datasheet) [kobakant]).

4.12.1.2 LED with Light Sensor

By using light sensor with transistor switch, a circuit can be made in which a “LED that turns on automatically when dark” without bothering with microcontrollers [www.kobakant/ DIY].

4.12.1.3 Infrared Toy Car Motor Controller

This designed circuit of infrared toy car motor controller can be switched ON/OFF with the help of a TV/ video remote control handset operating at 30–40 kHz. A 6V battery is used to energize the circuit. In this circuit IC2 (CD4017) is a decade counter working as a toggle flip-flop, is immediately reset by the power-on reset combination of capacitor C3 (10µF, 16V) and resistor R6 of 100 KΩ. LED1 of red
color is connected to pin 3 (Q0) of IC2 via resistor R5 of 1 KΩ glows to indicate the standby condition. In standby condition, the pin 3 of data output of the integrated infrared receiver/demodulator (SFH505A or TSOP1738) is at a high level (about 5 volts) and transistor T1 (C557B) is ‘OFF’ because in this condition it is reversed biased. The monostable wired around IC1 is inactive in this condition. When any key on the remote control handset is pressed, the output of the IR receiver momentarily transits through low state and transistor T1 conducts. As a result, the monostable is triggered and a short pulse is applied to the clock input (pin 14) of IC2, which takes Q1 output (pin 2) of IC2 high to switch on motor driver transistor T2 (BD139) via base bias resistor R7 of 220Ω and the motor starts rotating continuously and hence car starts running. The function of Resistor R8 of value 1Ω and 1W limits the starting current.

When any key on the handset is depressed again, the monostable is retriggers to reset decade counter IC2 and thus the motor is switched OFF. Standby LED1 glows again [Hareendran 2012].

4.12.1.4 7-Segment Display Reference
This simple counter can be used to count pulses, as the basis for a customer counter (like at the doors of some stores and shopping malls), or for anything else that may be counted. The circuit accepts any TTL (Transistor Transistor Logic) compatible logic signal, and can be expanded easily.

4.12.2 Cost Optimization (Modification/Innovation) in Electronic Toy Design and Development
For any article, generally people search for two values that is aesthetic and functional. The basic idea here is how a specific function can be performed effectively at the lowest possible total cost. This can be achieved by removing unnecessary accessories used in the toys and also by replacing some components of higher capacity by smaller capacity.

Electronic toy design and development requires an innovative approach to produce something ‘magical’ that captures the imagination whilst keeping a firm hand on costs. It often requires a novel approach to using electronic components in ways in which they were not necessarily designed, together with clever and efficient firmware coding. In this research work, 16 old and new electronic toys were considered. By
making slight modification in these toys in such a way that performance will not be affected too much and cost may be reduced marginally.

For three electronic toys, some innovative ideas are suggested in such a way that cost of a toy will remain the same but look of a toy can be enhanced.

4.13 Interview Stage

Multiple interviews were conducted by researcher at exhibition in Aligarh city (which takes place for a period of about a month in the city of Aligarh) with entrepreneur-shop keepers who sell electronic toys and employ women to manufacture the toys with the objectives of seeing it as a viable opportunity for employing women, cutting cost and also manufacturing innovative toys.
CHAPTER 5
DATA ANALYSIS AND INTERPRETATIONS

The study was undertaken in four (4) phases. Phase I covers market survey undertaken and Phase II consists of cost optimization by using linear programming. Phase III covers experiments undertaken by researcher and her team to optimize the cost. Phase III is further divided into three parts. First part is based on implementation and testing of some cost effective circuits used in toys. Second part is based on modification of toys with the objective of reduced cost and third part discusses innovation of toys without any change in their cost. Phase IV consisted of interview with entrepreneurs and toy manufacturers who employed women to assemble toys with the objective of pursuing electronic toy manufacturer as a viable option for women entrepreneurship.

This chapter is therefore organised into four main sections A, B, C and D covering each of the above mentioned phases respectively.

The first section, Section A, presents analysis of data collected from market survey which tested 22 hypotheses.

The second section, Section B, presents analysis undertaken by applying linear programming in order to increase the profit by optimum utilization of resources.

The third section, Section C, presents analysis of outcomes of experiments done on electronic toys in terms of cost. This section contains three (3) parts. Part 1 is about implementation and testing of four cost effective toys. Part 2 suggests some modification in the designing of toys so that cost can be reduced. Part 3 presents some innovative ideas in designing of toys with the same cost.

The fourth section, Section D, presents analysis of Phase IV which refers to result of interview conducted at exhibition.

SECTION A

5.1 Introduction to Hypothesis Testing

This section presents an analysis of the proposed hypotheses using ANOVA and t-tests. In this section, each hypothesis is first listed which is followed by a Table that
shows the result of the administered ANOVA (or t-test, wherever appropriate). This is followed by an inference stating whether the hypothesis is supported or not supported. First, the first set of hypotheses have been analysed and presented. These are hypotheses H01 to H016. This set refers to hypotheses relating the variables with demographic profile like age, gender, occupation, and educational qualification. Thereafter, the second set of hypotheses has been analysed. These are hypotheses H017 to H022. These consider relation between the variables.

H01: There is no significant relationship between motives for purchase of toys and occupation.

Table 5.1 ANOVA Test for Testing Relationship between Motives and Occupation

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Professional/Service</td>
<td>54</td>
<td>3.3222</td>
<td>0.83455</td>
<td>0.175</td>
<td>0.913</td>
</tr>
<tr>
<td>Business</td>
<td>11</td>
<td>3.4364</td>
<td>0.92873</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Home maker</td>
<td>9</td>
<td>3.2667</td>
<td>0.75498</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Any other</td>
<td>10</td>
<td>3.4800</td>
<td>0.67462</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>84</td>
<td>3.3500</td>
<td>0.81070</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 5.1 shows the result of ANOVA test, which is run to test the difference across different occupational group on the dimension of motives for purchase of toys. It has been found that the value of $F = 0.175$ and $\text{Sig} = 0.913$, which is more than 0.05. Hence no difference exists.

Hypothesis H01 is supported (accepted); that is, there is no significant relation between motive for purchase of toys and occupation.

The descriptive statistics of the sample along with the mean values and the standard deviation are presented in Table 5.1. The Table shows the highest mean value was for the business sector at 3.4364 followed by professional/service sector which was at 3.3222 and then by home maker at 3.2667.

H02: There is no significant relationship between motives for purchase of toys and age.
Table 5.2 ANOVA Test for Testing Relationship between Motives and Age

<table>
<thead>
<tr>
<th>Age Group</th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 25 years</td>
<td>12</td>
<td>3.2000</td>
<td>0.42640</td>
<td>0.877</td>
<td>0.456</td>
</tr>
<tr>
<td>25-35 years</td>
<td>29</td>
<td>3.2069</td>
<td>0.92038</td>
<td></td>
<td></td>
</tr>
<tr>
<td>35-45 years</td>
<td>31</td>
<td>3.5097</td>
<td>0.84355</td>
<td></td>
<td></td>
</tr>
<tr>
<td>More than 45 years</td>
<td>12</td>
<td>3.4333</td>
<td>0.72279</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>84</td>
<td>3.3500</td>
<td>0.81070</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 5.2 shows the result of ANOVA test, which is run to test the difference across different age groups on the dimension of motives for purchase of toys. It has been found that the value of $F = 0.877$ and $\text{Sig} = 0.456$, which is more than 0.05. Hence no difference exists.

Hypothesis Ho2 is supported (accepted); that is, there is no significant relation between motive for purchase of toys and age.

The descriptive statistics of the sample along with the mean values and the standard deviation are presented in Table 5.2. The Table shows the highest mean value was for the age group 35-45 years which was at 3.5097 followed by the age bracket more than 45 years which was at 3.4333.

**Ho3: There is no significant relationship between motives for purchase of toys and gender.**

Table 5.3 ANOVA Test for Testing Relationship between Motives and Gender

<table>
<thead>
<tr>
<th>Gender</th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>T</th>
<th>Sig. (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>38</td>
<td>3.4053</td>
<td>0.53924</td>
<td>0.566</td>
<td>0.573</td>
</tr>
<tr>
<td>Female</td>
<td>46</td>
<td>3.3043</td>
<td>0.98409</td>
<td>0.596</td>
<td>0.553</td>
</tr>
</tbody>
</table>

Table 5.3 shows the result of independent sample t test, which is run to test the difference across different gender group on the dimension of motives for purchase of toys. It has been found that the value of $T = 0.566$ and $\text{Sig} = 0.573$, which is more than 0.05. Hence no difference exists.
Hypothesis Ho3 is supported (accepted); that is, there is no significant relation between motive for purchase of toys and gender.

The descriptive statistics of the sample along with the mean values and the standard deviation are presented in Table 5.3. The Table shows the higher mean value was for male which was at 3.4053 while female was close behind with a mean value of 3.3043.

**Ho4: There is no significant relationship between motives for purchase of toys and qualification.**

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technical/Professional Graduate</td>
<td>26</td>
<td>3.3231</td>
<td>0.81403</td>
<td>0.180</td>
<td>0.909</td>
</tr>
<tr>
<td>Non-Technical Graduate</td>
<td>19</td>
<td>3.2632</td>
<td>0.71508</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Post Graduate</td>
<td>27</td>
<td>3.4370</td>
<td>0.89792</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Any Other</td>
<td>12</td>
<td>3.3500</td>
<td>0.82297</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>84</td>
<td>3.3500</td>
<td>0.81070</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 5.4 shows the result of ANOVA test, which is run to test the difference across different qualification group on the dimension of motives for purchase of toys. It has been found that the value of $F = 0.180$ and Sig = 0.909, which is more than 0.05. Hence no difference exists.

Hypothesis Ho4 is supported (accepted); that is, there is no significant relation between criteria for purchase of toys and qualification.

The descriptive statistics of the sample along with the mean values and the standard deviation are presented in Table 5.4. The Table shows the higher mean value was for post graduate which was at 3.4370 followed by non-technical graduate which was at 3.2632.
Ho5: There is no significant relationship between criteria for selection of toys and occupation.

Table 5.5 ANOVA Test for Testing Relationship between Criteria for Selection of Toys and Occupation

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Professional/Service</td>
<td>54</td>
<td>3.3179</td>
<td>0.73278</td>
<td>0.910</td>
<td>0.440</td>
</tr>
<tr>
<td>Business</td>
<td>11</td>
<td>3.6818</td>
<td>0.94120</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Home maker</td>
<td>9</td>
<td>3.4444</td>
<td>0.81223</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Any other</td>
<td>10</td>
<td>3.6000</td>
<td>0.78253</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>84</td>
<td>3.4127</td>
<td>0.77420</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 5.5 shows the result of ANOVA test, which is run to test the difference across different occupational group on the dimension of criteria for selection of toys. It has been found that the value of $F = 0.910$ and $\text{Sig} = 0.440$, which is more than 0.05. Hence no difference exists.

Hypothesis Ho5 is supported (accepted); that is, there is no significant relation between criteria for purchase of toys and occupation.

The descriptive statistics of the sample along with the mean values and the standard deviation are presented in Table 5.5. The Table shows the highest mean value was for the business sector at 3.6818 followed by home maker which was at 3.4444 and then by professional/service sector which was at 3.3179.
Ho6: There is no significant relationship between criteria for selection of toys and age.

Table 5.6 ANOVA Test for Testing Relationship between Criteria for Selection of Toys and Age

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 25 years</td>
<td>12</td>
<td>3.4861</td>
<td>0.69797</td>
<td>1.857</td>
<td>0.144</td>
</tr>
<tr>
<td>25-35 years</td>
<td>29</td>
<td>3.1724</td>
<td>0.86886</td>
<td></td>
<td></td>
</tr>
<tr>
<td>35-45 years</td>
<td>31</td>
<td>3.4785</td>
<td>0.75368</td>
<td></td>
<td></td>
</tr>
<tr>
<td>More than 45 years</td>
<td>12</td>
<td>3.7500</td>
<td>0.51981</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>84</td>
<td>3.4127</td>
<td>0.77420</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 5.6 shows the result of ANOVA test, which is run to test the difference across different age group on the dimension of criteria for selection of toys. It has been found that the value of $F = 1.857$ and Sig = 0.144, which is more than 0.05. Hence no difference exists.

Hypothesis Ho6 is supported (accepted); that is, there is no significant relation between criteria for purchase of toys and occupation.

The descriptive statistics of the sample along with the mean values and the standard deviation are presented in Table 5.6. The Table shows the highest mean value was for the age group 'more than 45 years' which was at 3.7500 followed by age group 'less than 25 years' which was at 3.4861 and between 25-35 years at 3.4785. Mean value for age group 35-45 years is much lower at 3.1724.

Ho7: There is no significant relationship between criteria for selection of toys and gender.

Table 5.7 t- Test for Testing Relationship between Criteria for Selection of Toys and Gender

<table>
<thead>
<tr>
<th>Gender</th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>T</th>
<th>Sig. (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>38</td>
<td>3.5088</td>
<td>0.62234</td>
<td>1.034</td>
<td>0.304</td>
</tr>
<tr>
<td>Female</td>
<td>46</td>
<td>3.3333</td>
<td>0.87911</td>
<td>1.068</td>
<td>0.289</td>
</tr>
</tbody>
</table>
Table 5.7 shows the result of independent sample t-test, which is run to test the difference across different gender group on the dimension of criteria for selection of toys. It has been found that the value of $T = 1.034$ and $\text{Sig} = 0.304$, which is more than 0.05. Hence no difference exists.

Hypothesis Ho7 is supported (accepted); that is, there is no significant relation between criteria for purchase of toys and occupation.

The descriptive statistics of the sample along with the mean values and the standard deviation are presented in Table 5.7. The Table shows the higher mean value was for the group males which was at 3.5088 followed by female at 3.333.

**Ho8: There is no significant relationship between criteria for selection of toys and qualification.**

**Table 5.8 ANOVA Test for Testing Relationship between Criteria for Selection of Toys and Qualification**

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technical/Professional Graduate</td>
<td>26</td>
<td>3.4679</td>
<td>0.87308</td>
<td>0.908</td>
<td>0.441</td>
</tr>
<tr>
<td>Non-Technical Graduate</td>
<td>19</td>
<td>3.1754</td>
<td>0.70814</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Post Graduate</td>
<td>27</td>
<td>3.4383</td>
<td>0.67645</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Any Other</td>
<td>12</td>
<td>3.6111</td>
<td>0.85968</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>84</td>
<td>3.4127</td>
<td>0.77420</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 5.8 shows the result of ANOVA test, which is run to test the difference across different occupational group on the dimension of criteria for selection of toys motives for purchase of toys. It has been found that the value of $F = 0.908$ and $\text{Sig} = 0.441$, which is more than 0.05.

Hence no difference exists.

Hypothesis Ho8 is supported (accepted); that is, there is no significant relation between criteria for purchase of toys and occupation.

The descriptive statistics of the sample along with the mean values and the standard deviation are presented in Table 5.8. The Table shows the highest mean value was for technical/professional graduate which was at 3.4679 followed by post graduate which was at 3.4383 and then by non-technical which is very low at 3.1754.
Ho9: There is no significant relationship between motivational factor for purchase of toys and occupation.

Table 5.9 ANOVA Test for Testing Relationship between Motivational Factor for Purchase of Toys and Occupation

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technical/Professional Graduate</td>
<td>54</td>
<td>3.1852</td>
<td>0.58845</td>
<td>0.465</td>
<td>0.707</td>
</tr>
<tr>
<td>Non-Technical Graduate</td>
<td>11</td>
<td>3.2468</td>
<td>0.81839</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Post Graduate</td>
<td>9</td>
<td>3.4444</td>
<td>0.68677</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Any Other</td>
<td>10</td>
<td>3.2714</td>
<td>0.50147</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>84</td>
<td>3.2313</td>
<td>0.61731</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 5.9 shows the result of ANOVA test, which is run to test the difference across different occupational group on the dimension of motivational factor for purchase of toys. It has been found that the value of $F = 0.465$ and Sig = 0.707, which is more than 0.05. Hence no difference exists.

Hypothesis Ho9 is supported (accepted); that is, there is no significant relation between motivational factor for purchase of toys and occupation.

The descriptive statistics of the sample along with the mean values and the standard deviation are presented in Table 5.9. The Table shows the highest mean value was for the occupation 3.444, followed by 'any other' which was at 3.2468 and closely followed by non-technical graduate which was at 3.2468.

Ho10: There is no significant relationship between motivational factor for purchase of toys and age.

Table 5.10 ANOVA Test for Testing Relationship between Motivational Factor for Purchase of Toys and Age

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 25 years</td>
<td>12</td>
<td>3.2381</td>
<td>0.46124</td>
<td>2.368</td>
<td>0.077</td>
</tr>
<tr>
<td>25-35 years</td>
<td>29</td>
<td>3.0000</td>
<td>0.69463</td>
<td></td>
<td></td>
</tr>
<tr>
<td>35-45 years</td>
<td>31</td>
<td>3.3779</td>
<td>0.56610</td>
<td></td>
<td></td>
</tr>
<tr>
<td>More than 45 years</td>
<td>12</td>
<td>3.4048</td>
<td>0.57089</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>84</td>
<td>3.2313</td>
<td>0.61731</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 5.10 shows the result of ANOVA test, which is run to test the difference across different age groups on the dimension of motivational factor for purchase of toys. It has been found that the value of $F = 2.368$ and $\text{Sig} = 0.077$, which is more than 0.05. Hence no difference exists.

Hypothesis $H_{010}$ is supported (accepted); that is, there is no significant relation between motivational factor for purchase of toys and age. The descriptive statistics of the sample along with the mean values and the standard deviation are presented in Table 5.10. The Table shows the highest mean value was for the age group 35 to 45 years which was at 3.3779 followed by the age bracket more than 45 years which was at 3.4048.

Ho11: There is no significant relationship between motivational factor for purchase of toys and gender.

Table 5.11 t-Test for Testing Relationship between Motivational Factor for Purchase of Toys and Gender

<table>
<thead>
<tr>
<th>Gender</th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>T</th>
<th>Sig. (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>38</td>
<td>3.3308</td>
<td>0.44821</td>
<td>1.350</td>
<td>0.181</td>
</tr>
<tr>
<td>Female</td>
<td>46</td>
<td>3.1491</td>
<td>0.72278</td>
<td>1.409</td>
<td>0.163</td>
</tr>
</tbody>
</table>

Table 5.11 shows the result of independent sample t-test, which is run to test the difference across different gender group on the dimension of motivational factor for purchase of toys. It has been found that the value of $T = 1.350$ and $\text{Sig} = 0.181$, which is more than 0.05. Hence no difference exists.

Hypothesis $H_{011}$ is supported (accepted); that is, there is no significant relation between motive for purchase of toys and occupation.

The descriptive statistics of the sample along with the mean values and the standard deviation are presented in Table 5.11. The Table shows the highest mean value noted was for male which was at 3.3308. The mean value for female was 3.1491.
Ho12: There is no significant relationship between motivational factor for purchase of toys and qualification.

Table 5.12 ANOVA Test for Testing Relationship between Motivational Factor for Purchase of Toys and Qualification

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technical/Professional Graduate</td>
<td>26</td>
<td>3.3407</td>
<td>0.74404</td>
<td>2.285</td>
<td>0.085</td>
</tr>
<tr>
<td>Non-Technical Graduate</td>
<td>19</td>
<td>2.9474</td>
<td>0.41022</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Post Graduate</td>
<td>27</td>
<td>3.2222</td>
<td>0.56913</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Any Other</td>
<td>12</td>
<td>3.4643</td>
<td>0.59098</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>84</td>
<td>3.2313</td>
<td>0.61731</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 5.12 shows the result of ANOVA test, which is run to test the difference across different qualification groups on the dimension of motivational factor for purchase of toys. It has been found that the value of $F = 2.285$ and Sig = 0.085, which is more than 0.05. Hence no difference exists.

Hypothesis Ho12 is supported (accepted); that is, there is no significant relation between motivational factor for purchase of toys and occupation.

The descriptive statistics of the sample along with the mean values and the standard deviation are presented in Table 5.12. The Table shows the highest mean value was for sector 'any other' at 3.4364 followed by technical/professional sector which was at 3.3407. Mean value for post graduate and non-technical graduate were at 3.2222 and 2.9474 respectively.

Ho13: There is no significant relationship between other aspects of purchase of toys and occupation.

Table 5.13 ANOVA Test for Testing Relationship between Other Aspects of Purchase of Toys and Occupation

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technical/Professional Graduate</td>
<td>54</td>
<td>3.2063</td>
<td>0.85429</td>
<td>0.650</td>
<td>0.586</td>
</tr>
<tr>
<td>Non-Technical Graduate</td>
<td>11</td>
<td>3.1818</td>
<td>1.13045</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Post Graduate</td>
<td>9</td>
<td>3.6349</td>
<td>0.83943</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Any Other</td>
<td>10</td>
<td>3.3143</td>
<td>0.75832</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>84</td>
<td>3.2619</td>
<td>0.87667</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 5.13 shows the result of ANOVA test, which is run to test the difference across different occupational group on the dimension of other aspects of purchase of toys. It has been found that the value of $F = 0.650$ and $\text{Sig} = 0.586$, which is more than 0.05. Hence no difference exists.

Hypothesis Ho13 is supported (accepted); that is, there is no significant relation between other aspects of purchase of toys and occupation.

The descriptive statistics of the sample along with the mean values and the standard deviation are presented in Table 5.13. The Table shows the highest mean value was for post graduates at 3.6349 followed by ‘any other’ which was at 3.3143. These were followed by technical/professional and non-technical graduates in that order.

Ho14: There is no significant relationship between other aspects of purchase of toys and age.

Table 5.14 ANOVA Test for Testing Relationship between Other Aspects of Purchase of Toys and Age

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 25 years</td>
<td>12</td>
<td>3.5595</td>
<td>0.66578</td>
<td>1.343</td>
<td>0.266</td>
</tr>
<tr>
<td>25-35 years</td>
<td>29</td>
<td>3.0197</td>
<td>0.87375</td>
<td></td>
<td></td>
</tr>
<tr>
<td>35-45 years</td>
<td>31</td>
<td>3.3548</td>
<td>0.91761</td>
<td></td>
<td></td>
</tr>
<tr>
<td>More than 45 years</td>
<td>12</td>
<td>3.3095</td>
<td>0.91541</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>84</td>
<td>3.2619</td>
<td>0.87667</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 5.14 shows the result of ANOVA test, which is run to test the difference across different age groups on the dimension of other aspects of purchase of toys. It has been found that the value of $F = 1.343$ and $\text{Sig} = 0.266$, which is more than 0.05. Hence no difference exists.

Hypothesis Ho14 is supported (accepted); that is, there is no significant relation between on the dimension of other aspects of purchase of toys and occupation.

The descriptive statistics of the sample along with the mean values and the standard deviation are presented in Table 5.14. The Table shows the highest mean value was for the age group falling under 25 years with mean value of 3.5595. This was followed by the age group falling between 35 to 45 years, more than 45 years and 25 to 35 years wherein the mean values were 3.3548, 3.3095 and 3.0197 respectively.
**Ho15:** There is no significant relationship between other aspects of purchase of toys and gender.

**Table 5.15 t-Test for Testing Relationship between Other Aspects of Purchase of Toys and Gender**

<table>
<thead>
<tr>
<th>Gender</th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>T</th>
<th>Sig. (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>38</td>
<td>3.3083</td>
<td>0.76645</td>
<td>0.438</td>
<td>0.662</td>
</tr>
<tr>
<td>Female</td>
<td>46</td>
<td>3.2236</td>
<td>0.96499</td>
<td>0.448</td>
<td>0.655</td>
</tr>
</tbody>
</table>

Table 5.15 shows the result of independent sample t-test, which is run to test the difference across different gender group on the dimension of other aspects of purchase of toys. It has been found that the value of $T = 0.438$ and $Sig = 0.622$, which is more than 0.05. Hence no difference exists.

Hypothesis Ho15 is supported (accepted); that is, there is no significant relation between the dimension of other aspects of purchase of toys and occupation.

The descriptive statistics of the sample along with the mean values and the standard deviation are presented in Table 5.15. The Table shows the highest mean value was for males at 3.3083. The mean value for females was 3.2236.

**Ho16:** There is no significant relationship between other aspects of purchase of toys and qualification.

**Table 5.16 ANOVA Test for Testing Relationship between Other Aspects of Purchase of Toys and Qualification**

<table>
<thead>
<tr>
<th>Qualification</th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technical/Professional Graduate</td>
<td>26</td>
<td>3.4011</td>
<td>0.90172</td>
<td>0.575</td>
<td>0.633</td>
</tr>
<tr>
<td>Non-Technical Graduate</td>
<td>19</td>
<td>3.0677</td>
<td>0.93115</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Post Graduate</td>
<td>27</td>
<td>3.3016</td>
<td>0.89944</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Any Other</td>
<td>12</td>
<td>3.1786</td>
<td>0.70547</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>84</td>
<td>3.2619</td>
<td>0.87667</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 5.16 shows the result of ANOVA test, which is run to test the difference across different qualification groups on the dimension of other aspects of purchase of toys. It
has been found that the value of $F = 0.575$ and $\text{Sig} = 0.633$, which is more than 0.05. Hence no difference exists.

Hypothesis Ho16 is supported (accepted); that is, there is no significant relation between the dimension of other aspects of purchase of toys and occupation.

The descriptive statistics of the sample along with the mean values and the standard deviation are presented in Table 5.16. The Table shows the highest mean value was for the technical/professional graduate which was at 3.4011 followed by post graduate which was at 3.3016. This was followed by non-technical graduates whose mean value was 3.0677 only.

**Ho17: There is no significant relationship between motives behind purchase of toys and criteria for selection of toys.**

**Table 5.17 Relationship between Motives for Purchase of Toys & Criteria for Selection of Toys**

<table>
<thead>
<tr>
<th></th>
<th>R</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ho17</td>
<td>0.510</td>
<td>0.000</td>
</tr>
</tbody>
</table>

Interpretation: The value of R is 0.510 which shows a very strong and positive correlation between motive behind purchase and criteria for toy selection. The null hypothesis Ho17 is rejected; that is, there exists a significant and positive relationship between motives behind purchase of toys and criteria for selection of toys.

**Ho18: There is no significant relationship between motives behind purchase of toys and motivational factor for purchase of toys.**

**Table 5.18 Relationship between Motives behind Purchase of Toys & Motivational Factor for Purchase of Toys**

<table>
<thead>
<tr>
<th></th>
<th>R</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ho18</td>
<td>0.517</td>
<td>0.000</td>
</tr>
</tbody>
</table>

Interpretation: The value of R is 0.517 which shows a very strong and positive correlation between motive behind purchase and criteria for toy selection. The null hypothesis Ho18 is rejected; that is, there exists a significant and positive relationship between motives behind purchase of toys and motivational factor for purchase of toys.
**Ho19:** There is no significant relationship between motives behind purchase of toys and other aspects of purchasing electronic toys.

**Table 5.19 Relationship between Motives for Purchase of Toys & Other Aspects of Purchasing Electronic Toys**

<table>
<thead>
<tr>
<th></th>
<th>R</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ho19</td>
<td>0.459</td>
<td>0.000</td>
</tr>
</tbody>
</table>

**Interpretation:** The value of R is 0.459 which shows a positive correlation between motives behind purchase and criteria for toy selection. The null hypothesis Ho19 is rejected; that is, there exists a significant and positive relationship between motives behind purchase of toys and other aspects of purchasing electronic toys.

**Ho20:** There is no significant relationship between criteria for selection of toys and motivational factor for purchase.

**Table 5.20 Relationship between Criteria for Selection of Toys & Motivational Factor for Purchase**

<table>
<thead>
<tr>
<th></th>
<th>R</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ho20</td>
<td>0.731</td>
<td>0.000</td>
</tr>
</tbody>
</table>

**Interpretation:** The value of R is 0.731 which shows a very strong and positive correlation between motive behind purchase and criteria for toy selection. The null hypothesis Ho20 is rejected; that is, there exists a significant and positive relationship between criteria for selection of toys and motivational factor for purchase.

**Ho21:** There is no significant relationship between criteria for selection of toys with other aspects of purchasing electronic toys.

**Table 5.21 Relationship between Criteria for Selection of Toys with Other Aspects of Purchasing Electronic Toys**

<table>
<thead>
<tr>
<th></th>
<th>R</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ho21</td>
<td>0.571</td>
<td>0.000</td>
</tr>
</tbody>
</table>

**Interpretation:** The value of R is 0.571 which shows a very strong and positive correlation between motive behind purchase and criteria for toy selection. The null
hypothesis Ho21 is rejected; that is, there exists a significant and positive relationship between criteria for selection of toys with other aspects of purchasing electronic toys.

Ho22: There is no significant relationship between motivational factor for purchase of toys and other aspects for purchase of electronic toys.

Table 5.22 Relationship between motivational factor for purchase of toys & other aspects for purchase of electronic toys

<table>
<thead>
<tr>
<th></th>
<th>R</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ho22</td>
<td>0.577</td>
<td>0.000</td>
</tr>
</tbody>
</table>

Interpretation: The value of R is 0.577 which shows a very strong and positive correlation between motive behind purchase and criteria for toy selection. The null hypothesis Ho22 is rejected; that is, there exists a significant and positive relationship between motivational factor for purchase of toys and other aspects for purchase of electronic toys.

5.1.1 Summary of Hypotheses Testing

This section presents a summary of the results obtained by administering ANOVA and t-tests on the proposed hypotheses. A Table 5.23 has been constructed to present in brief the various hypotheses and its results.
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Hypothesis</th>
<th>F/T</th>
<th>Sig.</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motives &amp; Occupation</td>
<td>Ho1: There is no significant relationship between motives for purchase of toys and occupation.</td>
<td>0.175</td>
<td>0.913</td>
<td>Supported</td>
</tr>
<tr>
<td>Motives &amp; Age</td>
<td>Ho2: There is no significant relationship between motives for purchase of toys and age.</td>
<td>0.877</td>
<td>0.456</td>
<td>Supported</td>
</tr>
<tr>
<td>Motives &amp; Gender</td>
<td>Ho3: There is no significant relationship between motives for purchase of toys and gender.</td>
<td>0.566</td>
<td>0.573</td>
<td>Supported</td>
</tr>
<tr>
<td>Motives &amp; Qualification</td>
<td>Ho4: There is no significant relationship between motives for purchase of toys and qualification.</td>
<td>0.180</td>
<td>0.909</td>
<td>Supported</td>
</tr>
<tr>
<td>Criteria for Selection &amp; Occupation</td>
<td>Ho5: There is no significant relationship between criteria for selection of toys and occupation</td>
<td>0.910</td>
<td>0.440</td>
<td>Supported</td>
</tr>
<tr>
<td>Criteria for Selection &amp; Age</td>
<td>Ho6: There is no significant relationship between criteria for selection of toys and age.</td>
<td>1.857</td>
<td>0.144</td>
<td>Supported</td>
</tr>
<tr>
<td>Criteria for Selection &amp; Gender</td>
<td>Ho7: There is no significant relationship between criteria for selection of toys and gender.</td>
<td>1.034</td>
<td>0.304</td>
<td>Supported</td>
</tr>
<tr>
<td>Criteria for Selection &amp; Qualification</td>
<td>Ho8: There is no significant relationship between criteria for selection of toys and qualification</td>
<td>0.908</td>
<td>0.441</td>
<td>Supported</td>
</tr>
<tr>
<td>Motivational Factor for Purchase &amp; Occupation</td>
<td>Ho9: There is no significant relationship between motivational factor for purchase of toys and occupation</td>
<td>0.465</td>
<td>0.707</td>
<td>Supported</td>
</tr>
<tr>
<td>Motivational Factor for Purchase &amp; Age</td>
<td>Ho10: There is no significant relationship between motivational factor for purchase of toys and age</td>
<td>2.368</td>
<td>0.077</td>
<td>Supported</td>
</tr>
<tr>
<td>Motivational Factor for Purchase &amp; Gender</td>
<td>Ho11: There is no significant relationship between motivational factor for purchase of toys and gender</td>
<td>1.350</td>
<td>0.181</td>
<td>Supported</td>
</tr>
<tr>
<td>Motivational Factor for Purchase &amp; Qualification</td>
<td>Ho12: There is no significant relationship between motivational factor for purchase of toys and qualification</td>
<td>2.285</td>
<td>0.085</td>
<td>Supported</td>
</tr>
<tr>
<td>Parameter</td>
<td>Hypothesis</td>
<td>F/T</td>
<td>Sig.</td>
<td>Results</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>--------------------------------------------------------------------------------------------------</td>
<td>-----</td>
<td>------</td>
<td>----------</td>
</tr>
<tr>
<td>Other Aspects of Purchase &amp; Occupation</td>
<td>Ho13: There is no significant relationship between other aspects of purchase of toys and occupation.</td>
<td>0.650</td>
<td>0.586</td>
<td>Supported</td>
</tr>
<tr>
<td>Other Aspects of Purchase &amp; Age</td>
<td>Ho14: There is no significant relationship between other aspects of purchase of toys and age</td>
<td>1.342</td>
<td>0.266</td>
<td>Supported</td>
</tr>
<tr>
<td>Other Aspects of Purchase &amp; Gender</td>
<td>Ho15: There is no significant relationship between other aspects of purchase of toys and gender</td>
<td>0.438</td>
<td>0.662</td>
<td>Supported</td>
</tr>
<tr>
<td>Other Aspects of Purchase &amp; Occupation</td>
<td>Ho16: There is no significant relationship between other aspects of purchase of toys and qualification</td>
<td>0.575</td>
<td>0.633</td>
<td>Supported</td>
</tr>
</tbody>
</table>

Table 5.24 Summary for hypotheses with variables (R values)

<table>
<thead>
<tr>
<th>Ho</th>
<th>Hypothesis</th>
<th>R</th>
<th>Result</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ho20</td>
<td>There is no significant relationship between criteria for selection of toys and motivational factor for purchase.</td>
<td>0.731</td>
<td>Positive &amp; strong</td>
<td>Rejected</td>
</tr>
<tr>
<td>Ho22</td>
<td>There is no significant relationship between motivational factor for purchase of toys and other aspects for purchase of electronic toys.</td>
<td>0.577</td>
<td>Positive &amp; strong</td>
<td>Rejected</td>
</tr>
<tr>
<td>Ho21</td>
<td>There is no significant relationship between criteria for selection of toys with other aspects of purchasing electronic toys.</td>
<td>0.571</td>
<td>Positive &amp; strong</td>
<td>Rejected</td>
</tr>
<tr>
<td>Ho18</td>
<td>Ho18: There is no significant relationship between motives behind purchase of toys and motivational factor for purchase of toys.</td>
<td>0.517</td>
<td>Positive &amp; strong</td>
<td>Rejected</td>
</tr>
<tr>
<td>Ho17</td>
<td>There is no significant relationship between motives behind purchase of toys and criteria for selection of toys.</td>
<td>0.510</td>
<td>Positive &amp; strong</td>
<td>Rejected</td>
</tr>
<tr>
<td>Ho19</td>
<td>There is no significant relationship between motives behind purchase of toys and other aspects of purchasing electronic toys.</td>
<td>0.459</td>
<td>Positive</td>
<td>Rejected</td>
</tr>
</tbody>
</table>
SECTION B

5.2 Analysis Undertaken By Applying Linear Programming

The second phase of the study is described in this section wherein a technique of linear programming which actually provide a passage to cost optimization is suggested. This technique will maximize the profit in production of toys by optimum use of resources.

For optimizing the cost of electronic toys in any company it is important that allocation of resources which are three machines here namely M₁, M₂ and M₃, should be adjusted in such a way that maximum profit is achieved. This is possible only if machines are utilized to its full capacity i.e. when idle time is zero.

If there are two types of toys “A” and “B” respectively. Their machine capacity and number of products produced are X₁ of type A and X₂ of type B are governed by following relation:

<table>
<thead>
<tr>
<th>Machine</th>
<th>X₁ + 2X₂ &lt; 720</th>
<th>Eq. 5.1</th>
</tr>
</thead>
<tbody>
<tr>
<td>M₁</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M₂</td>
<td>2X₁ + X₂ &lt; 780</td>
<td>Eq. 5.2</td>
</tr>
<tr>
<td>M₃</td>
<td>X₁ &lt; 320</td>
<td>Eq. 5.3</td>
</tr>
</tbody>
</table>

Solution of Equation 5.1 and 5.2 yields

\[
\begin{align*}
X₁ + 2X₂ &= 720 \\
2X₁ + X₂ &= 780 \\
2X₁ + 4X₂ &= 1440 \\
-2X₁ - X₂ &= -780
\end{align*}
\]

\[
\begin{align*}
3X₂ &= 660 \\
X₂ &= 220 \\
X₁ &= 280 \\
X₂ &= 220
\end{align*}
\] (First Set)

In first set X₁ is less than 320 so third constraint/equation is satisfied. Hence, it is feasible solution. And under this condition profit is as given under:

Profit \( Z = 60 \cdot X₁ + 40X₂ \)

\[
= 25600
\]
Now find the value of $X_1$ and $X_2$ with the help of equation 5.2 and 5.3

\[ 2X_1 + X_2 = 780 \]
\[ X_1 = 320 \]

This yields $X_1 = 320 \quad X_2 = 140$ (Second set)

Now test these values on equation 5.1

\[ X_1 + 2X_2 = 720 \]

L H S
\[ 320 + 280 \]
\[ = 600 \]

L H S is less than 720. So first constraint is satisfied and hence it is also a feasible solution

and under this condition profit is as given under:

Profit $Z = 60 \quad X_1 + 40X_2$

\[ = 24800 \]

Now work on equation 5.3 and 5.1

$X_1 = 320$

$X_1 + 2X_2 = 720$

This yields $X_1 = 320 \quad \text{and} \quad X_2 = 200$ (Third set)

Test these values on equation 5.2

\[ 2X_1 + X_2 = 780 \]

This yields L H S
\[ 640 + 200 \]
\[ = 840 \]

L H S is 840 which is more than 780. Thus this solution is not a feasible solution because it violates second constraint.

Now the value of $X_1$ and $X_2$ should be so adjusted that II constraint is satisfied.

These results are summarized as given in Table 5.25.
The Table 5.25 which is for graphical solution, shows that maximum profit of ₹ 25600 is obtained when III constraint is satisfied and hence it is optimal solution.

Now whatever solution is obtained analytically that can also be obtained graphically by superimposing Figure 4.2 & 4.3, Figure 4.3 & 4.4, Figure 4.4 & 4.2. The point of intersection gives an extremum solution as shown in Figure 4.5. Intersection of two lines is a pointer of satisfaction of two constraints.

If all the three constraints intersect at one point i.e. all the constraints have been satisfied this will be the ideal situation.

Every constraint equation divides the first quadrant into two parts one is triangular which can be called intra the line or below the line. Another part is trans the line or across the line. It is just like Trans Gomti, Trans Yamuna, Trans Kathpula. What these lines tell that Solution Point is below this line.

Every line will form a right angle triangle with X and Y axes as base, height and hypotenuse. The hypotenuse is the line of constraint. On joining line of constraint a polygon will be formed and feasible solution will lie inside the polygon which has X and Y axis as two sides and rest of the side will represent constraints. The polygon thus formed having minimum area will contain feasible solution. The co-ordinates of any point falling in this region is a feasible solution. Now the point of vertices will give optimum solution which will maximize the objective function. The set which maximizes the objective function is the optimal solution.

With the advent of computers what is desired is an iterative solution of simultaneous linear equation in the case of linear programming. There is no dearth of iterative methods but this solution does only satisfy the simultaneous equations. But in case of linear programming a solution is needed which maximizes or minimizes the objective function or one can say small and above the simultaneous linear equation one more equation with one more variable (profit, revenue, cost etc.) is given that has to be satisfied and value of this variable is not known before hand.
Up till now it was assumed that machines should be utilized to full capacity i.e. idle time is zero. Now consider a different thought that every machine has idle time represented by $S_1$, $S_2$, $S_3$ then constraint equation reduces to

$$X_1 + 2X_2 + S_1 = 720$$
$$2X_1 + X_2 + S_2 = 780$$
$$X_1 + S_3 = 320$$

Now three more variables have been added. These variables are called slack variables. Values of these slack variables have to be determined at subsequent stages. Now three things will happen with the values of $S_1$, $S_2$, $S_3$.

(i) First possibility if the value of slack variable is positive i.e. machine has spare capacity or has idle time.

(ii) Second possibility if the value of slack variable is zero i.e. machine is running at its full production potential. This is ideal condition for any particular machine.

(iii) Third possibility is value of slack variable is negative i.e. jobs are in waiting and machine hours are short.

In this situation either reduces the number of jobs or increase number of machines. In this particular case number of machines cannot be increased, so it is forced to reduce number of jobs.

Finally there is a search of those values of $X_1$ and $X_2$ which will satisfy constraint equations as well as maximize the objective function $Z$.

Since equations are linear so solution is not very tedious.

Since computer lacks wisdom and common sense most of the time. So it is necessary to develop a system on the basis of which computer can do the work. Computer is very happy with iterative work. Therefore iterative method should be developed. The first step in this direction is to write inequality in the form of equality equation. This can be done by adding variables $S_1$, $S_2$ and $S_3$ on LHS from the pocket.

$$Z = 60X_1 + 40X_2$$

$$X_1 + 2X_2 + S_1 = 720 \quad \text{Eq. 5.4}$$
$$2X_1 + X_2 + S_2 = 780 \quad \text{Eq. 5.5}$$
$$X_1 + S_3 = 320 \quad \text{Eq. 5.6}$$

On inspection of these equations if one unit of $X_1$ and $X_2$ are to be produced simultaneously then resource needed are $S_1$ three units, $S_2$ three units and $S_3$ one unit and in turn will yield ₹ 100 as profit.

These constraints/equations can be written in matrix form as given in Table 5.26.
Table 5.26 Constraints/Equations in Matrix Form

<table>
<thead>
<tr>
<th>Profit per unit</th>
<th>Basic variables</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>C₀</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>S₁</td>
<td>720</td>
</tr>
<tr>
<td>0</td>
<td>S₂</td>
<td>780</td>
</tr>
<tr>
<td>0</td>
<td>S₃</td>
<td>320</td>
</tr>
</tbody>
</table>

C₀ stands for profit or cost coefficient of basic variables.
First of all try a trivial solution i.e. X₁ and X₂ both equal to zero. It will give

S₁ = 720  
S₂ = 780  
S₃ = 320

Profit is always nil when there is no production i.e. X₁ = 0 and X₂ = 0
I.e. all resources are idle.

Now solution is to be developed in such a manner that gives a combination of minimum value of S₁, S₂, S₃ and in turn will maximize the value of objective function Z.
In this way a matrix of 5 by 3 of coefficients has been formed. In this problem numbers of unknowns are five and numbers of equations are three. So value of at least two variables is to be supplied from the pocket. Such variables are called assigned variable.
The matrix can be written in a different form as given in Table 5.27

Table 5.27 Matrix of Coefficients

<table>
<thead>
<tr>
<th>Z</th>
<th>60</th>
<th>40</th>
<th>0</th>
<th>0</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>X₁</td>
<td>X₂</td>
<td>S₁</td>
<td>S₂</td>
<td>S₃</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

Now analyze 1st column of newly formed table, moving from top to bottom
First term 60 denotes if one unit of X₁ is produced that will give a profit of ₹60 to the entrepreneur.
The second term is X₁ it simply tells about product which is under consideration
The third term is 1 it tells if one unit of $X_1$ is produced it will consume one unit of resource $S_1$.

The fourth term is 2 it tells if one unit of $X_1$ is produced it will consume two units of resource $S_2$.

The fifth term is 1 it tells one unit of production of $X_1$ will consume 1 unit of $S_3$.

In the same manner rest of the column can be interpreted.

Now to begin with consider a situation of no production, this will yield value of $S_1$, $S_2$, $S_3$, as 720, 780, and 320 respectively. Such situation is not desirable as it gives no profit. So production has to be done for the survival of the unit.

The inspection of objective function clearly tells production of $X_1$ yields more profit than $X_2$. Now first step of attack strategy will be to determine maximum production capacity of the unit as a whole. Naturally this value will be minima of the maxima produced by individual machine. To obtain this value take production of $X_1$ as nil.

Production of $X_1$ by first machine $\quad 720/1 = 720$

Production of $X_1$ by second machine $\quad 780/2 = 390$

Production of $X_1$ by third machine $\quad 320/1 = 320$

So least of 720, 390, 320 is 320

Now what will happen if 320 numbers of $X_1$ is produced.

$X_1 = 320$

$X_2 = 0$

$S_1 = 400$

$S_2 = 140$

$S_3 = 0$

The above information can be presented in tabular form (Table 5.28)
Table 5.28 Situation of No Production

<table>
<thead>
<tr>
<th>C_B</th>
<th>Basic Variables</th>
<th>Solution Values</th>
<th>x_1</th>
<th>x_2</th>
<th>S_1</th>
<th>S_2</th>
<th>S_3</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>S_1</td>
<td>720</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>S_2</td>
<td>780</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>S_3</td>
<td>320</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

Net Evaluation (or index) Row: \( C_j - Z_j \)

Since production of \( X_1 \) gives more profit so produce \( X_1 \) first.

Now by manipulating equations 5.4, 5.5, and 5.6 following equations can be obtained

By manipulating Eq. 5.4 and Eq. 5.6

\[ 0X_1 + 2X_2 + 1S_1 + 0S_2 - 1S_3 = 400 \]

By manipulating Eq. 5.5 and Eq. 5.6

\[ 0X_1 + 1X_2 + 0S_1 + 1S_2 - 2S_3 = 140 \]

Equation 5.6 is retained as it is

\[ 1X_1 + 0X_2 + 0S_1 + 0S_2 + 1S_3 = 320 \]

These results have been summarized as given in Table 5.29

Table 5.29 Situation of Production when Profit is \( \text{₹} \) 19200

<table>
<thead>
<tr>
<th>C_B</th>
<th>Basic Variables</th>
<th>Solution Values</th>
<th>x_1</th>
<th>x_2</th>
<th>S_1</th>
<th>S_2</th>
<th>S_3</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>S_1</td>
<td>400</td>
<td>0</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>-1</td>
</tr>
<tr>
<td>0</td>
<td>S_2</td>
<td>140</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>-2</td>
</tr>
<tr>
<td>60</td>
<td>X_1</td>
<td>320</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

Net Evaluation (or index) Row: \( C_j - Z_j \)

Now inspection of Table 5.29 shows that profit has improved from nil to \( \text{₹} \) 19200.

Now it is clear that resource \( S_1 \) and \( S_2 \) are available for production.
$S_1$ resource is available 200 number of product $X_2$ while $S_2$ resource is available for 140 numbers $X_2$. So maximum quantity of $X_2$ can be produced is only 140. $X_1$ is already being produced to its full capacity.

Now this situation can be stated as under

$X_1 = 320$

$X_2 = 140$

$S_1 = 120$

$S_2 = 0$

$S_3 = 0$

Profit $Z = 24800$

So profit has improved from ₹ 19200 to ₹ 24800. So this strategy is better than previous one. This situation of production can be written in tabular form as given in Table 5.30

<table>
<thead>
<tr>
<th>Cj</th>
<th>60</th>
<th>40</th>
<th>0</th>
<th>0</th>
<th>0</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>$C_B$</td>
<td>Basic Variables</td>
<td>Solution Values $b(=X_B)$</td>
<td>$x_1$</td>
<td>$x_2$</td>
<td>$S_1$</td>
<td>$S_2$</td>
</tr>
<tr>
<td>0</td>
<td>$S_1$</td>
<td>120</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>-2</td>
</tr>
<tr>
<td>40</td>
<td>$X_2$</td>
<td>140</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>60</td>
<td>$X_1$</td>
<td>320</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Zj</td>
<td>24800</td>
<td>60</td>
<td>40</td>
<td>0</td>
<td>4</td>
<td>-2</td>
</tr>
</tbody>
</table>

Net Evaluation (or index) Row:

$C_j - Z_j$

| Cj  | 0  | 0  | 0  | -4 | 2 |

The inspection of Table 5.30 shows still resource $S_1$ of 120 unit is available for production.

Now exploit this resource to full extent i.e. Make $S_1 = 0$

This row will yield the relation

$S_1 - 2S_2 + 3S_3 = 120$

Now examine the position of resource of $S_3$. Dividing the above relation by 3 we get

$1/3S_1 - 2/3S_2 + S_3 = 40$

In the state of production resource $S_1$, $S_2$, $S_3$ are connected with relation

$1/3S_1 - 2/3S_2 + S_3 = 40$
If $S_1$ and $S_2$ are fully exhausted i.e. $S_1=0$ and $S_2=0$, then $S_3 = 40$.

This shows that 40 units of $S_3$ resource will be left unused.

Now solve first constraint (Eq. 5.4) and second constraint (Eq. 5.5) after putting $S_1$ and $S_2$ equal to zero

\[ X_1 + 2X_2 + S_1 = 720 \]

\[ 2X_1 + X_2 + S_2 = 780 \]

\[ X_1 + 2X_2 = 720 \]

\[ 2X_1 + X_2 = 780 \]

This relation yields

\[ X_1 = 280 \]

\[ X_2 = 220 \]

Putting these results in third constraint (Eq. 5.6)

\[ X_1 + S_3 = 320 \]

\[ S_3 = 40 \]

Now the whole exercise can be summarized in tabular form as given in Table 5.31

<table>
<thead>
<tr>
<th>$C_B$</th>
<th>Basic Variables $B$</th>
<th>Solution Values $b(X_B)$</th>
<th>$x_1$</th>
<th>$x_2$</th>
<th>$S_1$</th>
<th>$S_2$</th>
<th>$S_3$</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>$S_3$</td>
<td>40</td>
<td>0</td>
<td>0</td>
<td>1/3</td>
<td>-2/3</td>
<td>1</td>
</tr>
<tr>
<td>40</td>
<td>$X_2$</td>
<td>220</td>
<td>0</td>
<td>1</td>
<td>2/3</td>
<td>-1/3</td>
<td>0</td>
</tr>
<tr>
<td>60</td>
<td>$X_1$</td>
<td>280</td>
<td>1</td>
<td>0</td>
<td>-1/3</td>
<td>2/3</td>
<td>0</td>
</tr>
<tr>
<td>$Z_j$</td>
<td></td>
<td>25600</td>
<td>6</td>
<td>4</td>
<td>2/3</td>
<td>8/3</td>
<td>0</td>
</tr>
</tbody>
</table>

| Net Evaluation (or index) Row: $C_j - Z_j$ | 0 | 0 | -2/3 | -8/3 | 0 |

Table 5.31 Situation of Production when Profit is ₹ 25600

In $C_j-Z_j$ row coefficient if the variables are either zero or negative this clearly shows that profit has been maximized.

If still, the profit has to be maximized then, enhance resource $S_1$ and $S_2$ as long as 40 units of idle $S_3$ resource is exhausted. The final profit equation is

\[ Z = 60X_1 + 40X_2 + 20/3S_1 + 80/3S_2 \]

needs discussion
The slack variable part tells that if $S_1$ is increased by 3 units and $S_2$ is also increased by 3 units, then enhancement in profit will be ₹100 which is true. In this situation the constraint equations will be

\[ X_1 + 2X_2 + S_1 = 723 \]
\[ 2X_1 + X_2 + S_2 = 783 \]
\[ X_1 + S_3 = 320 \]

Now optimal solution will be $X_1 = 281$, $X_2 = 221$ and $S_3 = 39$

The basis of solution is critical resources should be exhausted simultaneously i.e. if $S_1$ is increased by one unit then the constraint equations will be

\[ X_1 + 2X_2 + S_1 = 721 \]
\[ 2X_1 + X_2 + S_2 = 780 \]
\[ X_1 + S_3 = 320 \]

These yields

\[ X_1 + X_2 = 1501/3 \] while $S_1$ and $S_2$ are Zero

\[ X_1 - X_2 = 59 \]

This yields value of $X_1$ as $(279 + 2/3)$ which is less than 280 by 1/3 i.e. a loss of ₹20.

Now the value of $X_1$ is $(220 + 2/3)$ which is more than 220 by 2/3 i.e. a profit of ₹80/3

So overall effect will be

₹80/3 -20 = 20/3 (Profit)

This result is same as indicated by the equation

\[ Z = 60X_1 + 40X_2 + 20/3S_1 + 80/3S_2 \]

This 20/3 is very much coefficient of $X_1$ i.e. effect of enhancement of one unit of $S_1$.

In same way effect of enhancement of one unit of $S_2$ on overall profit can be obtained that will amount a profit of ₹80/3.

\[ X_1 + 2X_2 + S_1 = 720 \]
\[ 2X_1 + X_2 + S_2 = 781 \]
\[ X_1 + S_3 = 320 \]

Full utilization of resource $S_1$ and $S_2$ yields

\[ X_1 + X_2 = 1501/3 \] While $S_1$ and $S_2$ are zero

\[ X_1 - X_2 = 61 \]

This yields $X_1 = 280 + 2/3$ which is more than 280 by 2/3 units or a profit of ₹40

And $X_2 = 219 + 2/3$ which is less than 220 by 1/3 units or a loss of ₹40/3 now the overall effect will be

40-40/3 = 80/3 (profit) which is the coefficient of $S_2$ in final profit equation
\[ Z = 60X_1 + 40X_2 + 20/3S_1 + 80/3S_2 \]

So in this equation coefficients of \( S_1 \) and \( S_2 \) are called Shadow Profit Coefficients.

As that gives shadow of one unit of resources on the overall profit.

At last the feasible and optimal solution of given problem is

Product A i.e. \( X_1 = 280 \) Units

Product B i.e. \( X_2 = 220 \) Units

Resource Left \( S_3 = 40 \) Hours

Resource \( S_1 = 0 \)

Resource \( S_2 = 0 \)

In this situation maximum profit is ₹25600. So this is the best strategy.

So \( S_1 \) and \( S_2 \) are the critical resources any disruption in machine \( M_1 \) and \( M_2 \) will have direct bearing on the profit.

### 5.2.1 Summary of Analysis of Linear Programming

<table>
<thead>
<tr>
<th>S.NO.</th>
<th>Product produced ( X_1 )</th>
<th>Product produced ( X_2 )</th>
<th>Remaining resource ( S_1 )</th>
<th>Remaining resource ( S_2 )</th>
<th>Remaining resource ( S_3 )</th>
<th>Profit in rupees (₹)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>320 Units</td>
<td>0 Units</td>
<td>400 Units</td>
<td>140 Units</td>
<td>0 Units</td>
<td>₹19200</td>
</tr>
<tr>
<td>2.</td>
<td>320 Units</td>
<td>140 Units</td>
<td>120 Units</td>
<td>0 Units</td>
<td>0 Units</td>
<td>₹24800</td>
</tr>
<tr>
<td>3.</td>
<td>280 Units</td>
<td>220 Units</td>
<td>0 Units</td>
<td>0 Units</td>
<td>40 Units</td>
<td>₹25600</td>
</tr>
</tbody>
</table>

### 5.2.2 Conclusion of Linear Programming

Here by applying the technique of linear programming, the resources are adjusted in such a way that maximum profit in production of toys under given constraints can be achieved. It can be concluded from the Table 5.25 that maximum profit of ₹25600 is obtained in production of toys when III constraint or equation is satisfied, and hence it is feasible and optimal solution. This is a graphical solution.

The Table 5.32 shows that maximum profit of ₹25600 is obtained when production of \( X_1 = 280 \) units, \( X_2 = 220 \) units and resources \( S_1 \) and \( S_2 \) are fully exhausted but \( S_3 = 40 \) (meaning 40 units of \( S_3 \) resource will be left unused). Therefore, it can be concluded that this is the best strategy under given constraints and hence maximum profit in production of toys can be achieved. This solution is mathematical solution and can
easily be computed by the computers. Further improvement in optimal solution can be obtained as long as difference between old profit and new profit is a negative value. Thus the technique of linear programming suggests the ways of reducing the production cost by maximizing the utilization of fixed resources and optimizing the use of variable resources like material and capital with the ultimate aim to increase the profit of the organization. When total production is enhanced then per unit cost falls and it will enhance the profit and entrepreneur will try to increase the production as long as marginal cost is equal to marginal revenue.

SECTION C

Outcomes of Experiments Done on Electronic Toys in Terms of Cost

PART 1

5.3 Implementation and Testing of Some Cost Effective Electronic Toy Circuits
In this section, four different cost effective circuits that can be used in electronic toys are implemented and tested. These circuits are Amplified Greeting-Card Sound Circuit, LED with Light Sensor, Infrared Toy Car Motor Controller and 7 Segment Display Reference. The total estimated cost involved in the implementation of these circuits are also tabulated and presented.

5.3.1 Amplified Greeting-Card Sound Circuit
However, this circuit is small and low cost but capable of amplifying the audio coming from our laptop, computer, or mp3 player. Figure 5.1(a) shows the circuit diagram for amplified greeting card sound circuit and Figure 5.1(b) shows its implementation. For implementation of this circuit, list of items required with their specifications are shown in Table 5.33.
Figure 5.1(a) Circuit Diagram for Amplified Greeting-Card Sound Circuit

Figure 5.1(b) Implementation of Amplified Greeting-Card Sound Circuit By Reseacher
Table 5.33 Specifications of Items Required

<table>
<thead>
<tr>
<th>S. NO.</th>
<th>Items</th>
<th>Specifications</th>
<th>Qty.</th>
<th>Cost in INR (₹)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Capacitor</td>
<td>0.1μF</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>2.</td>
<td>Transistor</td>
<td>Tip122/ BD139</td>
<td>1</td>
<td>20</td>
</tr>
<tr>
<td>3.</td>
<td>Speaker</td>
<td>8 Ω, 2 watts</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>4.</td>
<td>Battery</td>
<td>9V</td>
<td>1</td>
<td>15</td>
</tr>
<tr>
<td>5.</td>
<td>Push to on switch</td>
<td></td>
<td>1</td>
<td>3</td>
</tr>
</tbody>
</table>

Total Cost Approx.= 50

After implementation of circuit for Amplified Greeting-Card Sound it can be concluded that cost involved in this circuit is approximately ₹ 45 - ₹ 50. The variation in the cost is because of variation in the prices of the electronic components used.

5.3.2 LED with Light Sensor

For implementation of light sensor the components with following specifications are required as given in Table 5.34. Figure 5.2 (a) shows the circuit diagram for light sensor and Figure 5.2 (b) shows its implementation.

Table 5.34 Specifications of Items Required

<table>
<thead>
<tr>
<th>S. NO.</th>
<th>Items</th>
<th>Specifications</th>
<th>Qty.</th>
<th>Cost in INR (₹)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>LDR</td>
<td></td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>2.</td>
<td>Bright light LED</td>
<td>Any colour</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>3.</td>
<td>Transistor</td>
<td>BC548</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>4.</td>
<td>Preset</td>
<td>1MΩ</td>
<td>1</td>
<td>3</td>
</tr>
</tbody>
</table>

Total Cost Approx.= 12
Cost involved in implementation of LED with light sensor is approximately ₹ 12 - ₹ 15.

5.3.3 Infrared Toy Car Motor Controller
This circuit is implemented on a general purpose printed circuit board. Once the circuit is ready it may be enclosed inside the toy car and supply wires may be connected to the battery of the toy car with correct polarity. Rewire the DC motor connections and fix the (Infra Red) IR receiver module in a suitable location, for
example, behind the front glass, and connect its wires to the circuit board using a short 3-core ribbon cable/shielded wire. Figure 5.3 (a) shows the circuit diagram for Infrared toy car motor controller and Figure 5.3 (b) shows its implementation.

Table 5.35 Specifications of Items Required

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Items</th>
<th>Qty.</th>
<th>Specifications</th>
<th>Cost in INR (₹)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>IC1</td>
<td>1</td>
<td>CD4047</td>
<td>25</td>
</tr>
<tr>
<td>2.</td>
<td>IC2</td>
<td>1</td>
<td>CD4017</td>
<td>20</td>
</tr>
<tr>
<td>3.</td>
<td>IR RXR (IC)</td>
<td>1</td>
<td>SFH 505A /TSOP 1738 (Receiver/Demodulator)</td>
<td>18</td>
</tr>
<tr>
<td>4.</td>
<td>T1 Transistor</td>
<td>1</td>
<td>BC557</td>
<td>3</td>
</tr>
<tr>
<td>5.</td>
<td>T2 Transistor</td>
<td>1</td>
<td>BD139</td>
<td>10</td>
</tr>
<tr>
<td>6.</td>
<td>D1 Diode</td>
<td>1</td>
<td>IN4148</td>
<td>3</td>
</tr>
<tr>
<td>7.</td>
<td>D2 Diode</td>
<td>1</td>
<td>IN4007</td>
<td>2</td>
</tr>
<tr>
<td>8.</td>
<td>LED1 (Red)</td>
<td>1</td>
<td>Standby condition</td>
<td>2</td>
</tr>
<tr>
<td>9.</td>
<td>R1 Resistor</td>
<td>1</td>
<td>100 Ω</td>
<td>1</td>
</tr>
<tr>
<td>10.</td>
<td>R2&amp;R5 Resistor</td>
<td>2</td>
<td>1 KΩ</td>
<td>1</td>
</tr>
<tr>
<td>11.</td>
<td>R3 Resistor</td>
<td>1</td>
<td>2.2 KΩ</td>
<td>1</td>
</tr>
<tr>
<td>12.</td>
<td>R4</td>
<td>1</td>
<td>1MΩ</td>
<td>1</td>
</tr>
<tr>
<td>13.</td>
<td>R6</td>
<td>1</td>
<td>100 KΩ</td>
<td>1</td>
</tr>
<tr>
<td>14.</td>
<td>R7</td>
<td>1</td>
<td>220 Ω</td>
<td>1</td>
</tr>
<tr>
<td>15.</td>
<td>R8</td>
<td>1</td>
<td>1 Ω, 1W</td>
<td>1</td>
</tr>
<tr>
<td>16.</td>
<td>C1,C4, C7 Capacitor</td>
<td>3</td>
<td>100 µF, 16V</td>
<td>15</td>
</tr>
<tr>
<td>17.</td>
<td>C2,C5, C6 Capacitor</td>
<td>3</td>
<td>100 nF</td>
<td>6</td>
</tr>
<tr>
<td>18.</td>
<td>C3 Capacitor</td>
<td>1</td>
<td>10µF, 16V</td>
<td>4</td>
</tr>
<tr>
<td>19.</td>
<td>ON-Off Switch</td>
<td>1</td>
<td></td>
<td>5</td>
</tr>
</tbody>
</table>

Total Cost Approx.= 120
Figure 5.3 (a) Schematic Diagram for Infrared Toy Car Motor Controller

Source: http://www.electronicsfort.com

[Hareendran 2012]

Figure 5.3 (b) Implementation of Infrared Toy Car Motor Controller by Researcher
At the right hand of the circuit in Figure 6.19, +6V supply has to be applied but for practically at 6V oscillations are occurring therefore, only 5V supply is applied for testing the circuit. Apart from this, the same circuit is also tested for switching ON and OFF of 100W bulb, night bulb and fan which can be connected in place of motor M. For switching ON and OFF of any remote in the range of 30-40 KHz frequency range can be used. For testing purposes the remote control of TV is used as a transmitter. In place of sensor IR RXR TSOP 1738 is used in the circuit. Table 5.35 gives the details for implementation of Infrared toy car motor controller.

It can be estimated that cost involved in implementation of Infrared toy car motor controller is approximately ₹ 100 to ₹ 120. This cost does not include the cost of power supply section. For testing purposes, DC supply of lab is used in testing of this circuit.

5.3.4 7 Segment Display Reference

Table 5.36 gives the details of items required for implementation of 7 Segment display reference circuit.

<table>
<thead>
<tr>
<th>S. NO.</th>
<th>Items</th>
<th>Qty.</th>
<th>Description</th>
<th>Cost in INR (₹)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>R1-R7</td>
<td>7</td>
<td>470 Ohms ¾ Watt resistor</td>
<td>7 (1₹ each)</td>
</tr>
<tr>
<td>2.</td>
<td>U1</td>
<td>1</td>
<td>74LS90 TTLBCD Counter IC</td>
<td>20</td>
</tr>
<tr>
<td>3.</td>
<td>U2</td>
<td>1</td>
<td>74LS47 TTL Seven Segment Display Driver IC</td>
<td>20</td>
</tr>
<tr>
<td>4.</td>
<td>D1SP1</td>
<td>1</td>
<td>Common Anode 7 Segment LED Display LT 542</td>
<td>15</td>
</tr>
<tr>
<td>6.</td>
<td>Resistor</td>
<td>1</td>
<td>2.2 KΩ</td>
<td>1</td>
</tr>
<tr>
<td>7.</td>
<td>ON/Off switch</td>
<td>1</td>
<td></td>
<td>10</td>
</tr>
<tr>
<td>8.</td>
<td>Step down transformer</td>
<td>1</td>
<td>6-0-6 / 500 mA</td>
<td>32</td>
</tr>
<tr>
<td>9.</td>
<td>Capacitor</td>
<td>1</td>
<td>2200 µF, 16 V</td>
<td>10</td>
</tr>
<tr>
<td>10.</td>
<td>Capacitor</td>
<td>1</td>
<td>0.1 µF</td>
<td>2</td>
</tr>
<tr>
<td>11.</td>
<td>Diode</td>
<td>2</td>
<td>IN 4007</td>
<td>2(1₹ each)</td>
</tr>
</tbody>
</table>

**Total Cost Approx. = 119**
For implementation of this circuit it is important that all pulses to be counted are to be (Transistor Transistor Logic) TTL compatible. They should not exceed 5V and not fall below ground. One can also add more digits by building a second (or third, or fourth, etc.) circuit and connecting the pin 11-6 junction of the 74LS90 and 74LS47 to pin 14 of the 74LS90 in the other circuit. One can keep expanding this way to as many digits as we want. Figure 5.4 (a) shows the Schematic diagram for 7 Segment display reference [Aaroncake.net].

Figure 5.4 (a) Schematic Diagram for 7 Segment Display Reference

Figure 5.4 (b) Implementation of 7 Segment Display Reference by Researcher
This circuit is implemented for general purpose counting and not for counting customers at doors of stores that is why Light Dependent Resistor (LDR) is not used here. This circuit may be used in many educational toys for counting and learning numbers.

By using items required in Table 5.36, a 7 Segment display reference circuit has been implemented for which total cost which includes DC power supply is approximately ₹100 - ₹125.

Total cost for circuit of 7-segment may further be reduced by ₹7 if small push to ON switch is used in place of common ON-OFF switch. But this will affect the performance in terms of counting. Figure 5.4(b) shows the implementation of 7 Segment display reference by researcher.

For implementation of all the above circuits cost for signal source or input and DC power supply, wires, socket and boards is not included unless mentioned and emphasis is only on estimation of total cost of electronic components of each circuit is considered.

5.3.5 Conclusions of Cost Effective Electronic Toy Circuit

For this work all the considered prices for calculation of cost are as per unit item and retail prices have been considered.

The wholesale prices of above components used in implementation of the circuits would be much cheaper and hence cost may further be reduced.

SECTION C

Outcomes of Experiments Done on Electronic Toys in Terms of Cost

PART 2

5.4 Modification in Designing of Electronic Toys (Cost Optimized)

This section presents outcomes of experiments done by the researcher and her team members, on toys in terms of cost. There were total of 16 electronic toys which were selected randomly by the researcher. These were Walkie-Talkie, Military Car Set, Electronic Sword, Laser Stick, Laser Sound Gun, Musical Monkey, Handy Video Game, Cartoon Phone, RC Police Petrol Car, RC Aeroplane, Laptop (Intellective
Computer), Magic Super Voice Song, Fantastic Puppy, Lovely Doll, Air plane (Super Power) and Lions Wild Animal.

Researcher has dismantled the said toys and suggested some modifications either in the internal circuitry of the toy or in external features of the toy.

All these electronic toys are analysed depending upon the toy circuitry, and redesigned with the objective of reducing cost while keeping the performance constant (that is performance of the toy would not be affected).

List of all these toys and their images for which modification has been done is described below. Change in design of toys brought about and the resultant decrease in cost is also indicated against each component in their respective tables.

### 5.4.1 Summary of Modification of Electronic Toys (Cost Optimized)

**Table 5.37 Walkie-Talkie: Ages 3 & Up**

<table>
<thead>
<tr>
<th>S.NO.</th>
<th>Present circuit component</th>
<th>Possible modification</th>
<th>Cost before modification</th>
<th>Cost after modification</th>
<th>Remarks on modified circuit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>100 μF, 16V, electrolytic capacitor</td>
<td>100 μF, 12V electrolytic capacitor</td>
<td>₹ 1.50</td>
<td>₹ 1.25</td>
<td>Low working voltage capacitor will have slightly low cost. No difference in the performance of circuit.</td>
</tr>
<tr>
<td>2.</td>
<td>Bulk inductor (Brown Colour)</td>
<td>It's length and core can be reduced</td>
<td>₹ 5</td>
<td>₹ 4</td>
<td>Cost of plastic and core can be reduced.</td>
</tr>
<tr>
<td>3.</td>
<td>Speaker of 8Ω, 0.25 Watts</td>
<td>Speaker of 4Ω, 0.25 Watts</td>
<td>₹ 10</td>
<td>₹ 8</td>
<td>Because of low impedance cost will be reduced.</td>
</tr>
</tbody>
</table>
Figure 5.5 Walkie-Talkie

The outer plastic casing of this toy is broken during handling therefore the image of its only internal circuitry is shown in Figure 5.5.

<table>
<thead>
<tr>
<th>S. NO.</th>
<th>Present circuit component</th>
<th>Possible modification</th>
<th>Cost before modification</th>
<th>Cost after modification</th>
<th>Remarks on modified circuit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Red bulb</td>
<td>LED and one resistance of 22 ohms</td>
<td>₹ 1</td>
<td>80P and 10P for LED and resistor respectively. 90P</td>
<td>More reliable, more light, less power consumption</td>
</tr>
<tr>
<td>2.</td>
<td>Wheel coupling</td>
<td>Chain or string pulley</td>
<td>₹ 10</td>
<td>₹ 9</td>
<td>Better and durable coupling</td>
</tr>
</tbody>
</table>
Table 5.39 Electronic Sword: Ages 3 & Up

<table>
<thead>
<tr>
<th>S. NO.</th>
<th>Present circuit component</th>
<th>Possible modification</th>
<th>Cost before modification</th>
<th>Cost after modification</th>
<th>Remarks on modified circuit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Speaker of 8Ω, 0.25 Watts</td>
<td>Speaker of 4Ω, 0.25 Watts</td>
<td>₹ 10</td>
<td>₹ 8</td>
<td>Because of low impedance cost can be reduced.</td>
</tr>
<tr>
<td>2.</td>
<td>2 LEDs</td>
<td>Only one LED can be used</td>
<td>₹ 1.60 (80P per LED)</td>
<td>₹ 80P</td>
<td>Power saving and cost saving</td>
</tr>
<tr>
<td>3.</td>
<td>3 lithium batteries of 1.5 V</td>
<td>2 lithium batteries of 1.5 V</td>
<td>₹ 15 (₹ 5 for each battery)</td>
<td>₹ 10</td>
<td>Marginal difference in sound</td>
</tr>
</tbody>
</table>
**Figure 5.7 Electronic Sword**

**Table 5.40 Laser Stick: Ages 3 & Up**

<table>
<thead>
<tr>
<th>S. NO.</th>
<th>Present circuit component</th>
<th>Possible modification</th>
<th>Cost before modification</th>
<th>Cost after modification</th>
<th>Remarks on modified circuit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>DIP switch</td>
<td>Mechanical switch</td>
<td>≈₹ 1</td>
<td>≈₹ 1</td>
<td>No change</td>
</tr>
<tr>
<td>S. NO.</td>
<td>Present circuit component</td>
<td>Possible modification</td>
<td>Cost before modification</td>
<td>Cost after modification</td>
<td>Remarks on modified circuit</td>
</tr>
<tr>
<td>-------</td>
<td>---------------------------</td>
<td>--------------------------------------------</td>
<td>--------------------------</td>
<td>------------------------</td>
<td>-----------------------------</td>
</tr>
<tr>
<td>1.</td>
<td>Speaker of 8Ω, 4 Watts</td>
<td>Speaker of 4Ω, 2 Watts</td>
<td>≈ ₹ 16</td>
<td>≈ ₹ 11</td>
<td>Because of low impedance cost can be reduced.</td>
</tr>
<tr>
<td>2.</td>
<td>Blue bulb and the plastic cover around it</td>
<td>Bulb is replaced by LED and one resistance of 22 ohms. plastic cover can also be reduced</td>
<td>For bulb cost is ≈ ₹ 1 Plastic cost is not estimated.</td>
<td>80P and 10 P for LED and resistor respectively. ≈ 90P Cost could not be estimated for plastic cover.</td>
<td>More focused illumination and more durability</td>
</tr>
</tbody>
</table>

Figure 5.9 Laser Sound Gun
<table>
<thead>
<tr>
<th>S. NO.</th>
<th>Present circuit component</th>
<th>Possible modification</th>
<th>Cost before modification</th>
<th>Cost after modification</th>
<th>Remarks on modified circuit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>2 LED of armpit and one LED of monkey nose</td>
<td>Can be replaced with a single LED</td>
<td>₹ 2.40 (80P per LED)</td>
<td>₹ 80P</td>
<td>Cost saving</td>
</tr>
<tr>
<td>2.</td>
<td>3 &quot;AA&quot; batteries of 1.5V</td>
<td>Can be replaced by 9V battery or a 6V battery can also be used</td>
<td>₹ 15 (₹ 5 for each battery)</td>
<td>₹ 10 (for 9V) ₹ 7 (for 7V)</td>
<td>Replacement of battery may be either with 9V or 6V. Use of 6V battery would be more cost effective and its size is smaller than 9V. This modification is more durable in comparison to &quot;AA&quot; local batteries.</td>
</tr>
</tbody>
</table>

Figure 5.10 Musical Monkey
Table 5.43 Handy Video Game: Ages 3 & Above

<table>
<thead>
<tr>
<th>S. NO.</th>
<th>Present circuit component</th>
<th>Possible modification</th>
<th>Cost before modification</th>
<th>Cost after modification</th>
<th>Remarks on modified circuit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Large body of toy</td>
<td>More compact at least in length</td>
<td>Not estimated</td>
<td>Not estimated</td>
<td>Material cost of plastic can be minimized</td>
</tr>
</tbody>
</table>

Figure 5.11 Handy Video Game

Table 5.44 Cartoon Phone: Ages 3 & Above

<table>
<thead>
<tr>
<th>S. NO.</th>
<th>Present circuit component</th>
<th>Possible modification</th>
<th>Cost before modification</th>
<th>Cost after modification</th>
<th>Remarks on modified circuit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Speaker of 8Ω, 0.25 Watts</td>
<td>Speaker of 4Ω, 0.25 Watts</td>
<td>≈ ₹ 10</td>
<td>≈ ₹ 8</td>
<td>Because of low impedance cost can be reduced.</td>
</tr>
<tr>
<td>2.</td>
<td>3 batteries of &quot;AA&quot; size 1.5 V</td>
<td>Replaced by 9V or 6V battery</td>
<td>≈ ₹ 15 (₹ 5 for each battery)</td>
<td>≈ ₹ 10 (For 9V) ≈ ₹ 7 (For 6V battery)</td>
<td>This modification is cost saving and more durable in comparison to &quot;AA&quot; local batteries.</td>
</tr>
</tbody>
</table>
Figure 5.12 Cartoon Phone

Table 5.45 RC Police Petrol Car: Ages 3 & Above

<table>
<thead>
<tr>
<th>S. NO.</th>
<th>Present circuit component</th>
<th>Possible modification</th>
<th>Cost before modification</th>
<th>Cost after modification</th>
<th>Remarks on modified circuit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Blue and red light on roof</td>
<td>Replaced by blue and red LEDs.</td>
<td>₹ 2</td>
<td>≈ ₹ 1.80 (80P per LED + 10P for per resistor of 22 Ohms)</td>
<td>Enhanced look and more realistic and attractive.</td>
</tr>
</tbody>
</table>

Figure 5.13 RC Police Petrol Car
Table 5.46 RC Aero Plane: Ages 3 & Above

<table>
<thead>
<tr>
<th>S. NO.</th>
<th>Present circuit component</th>
<th>Possible modification</th>
<th>Cost before modification</th>
<th>Cost after modification</th>
<th>Remarks on modified circuit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Red Bulb</td>
<td>Red LED and one resistance of 22 ohms</td>
<td>₹ 1</td>
<td>Red LED 80P and 10 P for resistor of 22ohms ≈ 90P</td>
<td>High illumination, light of any eye catching color can be obtained, less power consumption, long life.</td>
</tr>
</tbody>
</table>

Figure 5.14 RC Aero Plane
<table>
<thead>
<tr>
<th>S. NO.</th>
<th>Present circuit component</th>
<th>Possible modification</th>
<th>Cost before modification</th>
<th>Cost after modification</th>
<th>Remarks on modified circuit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>3 batteries of &quot;AA&quot; size 1.5 V</td>
<td>Point for adapter can be created Or chargeable battery may be used.</td>
<td>₹ 15 (₹ 5 for each battery)</td>
<td>₹ 35</td>
<td>Very economical game by reducing the consumption of battery. This modification is cost effective in long run.</td>
</tr>
</tbody>
</table>

Figure 5.15 Laptop (Intellective Computer)
Table 5.48 Magic Super Voice Song: Ages 3 & Above

<table>
<thead>
<tr>
<th>S. NO.</th>
<th>Present circuit component</th>
<th>Possible modification</th>
<th>Cost before modification</th>
<th>Cost after modification</th>
<th>Remarks on modified circuit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>2 head phone jacks</td>
<td>Replaced by one jack</td>
<td>≈ ₹ 20 (₹ 10 for each jack)</td>
<td>≈ ₹ 10</td>
<td>Reduced cost</td>
</tr>
<tr>
<td>2.</td>
<td>LED</td>
<td>No significant use of LED and hence can be eliminated</td>
<td>≈ 80P</td>
<td>Saving of ≈ 80P</td>
<td>Reduced cost</td>
</tr>
<tr>
<td>3.</td>
<td>Circuit (PCB)</td>
<td>Can be modular</td>
<td>Not estimated</td>
<td>Not estimated</td>
<td>Mass production and hence reduced cost, reduced space and easy in troubleshooting.</td>
</tr>
<tr>
<td>4.</td>
<td>High power speaker of 8Ω &amp; 4W</td>
<td>Can be replaced by low impedance and power speaker without any compromise in quality of sound</td>
<td>≈ ₹ 16</td>
<td>≈ ₹ 11 Depending upon how low are the values, cost may be reduced from ≈ Rs 5 to Rs 8</td>
<td>Cost effective because of Because of low impedance.</td>
</tr>
<tr>
<td>5.</td>
<td>3 batteries of &quot;AA&quot; size 1.5 V</td>
<td>Replaced by 9V or 6V battery</td>
<td>≈ ₹ 15 (₹ 5 for each battery)</td>
<td>≈ ₹ 10 (For 9V)</td>
<td>This modification is cost saving and more durable in comparison to &quot;AA&quot; local batteries.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>≈ ₹ 7 (For 6V battery)</td>
<td></td>
</tr>
</tbody>
</table>
Figure 5.16 Magic Super Voice Song

Table 5.49 Lovely Doll: Ages Above 3 Years

<table>
<thead>
<tr>
<th>S. NO.</th>
<th>Present circuit component</th>
<th>Possible modification</th>
<th>Cost before modification</th>
<th>Cost after modification</th>
<th>Remarks on modified circuit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>3 batteries of &quot;AA&quot; size 1.5 V</td>
<td>can be replaced by Two batteries only</td>
<td>≈ $15 (₹ 5 for each battery)</td>
<td>≈ ₹ 10</td>
<td>No effect on movement of legs and quality of sound. Cost may further be reduced because minimum pin contacts and use of spring would be need to fit this battery.</td>
</tr>
</tbody>
</table>
**Figure 5.17 Lovely Doll**

**Table 5.50  Fantastic Puppy: Ages Above 3 Years**

<table>
<thead>
<tr>
<th>S. NO.</th>
<th>Present circuit components</th>
<th>Possible modification</th>
<th>Cost before modification</th>
<th>Cost after modification</th>
<th>Remarks on modified circuit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Puppys voice</td>
<td>Sound circuit that creates the barking sound can be modified</td>
<td>Not estimated</td>
<td>Not estimated</td>
<td>To make it More realistic and enjoyable</td>
</tr>
<tr>
<td>2.</td>
<td>2 “AA” batteries of 1.5 V</td>
<td>Can be replaced by Two chargeable batteries</td>
<td>( \approx \text{₹} \ 10 ) (( \text{₹} \ 5 ) for each battery)</td>
<td>( \approx \text{₹} \ 30 ) (( \text{₹} \ 15 ) for each battery)</td>
<td>Will reduce the operational cost in long run</td>
</tr>
<tr>
<td>S. NO.</td>
<td>Present circuit component</td>
<td>Possible modification</td>
<td>Cost before modification</td>
<td>Cost after modification</td>
<td>Remarks on modified circuit</td>
</tr>
<tr>
<td>--------</td>
<td>---------------------------</td>
<td>-----------------------</td>
<td>--------------------------</td>
<td>------------------------</td>
<td>-----------------------------</td>
</tr>
<tr>
<td>1.</td>
<td>Red and blue bulb in front of wings</td>
<td>Replaced by red and blue LEDs</td>
<td>≈₹ 2</td>
<td>≈₹ 1.80 (80P per LED + 10P for per resistor of 22 Ohms)</td>
<td>Small space, high durability and high illumination for the same voltage</td>
</tr>
<tr>
<td>2.</td>
<td>High power speaker (8Ω &amp; 4W)</td>
<td>Replace by low power and low impedance speaker</td>
<td>≈₹ 16</td>
<td>≈₹ 11</td>
<td>Depending upon how low are the values, cost may be reduced from ≈₹ 5 to ≈₹ 8</td>
</tr>
<tr>
<td>3.</td>
<td>ON-OFF electronic switch</td>
<td>Replace by simple mechanical switch</td>
<td>≈₹ 3</td>
<td>≈₹ 2</td>
<td>High durability and low cost</td>
</tr>
<tr>
<td>4.</td>
<td>3 &quot;AA&quot; batteries of 1.5 V</td>
<td>can be replaced by one 9V battery</td>
<td>≈₹ 15 (₹ 5 for each battery)</td>
<td>≈₹ 10</td>
<td>low cost, minimum pin contacts and use of spring.</td>
</tr>
</tbody>
</table>

Table 5.51 Air plane (Super Power): Ages Above 3 Years
Figure 5.19 Air Plane (Super power)

Table 5.52 Lions Wild Animal: Ages Above 3 Years

<table>
<thead>
<tr>
<th>S. NO.</th>
<th>Present circuit component</th>
<th>Possible modification</th>
<th>Cost before modification</th>
<th>Cost after modification</th>
<th>Remarks on modified circuit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Mouth bulb</td>
<td>LED and one resistance of 22 ohms</td>
<td>≈ ₹ 1</td>
<td>80P and 10 P for LED and resistor respectively. ≈ 90</td>
<td>Low cost and low power consumption</td>
</tr>
</tbody>
</table>
5.4.2 Conclusion of Modification of Electronic Toys (Cost Optimized)

For these toys, it is suggested that by replacing components or by redesigning circuits its cost can effectively reduced. Also, for some of the toys, it is suggested that the size may further be reduced which will also lead to reduction in cost. It can be concluded that by making these modifications in the toys, reduction in operational cost will be achieved which will work as a catalyst for winning the tender in a very competitive toy industry. This concept of reduced cost will also help in tremendous increase in sales and hence more profit.
SECTION C

Outcomes of Experiments Done on Electronic Toys in Terms of Cost

PART 3

5.5 Innovation of Electronic Toys with Same Cost

In this section of the research work, three of the electronic toys for which cost optimization has already been suggested in section C, part 2, there are some suggested innovative ideas which will further improve its look and will be more eye catching for kids. Hence such toys will make the child happier.

For these electronic toys innovation with no change in cost has been suggested so that a toy can be made more appealing, attractive and at the same time its cost will remain the same. These toys were Musical Monkey, Lovely Doll and Lions Wild Animal.

List of all these toys for which innovation has been done is described below. Change in design of toys brought about and their respective remarks on the modified circuit are given in Tables below.

5.5.1 Summary of Innovation of Electronic Toys with Same Cost

Table 5.53  Musical Monkey: Ages 3 & Up

<table>
<thead>
<tr>
<th>S. NO.</th>
<th>Present circuit component</th>
<th>Possible modification</th>
<th>Cost before modification</th>
<th>Cost after modification</th>
<th>Remarks on modified circuit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Motion of arm and motion of toy is straight</td>
<td>Motion of monkey can be made in zig-zag by changing the orientation of shaft</td>
<td>Not estimated</td>
<td>No difference in cost after making this modification</td>
<td>More appealing and attractive to kids</td>
</tr>
</tbody>
</table>
Table 5.54  Lovely Doll: Ages Above 3 Years

<table>
<thead>
<tr>
<th>S. NO.</th>
<th>Present circuit component</th>
<th>Possible modification</th>
<th>Cost before modification</th>
<th>Cost after modification</th>
<th>Remarks on modified circuit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Hands of doll are stable</td>
<td>Movement of hands can also be made and it can be synchronized with legs</td>
<td>Not estimated</td>
<td>Cost will remain the same</td>
<td>For this modification no additional motor will be required and hence there is no change in cost but its appearance will improve</td>
</tr>
</tbody>
</table>

Table 5.55  Lions Wild Animal: Ages Above 3 Years

<table>
<thead>
<tr>
<th>S. NO.</th>
<th>Present circuit component</th>
<th>Possible modification</th>
<th>Cost before modification</th>
<th>Cost after modification</th>
<th>Remarks on modified circuit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Position of speaker</td>
<td>Can be behind or inside the lions mouth</td>
<td>Not estimated</td>
<td>No change in cost</td>
<td>so that when it opens or closes the mouth variation in the intensity of sound may be noticed and can provide much better effect of sound</td>
</tr>
</tbody>
</table>

5.5.2 Conclusion of Innovation of Electronic Toys with Same Cost

Some innovative and novel ideas in modifying the above electronic toys are suggested. By making minor modifications (as suggested), toy will be more attractive, eye catching and appealing for kids which can make the child more happy.
By implementing these ideas in the suggested electronic toys will appeal more to parents and children and hence the popularity and demand of these will drastically increase in the market. Because of the high demand of attracting and appealing electronic toys in the market their marketing will be high and hence with the help of mass production of these toys cost may further be reduced.

SECTION D
Analysis of Interview

5.6 Report on Survey of Aligarh Exhibition
Multiple interviews were conducted by researcher at exhibition in Aligarh city (which takes place for a period of a month in the city of Aligarh) with entrepreneur-shop keepers who sell electronic toys and employ women to manufacture the toys. The basic objective of employing women is to make it a viable opportunity for promoting entrepreneurial activity among women.

In-depth interviews were conducted in Aligarh exhibition on a one-on-one basis with some of the shopkeepers and on the basis of information gathered in the process of interview and discussion that followed, it can be concluded that in most of the shops the popular electronic toys were Car, Motorcycle, Aeroplane, RC Helicopter, Stuff Toys, Electronic Gun, Piano, Guitar, Joseph Cyril Bamford (JCB) Machine (Crane), Horse, Camel, Lion, And Elephant, Laptop And Mobile. Interview with each of these shopkeeper-owners was unstructured and direct for duration of about thirty (30) minutes to one (1) hour.

It was gathered that cost for these toys is generally between ₹ 30 - ₹ 100 and in most cases people preferred to purchase electronic toys which fell in this price range.

During survey it has also been noticed that in each shop every item was of ₹ 30 which includes Electronic Bad Man, RC Car, Fighter Plane, Funny Toys, Jie Cheng Toys, Line Pull Animal, Gun and Frequency Modulated (FM) Radio. This indicates that the lower price limit of toy is ₹ 30 and hence if there is any toy which costs more than ₹ 30 it will not be successfully sold.

It was further found that in the same market there are also some sophisticated electronic toys which is of ₹ 250 but its sale is too less as compared to toys of ₹ 30.
Therefore, it implies that popular toys which are purchased are the lower priced, their range being ₹ 30 - ₹ 50. Hence manufacture of low cost toys should be undertaken. With these pieces of information at hand, the population density could be calculated and it has been illustrated below in the Table 5.56.

In pathway of exhibition, one can calculate the population density. Further, this could be then multiplied by 3 (as because one person visit exhibition 3 times which is also arrived at through interview process). Therefore, it could be estimated as to the number of people (in Lacs) who visited the exhibition and the number of people who preferred toys of ₹ 30. Profit on these toys is not more than ₹ 3 - ₹ 4. This depicts the market potential of marketing and selling toys. Table 5.56 presents a summary of interview.

### Table 5.56 Summary of Interview

<table>
<thead>
<tr>
<th>No of shopkeepers interviewed</th>
<th>Cost of popular toys</th>
<th>Average life of toys</th>
<th>Profit per toy in (₹)</th>
<th>Total number of toy's shop</th>
</tr>
</thead>
<tbody>
<tr>
<td>32</td>
<td>₹ 30 - ₹100</td>
<td>1 year</td>
<td>₹ 3 - ₹ 4</td>
<td>64</td>
</tr>
</tbody>
</table>

### Table 5.57 Summary of People Visiting and Sale

<table>
<thead>
<tr>
<th>Year</th>
<th>Average number of people visiting exhibition per day</th>
<th>Total number of people visiting exhibition in 25 days</th>
<th>Sale of electronic toys per day in (₹)</th>
<th>Total Sale of electronic toys in 25 days in (₹)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009-2010</td>
<td>80,000</td>
<td>20,00,000</td>
<td>2,80,000</td>
<td>70,00,000</td>
</tr>
<tr>
<td>2010-2011</td>
<td>80,000</td>
<td>20,00,000</td>
<td>2,96,000</td>
<td>74,00,000</td>
</tr>
<tr>
<td>2011-2012</td>
<td>No exhibition was held due to elections</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>2012-2013</td>
<td>1,00,000</td>
<td>25,00,000</td>
<td>3,32,000</td>
<td>83,00,000</td>
</tr>
<tr>
<td>2013-2014</td>
<td>1,08,000</td>
<td>27,00,000</td>
<td>3,36,000</td>
<td>84,00,000</td>
</tr>
</tbody>
</table>

Source: Aligarh Exhibition Office

Table 5.57 shows that total number of people visiting exhibition every year is continuously increasing and the total sale of electronic toys for entire duration of exhibition i.e. for 25 days is also increasing. This clearly shows that the demand of
toys is increasing. Total sale of toys are calculated for 64 toy shops at exhibition in Aligarh. The list of names of the shopkeepers is provided in Annexure A.II.

5.7 A Viable Alternative to Women Entrepreneur
It was also found on the basis of interview and discussion, that these shopkeeper-entrepreneurs employed women (giving them an entrepreneurial opportunity) to undertake manufacture of these toys. It was also arrived at that majority of women entrepreneurs in SMEs (Small and Medium Enterprises) fall within the age group of 25-40 years; most SME women owners were married, had a good educational background, (with most of them at least graduates), and had an above average record in education and participated in extra-curricular activities. Of late, the trend of working at home has steadily become popular. Also, home workers are in great demand and are needed immediately by many established, reputable, large and small companies. Assembly of electronic and stuff toys at home can provide a way out to work from comfort zone of home.

Therefore, these shop-owners-entrepreneurs employ women for assembly of electronic toys by sitting at home. Assembling of toys could be undertaken with ease because electronic circuitry which was needed for making the toys were already available with simple, easy-to-understand directions. Therefore, for women entrepreneurs' assembly of electronic toys would be the better and easy option.

Further from the discussion it was also arrived at that according to new techniques instead of using discrete electronic components, a modular approach was also available for a particular type of toy and it is very easy to fit in that modular circuit in the body or casing of the toy because that does not involve any expert hand. Therefore even those women who do not have much knowledge of electronics can also do this job. Generally, modular circuits along with simple and easy-to-understand directions are provided by the company. Also for the convenience of the assembler usually, a picture or diagram accompanies each step in the process until the end of the instruction material. Therefore women could undertake this work at their own pace and return the completed items for payment. Further, for assembly of electronic toys generally a small module which contains electronic circuitry has to be fitted inside the toy and then reassembly is needed. Women are better suited to do this job more conveniently because of their soft and thin fingers. Also work related to designing and developments of toy which can be done effectively and efficiently by women as
compared to men. This is because this work includes stitching, cutting, sewing and stuffing, embroidery and colour painting etc. for which women are having good taste and also aptitude as compared to men. Further, women are also more concerned about the safety aspect of a toy and therefore they can think more and suggest better about the safety features of a toy. For example, it is suggested that toys should be made with renewable, recyclable and natural materials rather than synthetics like plastic. Hence, it is possible that many women sitting at home can be engaged to do this job from their homes itself and at the same time they can look after their children and can do the household work. Therefore, for women there is no need to go out or travel from one place to another. By doing this, their social and economic status can be improved and also assembly of toys can be more cost effective and hence will improve the profit.
CHAPTER 6
CONCLUSIONS AND RECOMMENDATIONS

This chapter is organised into four (4) sections. The first section presents findings based on the results of the study. The second section gives the details of implications. The third section presents the recommendations for electronic toy manufacturers and at the end of the chapter scope of future research is provided.

6.1 Findings
The study concludes that there exists no significant relationship between motives for purchase of toys and the various demographic profiles, they being occupation, age, gender and qualification. It also found that there existed no significant relationship between criteria for selection of toys with respect to occupation, age, gender and qualification. It also showed that there was no significant relationship between motivational factor for purchase of toys and occupation, age, gender and qualification. Similar conclusions were arrived at with respect to the relationship between other aspects of purchase of toys and various demographic profile they being occupation, age, gender and qualification.

The study further concludes that there exists a very strong and positive correlation between motive behind purchase and criteria for toy selection, motivational factor for purchase of toys and other aspects of purchasing electronic toys. Also a significant and positive relationship was observed between criteria for selection of toys and motivational factor for purchase and other aspects of purchasing electronic toys. Further, a significant relationship was noted between motivational factor for purchase of toys and other aspect of purchase of toys.

Of these the strongest relation was observed between criteria for purchase and motivational factor for purchase which was at 0.731. All others also showed strong positive relationship. Only one factor motive for purchase and other aspect showed a comparative weak relationship.

This implies that demography does not play a role in purchase of toys but overall the motivational factor for purchase could be considered for manufacture of toys.

Through linear programming it was suggested that cost could be reduced and profit increased if resources could be optimally utilized.
The implementation and testing of four cost effective electronic toy circuits i.e. Amplified Greeting-Card Sound Circuit, LED with Light Sensor, Infrared Toy Car Motor Controller and 7 Segment Display Reference shows that there were different alternative costs which gives one an option to further reduce the cost.

Experiments undertaken by the researcher and her team in 16 electronic toys also indicated that cost can be optimized without sacrificing the quality. For some key components where modifications are suggested are AA batteries, speakers and colourful bulbs. It is found that in place of 3 AA batteries one 9V battery can be used which can save rupees of ₹ 5. Similarly speakers of high power and impedance can be replaced by slightly low power and low impedance speakers which will save rupees of ₹ 2–₹ 8 depending upon rating of speakers. In place of bulb, LED of same colour may be used which will further reduce cost by 10P. The researcher has done sufficient work and data analysis for optimizing the cost of electronic toys. Some modifications in simple circuits of electronic toys have been suggested which can reduce the cost marginally.

An assessment about the total demand of cost effective electronic toys could be made based on the population density in each year.

6.2 Implications

The demographic profiles like occupation, age, gender and qualification have no influence on motives for purchase of toys, criteria for selection of toys, motivational factor for purchase of toys and other aspects of purchase of toys.

All the variables under study, they being motive for purchase, criteria for purchase, motivational factor for purchase and other aspects for purchase show strong positive relation with each other.

In any toy company, technique of linear programming may be applied to make optimum use of resources under given constraints in such a way that maximum profit may be obtained in production of electronic toy.

It may be concluded from this research work that implementation of cost effective electronic circuits or slight modifications in electronic toys, without compromising too much on the quality and performance of the toy, would lead to cost optimization. This reduced cost toy would be more useful for the lower strata of the society,
particularly the deprived children in rural areas, and would thus lead to its increased
popularity and marketing in rural areas.

For innovative toy designing, there is a dire need for greater creative skill, user
knowledge and technical advancement. By implementing the suggested innovative
ideas in the electronic toys, the toy will appeal more to parents and children and hence
the popularity and demand of these will drastically increase in the market. Because of
the high demand of attracting and appealing electronic toys in the market their
marketing will be high and hence with the help of mass production of these toys cost
may further be reduced.

6.3 Recommendations
If a toy has appeal and is purchased by a person, it would be purchased irrespective of
the age, occupation, gender or qualification. These demographic factors have no
influence and therefore need not be considered for design of toys.

Motive for purchase, the criteria for purchase and motivational factor strongly
influences purchase decision and therefore these factors should be considered by
designers while designing new toys. Therefore toy manufacturers must keep these
factors in mind in new product development.

Toy manufacturing company must make optimal utilization of existing resources
because it is a very important task for electronic toy manufacturers. Linear
programming will help in making an optimal decision that meets a specified objective
of profit subject to various constraints and restriction.

Although, further reduction in the cost of electronic toys can be done but it may affect
the quality, performance, reliability and durability of toys. Therefore, it is
recommended that cost should not be reduced further; this is because toy may become
out of order repeatedly and then repairing would be major issue and will involve
money.

Any new innovation of electronic toys could shape the kind of toys kids play with. In
addition, renowned toy designers must make their efforts to spread awareness about
the impact of inventive toy designing.

6.4 Scope of Future Research
This section points out how the research effort could be extended further. In other
words it provides a research direction for future.
(i) Future research could cover different segments of market that is rural and urban areas.
(ii) Future research study could cover market acceptance (that is response of market) after change has been introduced in the toys.
(iii) Study could cover cost of toy before modification and cost after modification.
(iv) Study could assess the benefit to women entrepreneurs as a result of this research.
(v) Future study could also calculate the actual demand for cost effective toys (for which modification/innovation has been done) based on population density of each year.

For doing this work a persistent effort is needed. Therefore, it is suggested that some young and dynamic researcher can take a lead in this direction and carry forward this work.
Bibliography


[Goyal 2013]: M. Goyal, "SMEs employ close to 40% of India's workforce, but contribute only 17% to GDP", SME Policy & Trends, The Economic Times, ET Bureau, (2013). Available on line at: http://articles.economictimes.indiatimes.com


[Lal and Badrinarayanan 2011]: R. Lal and H. S. Badrinarayanan, "The role of women entrepreneurs as a change agent in the society: a case study", Zeneth International


Websites:

[Aaroncake.net]: Available on line at: www.aaroncake.net


[Justfun group]: "Mattel", New Justfun group (PTY) LTD. Available online at: http://www.justfun.co.za

[Kobakant]: "How to get what you want", Open source hardware. Available online at: http://www.kobakant.at/DIY


[Madehow]: "Plastic dolls", How products are made, vol.5, Available online at: www.madehow.com

[MSME 2010]: "Project profile on electronic remote controlled toy", MSME development Institute, Govt. of India, Ministry of MSME, Ayyanthole, Thrissur, (2010). Available online at: http://www.dcmsme.gov.in


Annexure A. I: Questionnaire

Dear Respondent,

I am conducting a study on 'cost optimization in electronic toys manufacturing and marketing – A viable alternative for women entrepreneurship'.

Your active and sincere participation can help me in suggesting in designing the electronic toys in a way that is affordable by the major section of the society keeping in view the attraction and multi faceted development of the child.

It is necessary to know your preferences of features in electronic toys and buying behaviour for strategic planning of manufacturing and marketing.

Thanks

Mrs. Salma Shaheen

AMU, Aligarh

Mob: +919634016650

Section 1- Instructions: Tick on any one of the following

Personal Information:

1. Occupation: (a) Professional/Service (b) Business (c) Home Maker (d) Any other
2. Age: (a) Less than 25 Yrs ( ) (b) 25-35 yrs ( ) (c) 35-45 Yrs ( ) (d) More than 45 Yrs ( )
3. Gender: (a) Male ( ) (b) Female ( )
4. Qualification: (a) Technical/Professional Graduate ( ) (b) Non-Technical Graduate ( ) (c) Post graduate (d) Any other

Section 2- Instructions Tick on any one of the following

1. Rank the following main criteria in order of its importance to you for selection of toys. (1 as most important & 5 as least important)
   (a) Appealing to children  
   (b) Safety aspect  
   (c) Educational value  
   (d) Instructions to play  
   (f) Child development
2. Five main criteria have been enlisted in the first row. Its sub criteria are listed in the respective column (below it).

<table>
<thead>
<tr>
<th>Main Criteria Sub Criteria</th>
<th>Appealing 1</th>
<th>Safety Aspect 2</th>
<th>Educational value 3</th>
<th>Instructions to play 4</th>
<th>Child development 5</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Color</td>
<td>Choking hazard</td>
<td>Mathematics</td>
<td>Clarity</td>
<td>Intellectual</td>
</tr>
<tr>
<td>2</td>
<td>Shape</td>
<td>Sharp edges</td>
<td>Science and nature</td>
<td>Easy to understand</td>
<td>Social</td>
</tr>
<tr>
<td>3</td>
<td>Best suited style for age</td>
<td>Danger of suffocation</td>
<td>Magnets and magnetism</td>
<td>Demo with audio</td>
<td>Emotional</td>
</tr>
<tr>
<td>4</td>
<td>Eye danger</td>
<td>Building and construction</td>
<td>Demo with video</td>
<td>Physical</td>
<td></td>
</tr>
</tbody>
</table>

You are required to compare the main criteria as well as sub criteria by putting a '✓' against your choice in the table given below.

**COMPARE "A" WITH "B" AND TICK YOUR OPINION**

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
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</thead>
<tbody>
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<tr>
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<td>A4 = &quot;A&quot; IS MODERATELY IMPORTANT OVER 'B'</td>
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<tr>
<td>AB = &quot;A&quot; AND 'B' ARE EQUALLY IMPORTANT</td>
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</tbody>
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You are required to compare the 5 main criteria of toy selection by putting a '✓' in the following table.

**MAIN CRITERIA**

<table>
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<th>B</th>
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You are required to compare the sub criteria of toy selection by putting a ‘\(/

### SUB CRITERIA of Appealing

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<th>Sharp edges</th>
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<th>Demo with video</th>
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<td>A2</td>
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<td>A4</td>
<td>AB</td>
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<td>B3</td>
<td>B2</td>
<td>B1</td>
<td>Physical</td>
</tr>
</tbody>
</table>
Section 3

Instructions- Give your degree of agreement for each of the alternatives where 1- Represents very important

2- Represents important
3- Represents neither important nor not important
4- Represents not important
5- Represents not very important

1. What is the motive behind purchase of electronic toys? Select them.
   a. Entertainment
   b. Intellectual Value
   c. Educational value
   d. Creative value
   e. Any Other

2. Rate the motive behind purchase of electronic toys? Rate the buying motives listed below:
   1  2  3  4  5
   a. Entertainment ( ) ( ) ( ) ( ) ( )
   b. Intellectual value ( ) ( ) ( ) ( ) ( )
   c. Educational value ( ) ( ) ( ) ( ) ( )
   d. Creative value ( ) ( ) ( ) ( ) ( )
   e. Any other ( ) ( ) ( ) ( ) ( )

3. What is the criterion for selection of electronic toys? Rank them in order of preference.
   a. Durability
   b. Safety
   c. Intellectual value
   d. Creativity
   e. Novelty (New features)
f. Minimum adult supervision

4. Rate each of the criteria for selection of toys 1 2 3 4 5
   a. Durability ( ) ( ) ( ) ( ) ( )
   b. Safety ( ) ( ) ( ) ( ) ( )
   c. Intellectual value ( ) ( ) ( ) ( ) ( )
   d. Creativity ( ) ( ) ( ) ( ) ( )
   e. Novelty (new features) ( ) ( ) ( ) ( ) ( )
   f. Minimum adult supervision ( ) ( ) ( ) ( ) ( )

5. What are the factors which motivate you to purchase electronic toys? Rank them in order of importance to you.
   a. Ease of buying  
   b. Ease of product selection  
   c. Brand value  
   d. Uniqueness of toy  
   e. Discounts and sales promotion  
   f. Any Other  

6. Rate the motivational factors for purchase 1 2 3 4 5
   a. Ease of buying ( ) ( ) ( ) ( ) ( )
   b. Ease of product selection ( ) ( ) ( ) ( ) ( )
   c. Brand value ( ) ( ) ( ) ( ) ( )
   d. Uniqueness of toy ( ) ( ) ( ) ( ) ( )
   e. Discounts and sales promotion ( ) ( ) ( ) ( ) ( )
   f. Any Other ( ) ( ) ( ) ( ) ( )

7. What are the other aspects that you consider when purchasing electronic toys?
   a. It must hold prolonged interest in child.  
   b. It must foster no-violence.  
   c. It must be repairable.  
   d. It must be easy to keep clean.  
   e. It must promote creativity.  
   f. It must encourage eye-hand coordination.  
   g. It must add to muscle development.  

164
8. Rate the other aspects that you consider when purchasing electronic toys? 

1 2 3 4 5

a. It must hold prolonged interest in child. ( ) ( ) ( ) ( ) ( )
b. It must foster no-violence. ( ) ( ) ( ) ( ) ( )
c. It must be repairable. ( ) ( ) ( ) ( ) ( )
d. It must be easy to keep clean. ( ) ( ) ( ) ( ) ( )
e. It must promote creativity. ( ) ( ) ( ) ( ) ( )
f. It must encourage eye-hand coordination. ( ) ( ) ( ) ( ) ( )
g. It must add to muscle development. ( ) ( ) ( ) ( ) ( )

9. The motive behind purchase of electronic toys influences your criteria for selection of toys

1 2 3 4 5

( ) ( ) ( ) ( ) ( )

10. The motive behind purchase of electronic toys influences the motivational factor for purchase of toys.

1 2 3 4 5

( ) ( ) ( ) ( ) ( )

11. The motive behind purchase of electronic toys influences the other aspects of purchasing electronic toys.

1 2 3 4 5

( ) ( ) ( ) ( ) ( )

12. The criteria for selection of toys influence the motivational factor for purchase.

1 2 3 4 5

( ) ( ) ( ) ( ) ( )

13. The criteria for selection of toys influence the other aspects of purchasing electronic toys.

1 2 3 4 5

( ) ( ) ( ) ( ) ( )

14. The motivational factor for purchase of toys influences the other aspect of purchasing electronic toys.

1 2 3 4 5

( ) ( ) ( ) ( ) ( )

15. Please give any other factor that influences you to purchase toys.

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16. Please give any other consideration that influences your decision to purchase electronic toys.

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Annexure A. II: List of Names of the Shopkeepers at Aligarh Exhibition

1. श्री कमल शार्मा पुत्र श्री सिश्नू, कुमार हारकाशीश गली अध्यादा
2. श्री गोविन्द चौहान पुत्र अमर सिंह चौहान
3. श्री अरोक गुप्ता पुत्र श्री रमेश लाल पंचवटी कारांनी गली
4. श्री अनिल गुप्ता पुत्र श्री चंद्र गुड़ाई हरदुआंज अलीगढ़
5. श्री जुन्जवरी शाह श्री शाह चरण महाविद्या लालू गली
6. श्री अनिल दांदी पुत्र श्री राम भरोली सुमार गली अलीगढ़
7. श्री सिरीकल अली पुत्र श्री सहिन दुह्रांज सामाल मुरादाबाद
8. श्री मोहन जाहिदु हुसैन पुत्र श्री आशिम अली गली नं 6 लोको कारांनी अलीगढ़
9. श्री अतीरेर पुत्र श्री जमल खाँ 218 सराये रहमान अलीगढ़
10. श्री शानवाद अली पुत्र श्री निमी साहा इदुरा दिल्ली
11. श्री नंद राज बाड श्री सहिन दुह्रांज इदुरा दिल्ली
12. श्री नववाल अली पुत्र श्री नजमुल बाड़ा इदुरा दिल्ली
13. श्री शाजाद खाँ पुत्र गुंजवरी खाँ आवास विकास कारांनी जेल रेड, अलीगढ़
14. श्री राघव स्याम पुत्र नालू लाल बाजार गाँव आवाला
15. श्री लाल पुत्र श्री फूल चंद गोपाल पुग गली
16. श्री अनसरजीत पुत्र श्री गंगा सहाय भवानीपुर बदांगू
17. श्री रिजाज असफर पुत्र शमीर हुसैन गुड़ाई हरदुआंज अलीगढ़
18. श्री नाशिर हुसैन पुत्र शमीर हुसैना गुड़ाई हरदुआंज
19. श्री न्यू खुमार भाटिया पुत्र विश्वनाथ दास भाटिया फरीदाबाद
20. श्री मोहन असलम पुत्र श्री असफर हुसैन फाल्ना टोला सहस्वान बदांगू
21. श्री साज खुमार पत्तन खुमार पुत्र दीघा राज्या प्रहलाद गाँव मेट्टा
22. श्री न्यू मोहम्मद पुत्र श्री नाशिर गोमसार रवान बाजार दाऊजी मुरादाबाद
23. श्री न्यू अली पुत्र श्री चंद्र बाबू, खाँ गोमसार रवान बाजार मुरादाबाद
24. श्री नाशिर खाँ पुत्र श्री हाशिम खाँ पीर गली नं 3 रहानपुर
25. श्री आदिर देवल पुत्र श्री देवनद्र खुमार मनोहर आंबला बरेली
26. श्री गुमोश वर्तन पुत्र असुफाफ शेखपान खुर्जा
27. श्री रहस्य अमद पुत्र मोहन इसराय विना बाला चौक शेखपान खुर्जा
28. श्री मोहम्मद पुत्र श्री अज्जाजिफ बिनदा बाला चौक शेखपान खुर्जा
29. श्री जसुना प्रसाद पुत्र श्री गल चंद मनोहर आंबला बरेली
30. श्री मोहन अली पुत्र सरदार हुसैन मोहन गुड़ाई हरदुआंज अलीगढ़
31. श्री नववाल अली पुत्र रजया बाबू सोरवन सिंह पुरेनी बाल आंबला बरेली
32. श्री नक्ष राजा पुत्र अहसन अली गुर्जियाई हरदुआंगज
33. श्री मोह युवुक पुत्र श्री रसियुदेवी सराय तरीन नयाव खेल समान
34. श्री सुशील कुमार पुत्र श्री राजाराम मनीना आंंदला बरेली
35. श्री शालिब हुजैन पुत्र सरदार हुजैना गुर्जियाई हरदुआंगज अलीगढ़
36. श्री मुनाहान कवि पुत्र श्री लियकु कुलसेन पाना टोला सहस्वास बदायूं
37. श्री सुरेश चन्द्र पुत्र कामल गुर्जियाई नरी सोन मुनमगर
38. श्री गीता गुरुफक पुत्र अदाक शेखान खूर्जा बुकन शाहर
39. श्री पुष्पक चन्द्र पुत्र श्री जंगलराम कामजी बाजार मैट्र
40. श्री पदन कुमार पुत्र श्री धिय दयाल महावीर नगर मथोना इटावा
41. श्री देवेश कुमार मी मारफ रसलगंज शरीवपुर
42. श्री नरेश शह नृत्र कामल गुरुफक शीर्षी देव.getAbsolutePath()
43. श्री नलन लाल पुत्र श्री राह श्याम कामजी बाजार खूर्जा वाली गली 119 मैट्र
44. श्री रतन प्रकाश अशोक कुमार पुत्र श्री राहे लाल श्रीलाल चौहान पाण्ड मथुरा
45. श्री रघु न सरन पुत्र श्री दुर्गा प्रसाद कुशल गली मथुरा
46. श्री शिकार गोपाल पुत्र श्री जयेश चन्द्र सहस्वास बदायूं
47. श्री नियालक अली पुत्र श्री मी मोट उमर शेखापन खूर्जा बुकन शाहर
48. श्री रांकर लाल पुत्र श्री बाबुदेव हलवाई खाना मैट्र
49. श्री निलो सुकार पुत्र श्री सहितुदेवी सराय तरीन नाब खेल मुरादाबाद
50. श्री नियालक खिलार पुत्र श्री महेन्द्र पाल जाफ़ावाद पोंजीर नगर हायरस
51. श्री राहे श्याम पुत्र श्री राजकुमार जज्वार नगर मैट्र
52. श्री अशोक कुमार पुत्र श्री मुनाहान लाज समान मुरादाबाद
53. श्री खान पुत्र श्री मुशा आदित पुत्र हारुण पुलिस चौहान मरुजाद अलीगढ़
54. श्री जयशंकर अली पुत्र श्री शाहफ अहमद सरायवी जिला हायरस
55. श्री राकेश कुमार पुत्र श्री राजा राम मनोना आंंदला बरेली
56. श्री शाहिद हुजैन पुत्र श्री आबिद हुजैन मुलाक नगर अलीगढ़
57. श्री सरदार हुजैन पुत्र श्री यामीन गुरुफक गुर्जियाई हरदुआंगज
58. श्री मुशारा हुजैन पुत्र श्री यामीन खान, नसीर कस्ता जलाली अलीगढ़
59. श्री मीह सरफरज पुत्र श्री सरजाज हरदुआंगज अलीगढ़
60. श्री अलमदार पुत्र श्री मुशारा हुजैन जलाली
61. श्री राकेश कुमार पुत्र श्री राहे श्याम बाजार आंंदला
62. श्री मनोज कुमार पुत्र पुत्र मनोज राजाराम भगवान आंंदला बरेली
63. श्री मुशारा हुजैन पुत्र श्री रस तारादुखक मुगलियाई कस्ता हरदुआंगज अलीगढ़
64. श्री मनोज लाल पुत्र भगवान दास सीता आराम चन्दराली
Annexure A. III: List of Publications

Papers Published

Conferences


Journals


Papers to be Communicated


- Salma Shaheen and Tayzeen ahmad, "Optimum utilization of resources in a toy company by using linear programming".