ECONOMICS OF PLASTIC INDUSTRY IN INDIA WITH SPECIAL REFERENCE TO KERALA

By

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Thesis Submitted to the

University of Calicut

for the award of the Degree of

Doctor of Philosophy in Economics

JUNE 2003

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CERTIFICATE

Certified that this written account on *Economics of Plastic Industry in India with special reference to Kerala* is a bonafide record of research work done by Sri. M.S.Suresh Kumar under my supervision. This thesis has not been submitted earlier for any other degree or diploma.

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DECLARATION

I, M.S.Suresh Kumar hereby declare that this written account entitled *Economics of Plastic Industry in India with special reference to Kerala* is a bonafide record of the research work done by me under the supervision of **Dr.K.R.Lakshmi Devi**, Professor, Department of Economics, University of Calicut.

I also declare that this thesis has not been submitted by me fully or partly for the award of any degree, diploma, title or recognition before.

M.S.Suresh Kumar.

Aranattukara,
10 - 6 - 2003

ACKNOWLEDGEMENT

I have great pleasure in expressing my hearty feelings of respect and deep sense of gratitude to my Teacher, Dr.K.R.Lakshmi Devi, Professor, Department of Economics, University of Calicut. It was her keen interest and able guidance, which made me to complete this thesis. She was the constant inspiration behind all the merits I had after joining as a PG student at this department.

I am also indebted to Dr.D.P.Nair, Head of the Department of Economics for his sincere encouragement through out my research. I make this opportunity to express my heartfelt thanks to Dr.P.P.Pillai, Econometrician, who taught me the methodology of econometric research.

I express my gratitude to all the faculty members of Department of Economics of the University of Calicut for sharing their ideas in research with me during a series of seminars and discussions organised at the department.

I express my heartfelt thanks to Smt. Usharani, Librarian, Department of Economics, for she sincerely helped me in many ways during my research period. Thanks are also due to the

librarians of Centre for Development Studies, Thiruvananthapuram; KSIDC, Thiruvananthapuram; Institute of Social and Economic Change, Bangalore; Madras School of Economics, Chennai; Central Institute of Plastic Engineering Technology, Chennai; Cochin University of Science and Technology, Kochi; and KITCO, Kochi.

I extend my thanks to the entrepreneurs of all sample units for their spontaneous co-operation during the survey. Thanks are also due to the Officers of the Department of Commerce and Industries, Government of Kerala and the District industries Centres of Thrissur, Alappuzha and Kozhikkode.

I am also acknowledging my heartfelt thanks to the staff of the Department of Economics for their co-operation during my study period. I also thank Mr.Gokul Kainoor of M/s.Amritha Printing Media, Mullakkara, for printing and setting of this thesis.

I will be lacking in gratitude if I fail to mention the affection and sincerity of all my friends whose unbounded help and co-operation made this work possible.

M.S.Suresh Kumar.

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INTRODUCTION

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INTRODUCTION

The present time is sometimes referred to as *Plastic age* on account of the use of plastic products in a wide range of areas. Plastic products are now being used in every spectrum of human life. The plastic products have out placed all other products, which were used in households, hospitals, agriculture, industry, defence and transport. Plastics industry served the needs of common man at lowest cost with innumerable products to meet needs of daily life and convenience. A wide spectrum of plastic products produced by the industry has touched the life of every person in some way or the other.

1.1. ORIGIN OF PLASTICS

The credit of having synthesized plastics goes to the U.S. inventor ***John Wesley Hyatt.*** In 1860, in a bid to win the prize money of $10,000 offered by a billiard ball manufacturing company to find a replacement for the ivory billiard balls that were used then, he made a ball from Cellulose Nitrate, which he called Celluloid. Though Hyatt did not win the prize, his product

turned to be a big commercial success for it was used in the manufacture of objects ranging from dental plates to men's collars. His invention laid the foundation of a material revolution in industrial sector (SIRI 1985).

Later with discovery of Bakelite in 1906 by Leo Hendrick Bakeland, the plastics industry was poised for growth. Introducing a new material, which can be made as hard as iron and as soft as feather, with variety of colours, science had given the humanity a good gift. Plastics started growing, replacing the traditional materials including wood, ceramics, glass and metals like iron, steel and aluminium, as well as competing with them in household and industrial applications.

DEFINITIONS AND COMPOSITION OF PLASTICS

The term *plastic* covers a large group of solid synthetic materials of high molecular weight, usually of organic origin. Plastics and rexins may be defined as organic materials that can be easily moulded or shaped by mechanical and chemical actions to give tough, non-crystalline substance that are solid at ordinary temperatures.

The American Society for Testing Materials has rather complicated definition for the term plastic. "*Plastic is a material that contains as an essential ingredient, an organic substance of large molecular weight, is solid in its finished state, which at a suitable stage in manufacture are soft enough to be formed into various shapes by application of heat and pressure*" (SIRI 1989).

Many people engaged in plastic industry loosely use the term rexin. It may be synonymous with 'plastics', but is usually referred to the essential ingredients before final processing and fabrication. Most of the plastics are synthetic and only a few occur naturally, say, rubber.

The molecules of plastics are composed principally of *carbon, hydrogen, nitrogen* and *oxygen.* These are derived from petroleum, coal, salt, air, and water. The properties of plastics depend to a large extent on the size and shape of the molecules of which they are composed.

The Sylicons fall under the classification of plastics even though they are partially inorganic rather than entirely organic composition. The sides of Cellulose chain can be suitably modified in various ways to range of 'Celluloid plastics', which

include Cellulose Acetate, Aceto Butyrate, Ethyl Cellulose and others. These are generally used to produce combs, eyeglass frames, business machine keys, shoe heels, etc.

The most widely used plastics of these series are those made from Phenol Formaldehyde, which has plastic properties during its manufacturing process only. Switch parts, automobile ignition parts, lamp sockets are the major phenolic products. In its finished shape it is rigid and cannot be altered in shape by heat or pressure. There are range of Phenol Formaldehyde plastics with varying properties according to the actual phenolic base used and the method of building up the large molecule.

PROPERTIES OF PLASTICS

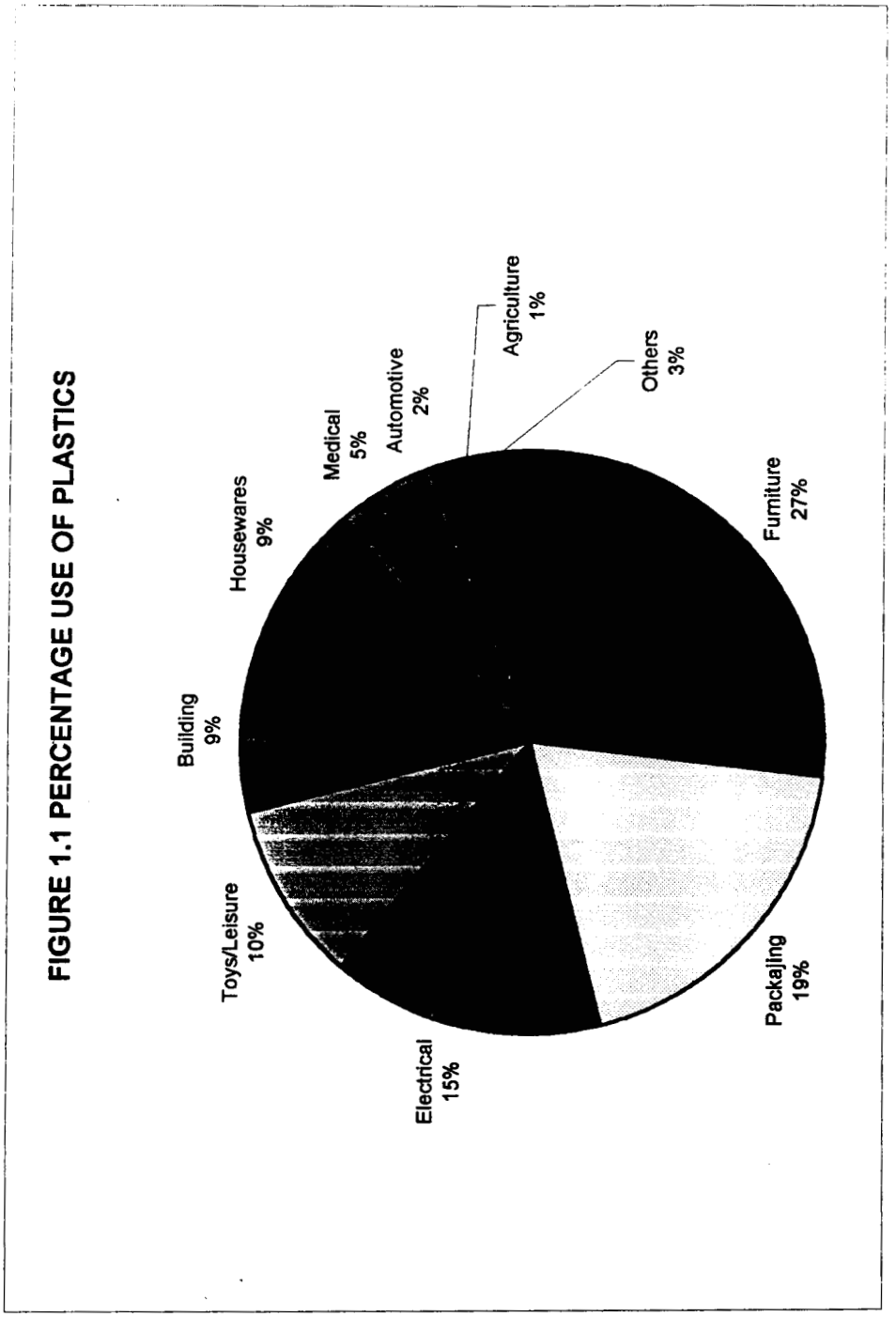
Plastics are light in weight but they are prodigiously strong. They can be changed into end products by relatively simple means and they have a good appearance and a good feel. Plastic products possess certain very useful qualities such as strength, flexibility, lightness, transparency, corrosion, resistance, electrical insulation and availability in a variety of colours.

The advantage in the use of plastics as compared to other materials includes these good physical properties and adaptability to mass production methods and excellent chemical resistance. In addition, the overall cost of production is often lower as compared to other materials. For the above reasons, today, plastics originally regarded as substitutes for metals, wood, glass, etc. and offer a wide range of utility and industrial applications.

1.2 APPLICATION AREAS OF PLASTICS

Some 4000 articles are produced from plastics for use in homes, hospitals, agriculture, industry, defence and transport. Their applications embrace industry as diverse as building, engineering, electrical, railway, automobile, shipbuilding, aircraft, chemical pharmaceutical, radio, telephone and textiles.

The world consumption of plastics in different fields is given in the figure given below



Source: Asian Plastic News, September 2000

The use of plastic material for any specific application is dependent upon its composition, its particular properties and the

design of the part. The great utility of plastics may be shown reference to a few typical applications in various fields where these new materials are being applied. In automobile and aircraft industries different plastics find specific utilisation because of beauty, strength and oil-electric resistance. Their resistance and strength make them very useful in the manufacture of safety glasses, laminated gears, coir, pulleys, self-lubricating bearing, and plywood and like. In other fields where plastics cannot be used alone, it is employed with metals as in the manufacturing of steering wheels and plastic covered dashboards. These combinations develop the best properties of each material.

PLASTICS IN INDUSTRY

The growth of plastics consumption can be attributed to wide application and material substitution in the fields of construction appliances, automotive parts, electronics, medical and packaging sectors[3]. Plastics are now accepted as important raw material supplementing metals, wood, ceramics, glass and rubber as well as competing with them for certain industrial applications. There are no materials at present available to science and industry, which can hoist of a variability even approaching that of modern plastics. Some of these are more

transparent than glass and weigh less than half its weight; others have a specific strength greater than steel while some possess electrical insulation properties. Several types of plastics have unique resistance to moisture, chemical corrosion and heat. For case of fabrication and adaptability to mass production methods, the range of plastics offer the greatest scope in manufactures catering for varied markets such as electrical accessories, mechanical, engineering, medical and optical goods, chemical and food products and building methods.

In electrical industry, moulded and laminated organic plastics are of real value as solid insulation materials because of their good electrical properties and relatively high mechanical strength. Organic plastics entered into competition with the usual materials in chemical processing industries. Such plastic materials are inherently resistant to corrosive gases, liquids and chemicals and are being used in the form of tubing and piping, tanks, absorption towers etc. Pipes for use in chemical plants are generally made from asbestos filled resins and the cast phenolic resins. Hoses can be made of extruded PVC or poly vinylidin chloride. Plastics are being used to an increasing extent for the lining of metal processing plants and for the actual fabrication of

storage vats, mixers, separators and other items of equipment employed in food processing industry. Apart from its use for making equipment, various types of plastics are employed for the packing of food products. Polythene coated paper and fabrics are the important packing media. Majority of the spectacles in use today have frames moulded out of cellulose acetate, which is comfortable to wear and is available in a wide range of attractive shades.

For the moulding of standard electrical fittings use is generally made of phenol formaldehyde rexin containing wood flavour. This gives a moulding with a clear sharp finish, good mechanical properties and reasonable high electrical strength. Special phenol formaldehyde and Anylene formaldehyde and polystyrene resins are used in radio industry, which minimise the cost to the maximum extent. Extensive use has recently been made of polyvinyl resins, polythene and ethyl cellulose in wire covering and sheeting. For all kinds of knobs and electrical accessories not affected by heat and moisture, the cellulose esters are very suitable and economic.

Plastics are also making inroads in building industry by replacing the usual materials in this industry. Of considerable

interest is the use of laminated sheets for wall coverings, flush door surfaces, kicking plates, window boards, tabletops and other purposes. The most important application of plastics for building purposes is in the form of new synthetic cements. Reinforced resin bound plywood is now widely used for Para-fabricating houses.

Numerous leather products have their finishing with plastic coating. The use of plastics as a material to replace leather in making of footwear indicates one of the new developments in the plastic industry. Very large quantities of plastics particularly celluloid, celluloid acetate, Methyl metacytrate resin, urea formaldehyde and phenolic resin as well as casein are used for the fabrication of a wide range of toilet wares and fancy goods.

Feminine accessories such as hand bag, belts, shoes and millinery are now being made form new vinyl resins. In sports and toy making industries, plastics are being utilised to a growing extent. Both thermosetting and thermoplastics resins are utilised as adhesives for bonding wood and other materials. Urea formaldehyde resin is recommended for causing joints, assembling of wooden parts and gives exceedingly strong joints.

The production of miscellaneous articles in plastics, which range from office equipment to musical instruments, owes its success to the following factors (Financial Express).

(i) Low cost and adaptability to mass production methods.

(ii) Low density or specific gravity of plastics in comparison with other materials like wood and metals.

(iii) Adaptability of plastics fabrication to the production of curved and Stream lined shapes

(iv) High specific strength

(v) Low thermal conductivity

(vi) Immunity to surface deterioration or corrosion

1.3 PLASTICS AND ENVIRONMENT

Plastics are invariably accused of polluting natural resources and contributing to our environmental problem thereby affecting eco-balance. Amongst environment issues, throwing away broken and discarded items of use, as wastes through 'garbage' and 'rubbish' are rituals for us concern every one of society. Discarded and used paper, boards/cartons and colourful plastic packaging and related items of consumer use are

more prominently spotted in any garbage dump, may it be household, landfills, industrial, and institutional including hospitals. With the constant urbanisation and industrialisation around the world, the problem of discarded items of use and their disposal through garbage has outgrown.

Plastics waste form an important share after paper, metals and glass in any garbage collection dump. The thrown up plastic articles include plastic bottles, chappals, bags, covers etc. PVC chappals account for bulk of plastic waste, i.e., over 75 per cent. Plastic bags and discarded plastic bottles and packaging film are the next after PVC chappals. The lion share of plastic waste comes from households, hospitals and other consuming sectors. This non-destructible waste debris is common scenery in every town. There have been pressures and counter pressures on governments and local bodies to set targets for appropriate measures relating to urban solid waste management.

However, banning usage of plastics is not a remedy for this problem. Plastics as materials have become a natural choice in varied applications due to their versatile qualities, inherent properties and economic value. Things like plastics being non-degradable, dangerous to environment, having chemical based

ingredients and being harmful to health are unfortunately created negative impressions in the minds of ill informed common people. The hundreds of virtues are totally forgotten or intentionally withheld for making a fair judgement.

As nation industrialises and its economy develops with prosperity, its people demand and look for a better quality of life. People become more conscious of the air, the water and the land and they express a desire for better standards of health, hygiene and safety. It is a gradual climbing in man's ladder of need hierarchy with greater affluence, and plastics do play an important role in improving modern life. The improvement in general standard of living and economic growth coincides with higher levels of plastics consumption. It benefited in a major way to the low and medium income people. With the use of plastics, the cost of living could be controlled retaining the same or better level of cleanness and beauty in home. For example, the cost of plastics household utensils are very low compared to those items made out of metals, glass etc. Despite this during the last few years the general image of plastics have become poorer vis-à-vis the environment.

The public perceptions about plastics being harmful, carcinogenic, toxic and polluting are quite contrary to real facts. Plastics do help save millions of barrels of oil and thousands of acres of forests and wood. There are various ways plastics products after one use, can be recycled and reused, serving to save our scarce resources. There are numerous ways plastics help conserve water and energy and help control pollution and food waste than any other raw materials but somehow this has not been effectively communicated to common people. In fact plastics are one of the most eco-friendly materials vis-à-vis alternatives like glass, metals, alloys etc.

Many eco-balance studies have proved that plastics application often has the lowest global environmental impact. The following facts are not negligible in this context.

1. Plastics lightweight offers resource saving in transportation.

2. In many applications production process is more energy efficient than alternative materials. Worldwide plastics use only 4 per cent of commercially produced oil.

3. Plastics waste is not injurious to health. They will neither produce nasty smell nor cause any contagious diseases.

4. At the end of useful service life, plastics can be recovered by recycling or provide an energy source equivalent to coal through energy recovery.

1.4 REVIEW OF LITERATURE

Industrial sector in India has been widely researched. Most of the industries have been subjected to detailed research repeatedly. However, there are some industries that have not received such attention of the researchers, plastics industry belongs to such category. Though plastics industry is nearly 5 decades old in India, its rapid growth was in the last 15 years. Consequently no serious attempt has been made so far to study how this industry has made progress, what are the perception of the people on this industry, its impact on cross section of people and various sectors and on environment.

Small Industry Research Institute (SIRI), New Delhi, has studied some aspects of plastics industry. Their primary emphasis is on small-scale plastics industries. Small-scale sector holds an important role in plastic industry. It points out that more than 70 per cent of the raw materials was consumed by this sector and contributes to over 80 per cent of the total output.

It has been also established that plastic industry, mainly small-scale sector provides more employment opportunities. SIRI has given more attention on the role of small-scale sector.

Productivity is another aspect generally studied by SIRI Researchers. It has been found that labour productivity is higher in small-scale sector compared to large-scale manufacturers.

Sankaranarayanan and Karunakaran (1985) suggested that the improvement of traditional and small-scale sector as the only way of industrialisation of Kerala.

According to Rajan (1987) capital investment and employment in the industrial sector of Kerala had not shown significant growth after 1947. The industrial growth during the Five Year Plans was not satisfactory compared to the other states.

Namboothiripad (1988) has also studied the trends and pattern of industrial development in Kerala after Independence.

Aswathy (1988) in her study, 'Analysis of regional growth pattern in India' has found that Kerala has remained almost static in industrial growth scenario.

Radhakrishnan (1989) in his study 'Growth, Structure and Productivity of Indian Manufacturing Industry – an Econometric Analysis' made a comparison of productivity performance in the large scale manufacturing sectors of Kerala and all India. The analysis indicated that the long-term trend in growth rates of labour productivity for Kerala exceeded the observed growth rates of capital productivity. The steep decline in the growth rates of both labour and capital productivities, during the 1970 –90 is disheartening and is a sure indication of the malice that has crept into the manufacturing sector of Kerala.

Abraham (1989) opined that the weakest link in the small-scale sector is in marketing.

Alice (1990) concluded that regional factors have been so strong as to over power the effect of structural factors and make Kerala's industrial growth rate negligible.

Kannan (1991) cited lack of infrastructure such as energy and transport as the major blockade on industrialisation.

Baby (1992) suggests that the industries that would diversify Kerala's industrial structure through linkages like electronics and petrochemical products especially plastics should be identified as thrust area.

Homi (1993) who studied the marketing strategies of small and tiny units recommended that Government should interfere to provide more marketing facilities to the small-scale sector.

Subrahmanyan and Pillai (1994) in their study 'Modern Small Industries in Kerala – a review of structural change and growth performance' suggested that modern small sector including electronics, plastics, engineering, computer, etc. would have a major role in the future industrial development of Kerala.

According to the Economic Review (2000) of the State Planning Board there was substantial development in the small-scale sector during the last two decades.

Sourabh and Sanjay (1989) in their study 'Indian Leather Industry – The Challenges of Modernisation' clearly depict the role of plastic industry in undermining the traditional leather industry. They have found that in many products like chappals, Hand bag etc. plastic industry is making deep inroads in the leather industry. At the same time they agreed the benefits made to the industry when plastics are jointly used with leather in making some beautiful and long lasting products.

All India Manufacturers Organisation (AIMA), an organisation of small-scale manufacturers and small exporters has also conducted some research on production and exports. AIMO Researchers (1996) have estimated that plastics exports from India will reach at the level of Rs.2 billion by 2005 AD.

Babu and Harilal (2002) have studied about the competitiveness of different industries in Kerala. The study suggested that Kerala ranks last comparing to Karnataka and Tamil Nadu in terms of competitiveness. The State has competitive advantage in industries like food processing, wood and wood products, paper and paper products, Chemical products, rubber, petroleum and plastic products. The study pointed out that the State is characterised by the existence of a

small section of modern sector and a predominant traditional sector with low investment and productivity.

Numerous studies have been made on the impact of plastics consumption on environment. Rathra (1994) in his study 'Plastics Waste and Environment' made it clear that to some extent plastics save wood and hence the forests. He suggested that standardised and regularised recycling process could solve waste management problem. He also reveals that plastics are not environmental hazards and never create any health related problems.

Grove (1987) in his book 'Recycling' explain the use of recycled plastics in cottons fibre, pillow stuffing and car interiors etc. The recycling technology is more advanced now days so that it can recycle the waste product in to the same raw material out of which it is made.

Chandra and Adab (1991) in their study 'Rubber and Plastic Waste – Recycling, Re use and Future Demand' concludes that recycling of plastics grew up rapidly after the increase of oil prices in the mid 70's and it now occupies a common place. In other countries, the composition and

common place. In other countries, the composition and constituents of the plastics is explicitly written on the product while in India manufacturers hide this information due to trade secret. This causes problems in the recycling of plastics.

Susan (1990) in her PhD Thesis, 'Packaging and Environment: Alternative Trends and Solutions', studied in detail about the chemical reactions of plastics waste disposal. Hydrogen Chloride and Dioxin are the pollutants produced by burning plastics in which Dioxin is highly toxic. Long-term effects of Dioxin may include Cancer, Birth Defects and reproductive difficulties. She suggested many remedial measures like avoiding hazardous materials in packaging and use of re usable packages.

According to Sudheer Kumar (2000) incineration has the advantage of 90 per cent volume reduction of plastic wastes.

Clavey (1991) in his article 'Plastic Recycling: Europe reaches 20 per cent' reveals that the content of plastic waste in Municipal Solid Waste is 7.3 per cent by weight and 20 per cent by volume.

Mustafa (1992) in his study on Canadian Plastic Industry, states that Canadian Plastic Industry is growing at an annual rate of 10.3 per cent and gives employment to 1,12,000 people.

Sunderesan (1993) suggests that recycling and re use of industrial waste within the industry or for other purposes would emerge as strategies in industrial waste management.

The World Bank Research Report (2000) states that only 55 percent of the factories compliant with the pollution regulations.

According to Hidenobu (1998) there is a trend that many industrialised countries mandate or at least guide industries to recover waste packaging mainly because of its large contribution to waste stream. However he found that less food packaging increases food waste derived from spoils and damages.

SCOPE OF THE STUDY

Plastics industry plays an important role in the development of modern small-scale sector in Kerala. According to a study

conducted by Centre for Development Studies, Thiruvananthapuram, the State has advantage in industries like food processing, wood and wood products, plastics, paper and rubber products. The plastics industrial units constitute a major share of the industrial units in the industrial estates of each district. The number of plastic industrial units in the small-scale sector amounts to 2864 in 2000-2001. It provides employment opportunities to a number of educated self-employment seekers. The major attraction of the entrepreneurs to this industry is the simplicity of the technology and relatively low capital requirement. The producer has to do only put the input on one end of the machine and collect output from the other end.

The industry provides indirect employment to masses through a chain of activities ranging from the sale of the product to the collection and recycling of waste. The reprocessing sector, apart from solving the urban solid waste management problem to some extent, provides additional raw material to the industry. Still the waste management continues to be a major matter of concern to the environmentalists and the government. The government already banned the consumption of plastic packaging materials at temple shrines and tourist places. It has

also appointed a Committee of Legislatures to look in to the matter, which raised a lot of discussions in the State. Therefore to study the different aspects relating to this industry, which once named 'Sunrise industry' by the Government is of greater scope.

1.5 OBJECTIVES OF THE STUDY

The study analyses the role of plastics in production and consumption. The major objectives of the study are the following.

1. To analyse the growth pattern of plastics industry in India.
2. To analyse the economics of plastics industry in Kerala in terms of costs, prices and profits.
3. To analyse the productivity, factor intensity and efficiency of the industry.
4. To discuss the environmental aspects of plastics consumption.

1.6 DATA AND METHODOLOGY

Sources of Data

The analysis requires both primary and secondary data. While primary data are required for the analysis of financial performance of plastic industries, secondary data are relevant for the overall analysis of the industry.

The primary data is collected through a sample survey. A selected number of large, medium and small-scale units constitute the sample. The method of stratified random sampling is used for sampling. The sample units are stratified according to investment and type of product.

The samples are selected from three districts namely Kozhikkode, Thrissur and Alappuzha. The three districts are selected from the three zones of the state say North, Middle and South. While Thrissur is the district with maximum number of units, Kozhikkode keeps a middle position and Alappuzha having a lowest position in terms of the number of units of plastics industry. At the same time all of the three are leading districts in the number of small-scale units.

Twenty units are selected from each of the three districts so that the total sample size is 60. These 20 units are selected by taking a proportionate sample of the different classes classified according to investment.

A questionnaire is prepared for collecting the details about investment, employment, output, value added, fixed capital, working capital, wages, raw materials, cost of production, sales revenue etc.

Methodology

Major aspects of the study are the growth of the industry during recent period; say 1980-2000, in terms of number of units, investment, employment, output, value added, and exports. Techniques to be used are different growth models like, linear, log linear and exponential models.

Growth Models

The Linear Growth Model, $Y = A + Bt$

The exponential Growth Model $Y = AB^t$

The Compound Growth Rate = (1-b)*100

The exponential Growth Model $Y = AB^t$

The Compound Growth Rate = (1-b)*100

Financial Ratios

To quantify and analyse the performance of the industry, economic indicators like debt equity ratio, gross profit margin, operating margin, rate of return on investment, capital output ratio, output labour ratio, capital labour ratio etc. are to be used.

Debt Equity Ratio

This ratio indicates the share of external finance in total capital investment.

$$\text{Debt Equity Ratio} = \frac{\text{External capital}}{\text{Total Capital}}$$

Gross Profit Margin

This is a measure of profitability, which is defined as the ratio of gross profit to net sales.

$$\text{Gross Profit Margin} = \frac{\text{Gross Profit}}{\text{Net Sales}}$$

Operating Margin

This is a ratio of net sales to total operating expenses. This is a short-term measure of profitability showing operating efficiency of the firm.

$$\text{Operating Margin} = \frac{\text{Net Sales}}{\text{Operating Cost}}$$

Rate of Return on investment

This is defined as the gross profit as the percentage of total fixed assets of the firm. The ratio reflects the long-term profitability of the firm.

$$\text{Rate of Return on investment} = \frac{\text{Gross profit}}{\text{Fixed cost}} \cdot 100$$

Capital Output Ratio

This is a measure of capital productivity in the industry.

$$\text{Capital Output Ratio} = \frac{\text{Value Added}}{\text{Total Investment}}$$

Labour Output Ratio

This is a measure of the productivity of labour in the industry.

$$\text{Labour Output Ratio} = \frac{\text{Total wage Bill}}{\text{Value Added}}$$

Capital Labour Ratio

This is an indicator of the nature of technology used in the industry'

$$\text{Capital Labour Ratio} = \frac{\text{Total Investment}}{\text{Total wage bill}}$$

Production Function Approach

Production function analysis gives direct measures for the productivity and efficiency of the industry. The linear homogeneous production function, say, Cobb-Douglas Production Function is used for this purpose.

Cobb-Douglas Production Function is of the firm

$$Q = A K^{\alpha} L^{\beta} U$$

Where Q is the total output,

K is the total capital

L is the total wages

α and β are the elasticity of production with respect to capital and labour. A is the efficiency coefficient. U is the random element.

Cobb-Douglas Production Function can be expressed in the logarithmic form as follows.

$$\text{Log } Q = \log A + \alpha \log K + \beta \log L + \log U$$

$$\text{i.e., } q = a + \alpha k + \beta l + u$$

The model is now in the linear form with parameters, a, α and β. This model can be estimated using ordinary least square method.

The advantages of fitting a Cobb-Douglas Production Function are the following.

The parameter A, which is called the efficiency parameter, can be used directly to compare the efficiencies of different industrial sectors.

The parameters α and β are the partial elasticity of output with respect to capital and labour respectively.

We can compute the rate of return on investment by simply adding the output elasticity.

Rate of return $= \alpha + \beta$

Factor Intensity, in the production technique can be computed using the formula,

Factor Intensity $= \beta / \alpha$

This model will be applied for product wise and investment wise classified samples.

Survey on Environmental Issues

The extent and pattern in plastic consumption in Kerala has been studied with the help of a sample survey. The survey was conducted in Thrissur district of Kerala.

The households are classified into four groups according to the area they live. They are Urban, Semi Urban and Rural. The Urban households are again divided into those living in Apartments and those living in independent houses. This is because of the fact that the methods of disposal of waste are very much different in these two sections of households. A total of 100 households are selected for the study.

Their consumption of plastics has been recorded for the month of September 2001. The survey was conducted in such manner that the households are requested to record their consumption of plastics for a month. For this purpose a printed schedule has been given to all the households.

The schedule is also used to collect more information such as the family income, family size, the methods of disposal of plastic waste and their opinion about impact of plastic consumption on environment. The model of the schedule is given in Appendix.

The data has been analysed using simple statistical tools including correlation and regression.

1.7 PLAN OF THE STUDY

The study is chapterised in such a way that each chapter discuss the aspects corresponding to each objective.

The chapter I is to give a brief introduction to the topic, review of selected literature, the scope of the present study, its objectives the methodology used and source of data. The second chapter is meant for presenting and analysing the current status of plastics industry in India. Chapter III is determined to analyse the economics of plastic industries in the State in terms of financial performance of the selected sample units.

The chapter IV will analyse the productivity and efficiency of the industry. The fifth chapter is to discuss the environmental issues relating to plastics consumption. Chapter VI will summarise the finding and conclusions of the study as well as giving some suggestions for the future development of the industry.

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PLASTIC INDUSTRY IN INDIA

M.S.Suresh Kumar " Economics of plastic industry in India with special reference to Kerala " Thesis. Department of Economics , Dr.John Matthai Centre , University of Calicut, 2003

Chapter II

PLASTIC INDUSTRY IN INDIA

CONTENTS

2.1 Growth of Plastic Industry In India

Indian Plastic Industry is nearly five decades old and it is still in the developing stage, compared to the developed countries. The industry is growing slowly keeping in pace with domestic demand. The consumption of plastic in India is increasing every year and now the per capita consumption is 1.7Kg. 13Kg. is the world average and 60Kg. in developed countries. Now the plastic industry has a very important role in the national economy. About 60,000 units mostly in the small-scale sector are engaged in producing plastic goods for an ever-expanding international market. The overall investment in this sector is around Rs.28,350 crore. The industry provides direct employment to 12.5 lakh people and indirect employment to 70 to 80 lakh people. At present commodity plastic production reached 5 Million Tonnes. The industry registered a growth rate of 18.8 per cent. The total value of production of plastic goods in this country is estimated to be over 10,000 crore.

The Indian Plastic Industry made a modest start in about 1926 with the manufacture of combs, soapboxes, ash treys and other domestic products from imported Cellulose sheets and rods. It was only after World War II Indian Plastic Industry began to

make a rapid progress. Several new units were established for the fabrication of moulded plastic goods. The number of units increased from 40 in 1948 to 80 in 1956, with a total capital investment of Rs.60 Million and employing nearly 10,000 workers. Apart from manufacturing a host of small utility products, industry had also started producing bigger items and industrial goods like carboys, buckets, electrical fittings, radio cabinets, gramophone records, telephone equipments and so on. Other important developments took place during this period is the use of Poly Vinyl Chloride (PVC).

The total installed capacity and actual production of various moulding powders at the commencement of the Second Five Year Plan (1956-57) were 1200 tonnes and 800 tonnes per annum respectively. The actual capacity achieved by the end of 1960-61 was 15,800 tonnes and production reached at 9,600 tonnes. The production of plastic goods and materials worth Rs.100 million in 1956 rose to Rs.200 million in 1960. Extrusion of PVC and Polythene pipes and the use of Polystyrene were some of the notable advancements during this period. The industry has also increased export earnings from Rs.0.741 million in 1956-57 to Rs.7.603 million in 1961-61[3].

The installed capacity for the production of various plastics raw materials had sharply increased in 1960's. In 1963, the production of plastic materials was about 90,000 tonnes against the total installed capacity of 1,36,000 tonnes. The main reason for production did not achieve the installed capacity was that severe restrictions imposed on the import of basic chemicals due to tight foreign exchange position. In sixties, there were about 100 units in the large-scale sector engaged in the manufacture of various plastic products. Bulk of plastic processing units is, however, in the small-scale sector, which is accounted for over 80 per cent of raw materials consumed in the country.

The industry was growing slowly during 1970-80 keeping in pace with domestic demand. During this period, raw materials consumption increased to 97,000 million tonnes. The investment in this sector reached at Rs. 8,01,160 crores. During 1980-81 the number of persons engaged in this industry was 1,11,000.

The major developments in the plastic industry took place during the last 20 years. 80's witnessed a rise in the modern small-scale sector in India. Due the changes in government policies towards small-scale sector, import of raw materials was

made liberal and exports were promoted with a series of measures introduced then. As a result of these, plastic industry has shown a steep growth during this period. The following table shows the growth of plastics industry during the period of 1983-2000.

Table 2.1: Growth of plastic industry in India

Year	No. of Factories	Annual Growth Rate	Value Of Output (Rs.crores)	Annual Growth Rate
1983-84	3240	-	15802.4	-
1984-85	3392	4.69	17289.3	9.41
1985-86	3243	-4.39	16937.2	-2.04
1986-87	3396	4.72	17979.6	6.15
1987-88	3590	5.71	19518.0	8.56
1988-89	3997	11.34	21550.4	10.41
1989-90	5047	26.27	22579.8	4.78
1990-91	5689	12.72	24519.0	8.59
1991-92	6627	16.49	23969.6	-2.24
1992-93	7971	20.28	32169.4	34.21
1993-94	8962	12.43	39295.6	22.15
1994-95	10475	16.88	45713.2	16.33
1995-96	12091	15.43	60484.4	32.31
1996-97	15181	25.56	73336.7	21.25
1997-98	18265	20.31	86187.6	17.52
1998-99	23936	31.05	103434	20.01
1999-2000	30016	25.40	126767	22.56

Source: Annual Survey of Industries

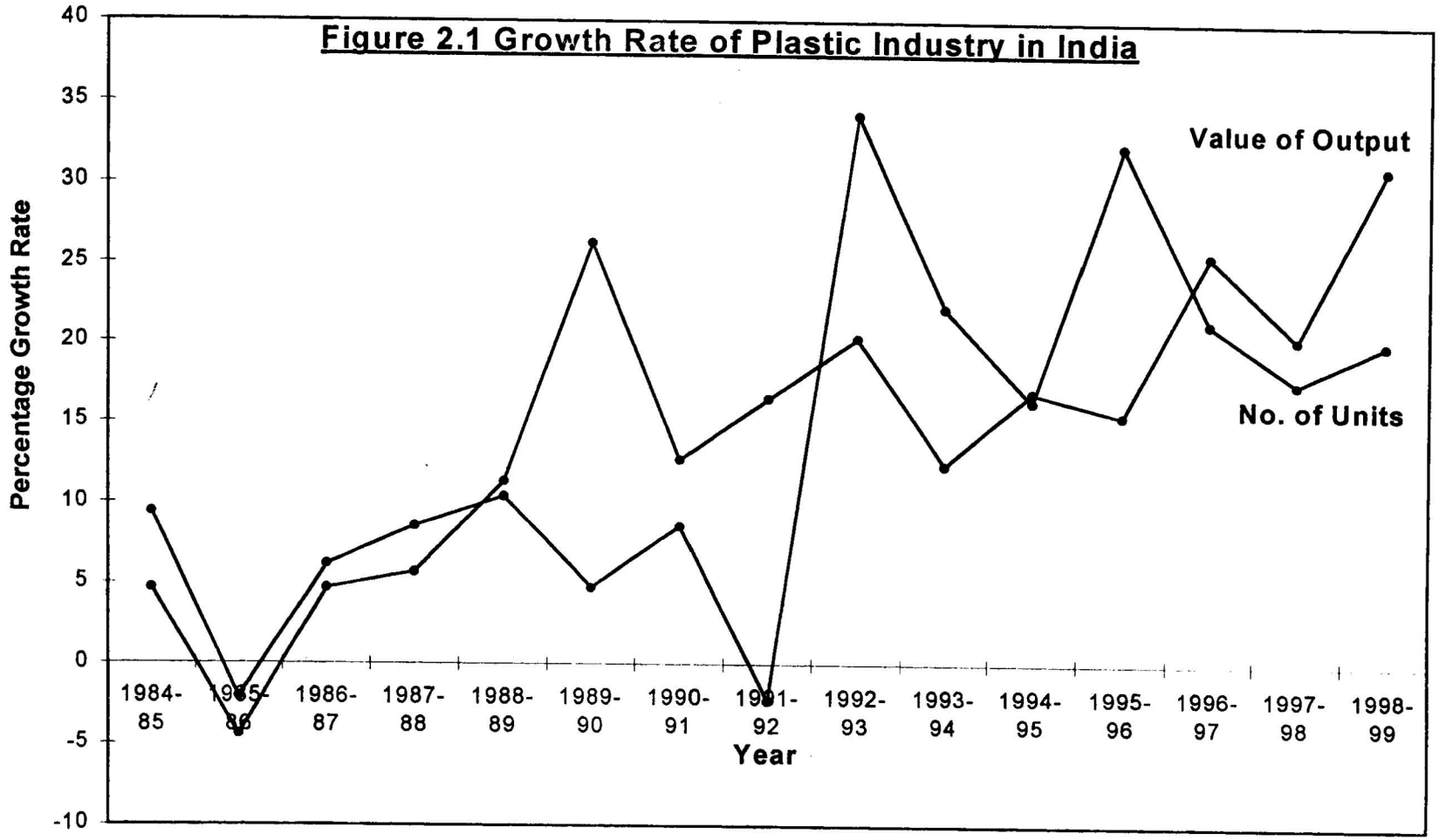


Figure 2.1 Growth Rate of Plastic Industry in India
Percentage Growth Rate
40
35
30
25
20
15
10
5
0
-5
-10
Value of Output
No. of Units
1984-85
1985-86
1986-87
1987-88
1988-89
1989-90
1990-91
1991-92
1992-93
1993-94
1994-95
1995-96
1996-97
1997-98
1998-99
Year

The table shows a moderate increase both in number of units and output produced. This trend can be also understood looking on the line chart given above.

The compound growth rate of the number of units for the period from 1983-84 to 1991-92 is 10.78 per cent and that for the period from 1992-93 to 1999-2000 is 21.47 per cent. The compound growth rate in the value of output for the corresponding periods are 7.09 per cent and 21.91 per cent respectively. The high growth rate for the period 1992-2000 is due to the industrial liberalisation process and the corresponding reduction in import restrictions. The import duty was reduced very much on plastic raw materials and other petrochemicals. In addition, the sales tax exemption and export promotion measures also became a boost to the industry.

2.10 Structure Of Plastic Industry In India

The economy of plastic industry in India veers around three sectors.

(1) The basic raw material sector, which uses materials like Naphtha, Benzene, Alcohol, Carbide, etc. to

produce intermediates, which are used in the manufacture of rexins.

(2) Plastic rexin sector which producing thermosetting and thermoplastic rexins.

(3) The ultimate conversion sector, which manufactures plastic products of utility such as household and electrical appliances, decorative, laminates, fittings, etc.

The three sectors are so interlinked that bent here or there in this link upsets the delicate balance among them. This is what happened on account of oil crisis resulting in the scarcity of basic building blocks for the industry. Another so rigid link is the conversion sector, which is ultimate end user of the plastic raw materials. The shortage of raw materials is a common problem faced by this sector, which comprise mostly of small and medium operators, that gets hit below the belt in any crisis.

Now more firms are engaged in moulding branch of plastics industry. Dies and moulds are important items for the moulding

industry that are mostly imported. Electrical, lighting and fitting accessories, buttons, bottle caps; industrial accessories and radio cabinets are some of the important articles so far made by compression moulding process. A host of toilet articles, combs, soap cases, toothbrush handles, wall tiles etc. are produced by the method of injection moulding.

Fabrication methods are employed for production of spectacle frames, fountain pens, travel bags, rain coat, etc. Wrist belts, straps, insulated wires, cables and flexible are produced from PVC by extrusion process. The manufacture of leather cloth by coating textiles with PVC has become well established. India is able to produce this material more economically than foreign countries. With the development of industries that consume plastics, such as telephone and automobiles, the demand for plastics has increased in India.

Machines and accessories are vital for the production of plastics goods. It is necessary for Indian industry to keep in view the advancement made on the mechanical side of the industry in other countries and import up to date equipment. It is essential that the moulding industry may produce its own moulds, if it is compete successfully with imported products

Equipments required for making moulds cannot be afforded by a small moulder in India who has to buy the imported moulds which are expensive. The main cost for making moulds is the labour cost which are much higher in other countries. Moulds can be made more economically in India provided the necessary technical assistance for design and production is secured.

2.3 The Role of Small Scale Sector in Plastics Industry

The small-scale sector occupies a prominent position as far as plastics industry is concerned. More than 95 per cent of the plastics processing units are in the small-scale sector. In addition, there are a large number of small units, which are not registered with the State Directorate of Industries.

The small-scale sector consumes more then 80 per cent of the raw materials produced in the country. As a matter of fact, their share in product market is 80 to 90 per cent. The major factors attracting the small sector into plastics industry are the following (Express Exim Review, 1996).

(i) Plastics processing industry requires less investment in plant and machinery compared to other sectors of industry

(ii) It requires simple technology so that a common man can operate the machines. An entrepreneur is required to place the raw material in one end of the processing equipment and take out the product from the other end.

(iii) A very ready demand for the produced items irrespective of quality.

The small sector is mainly concentrated in the ultimate conversion sector. The major items produced by this sector include household goods, kitchen wears, toilet items, toys, etc.

The Small Industry Development Corporation (SIDCO) encouraged a number of new items in the field of plastics processing. Some of them are acrylic sheets, huge plastics containers, PVC foot wear, PVC pipe and fittings, polypropylene box strapping, etc. The government reserved more than 200 items exclusively for the development of small-scale sector in plastics industry.

The main thermoplastics raw materials being manufactured in the country at present are polythene, poly vinyl chloride and polystyrene. Whereas the production of these raw materials is carried out in the large-scale sector, the conversion industry is concentrated in small-scale sector.

At present, there are about 30,000 units throughout the country engaged in the manufacture of various plastics products. These units manufacture a variety of items both for consumption and industrial uses. This sector employs 750,000 workers. The concentration of processing units is in Maharashtra, Gujarat, Karnataka, New Delhi, West Bengal and Uttar Pradesh.

The following table gives the installed capacity in small-scale sector in India for processing of plastics. There are two sections of the industry, say, extrusion and moulding.

Table 2.2. Installed capacity in small scale sector for plastic processing

	Purpose	Installed capacity (in Million Tonnes)
Extrusion	Film	66,346
	Pipes	20,366
	Sheet	5,140
	Mono filaments	7,949
	Slit films	14,366
	Profiles	4,268
	Wires and cables	26,933
	Extrusion coating	12,000
	Total	157,368
Moulding	Auto injection	49,878
	Hand injection	8,286
	Auto blow	17,416
	Hand blow	1,128
	Calendaring	9,933
	Fabric coating	6,266
	Others	1,400
	Total	93,707
	Grand Total	251,075

Source: SIRI (1987). *Modern Plastics Industry*, New Delhi, Vol.1, pp.32-34

The installed capacity for extrusion is 157,368 MT and for moulding is 93,707 MT with a total capacity of 251,075 MT of output per year. This constitutes a major share output in plastic industry in India.

2.4 Product-wise trend in plastic industry

As we go through the data we can see that the plastics raw material sector was recorded a very low growth rate compared to that of the final processing sector. This is the reason for periodical shortage of raw materials and increasing import burden of synthetic plastics resins. For the sake of analysis we classify the industry into four product groups in accordance with the ASI Data. The following are these product groups.

A. Manufacture of synthetic resins, plastic materials and synthetic fibers like nylone, torylen etc.

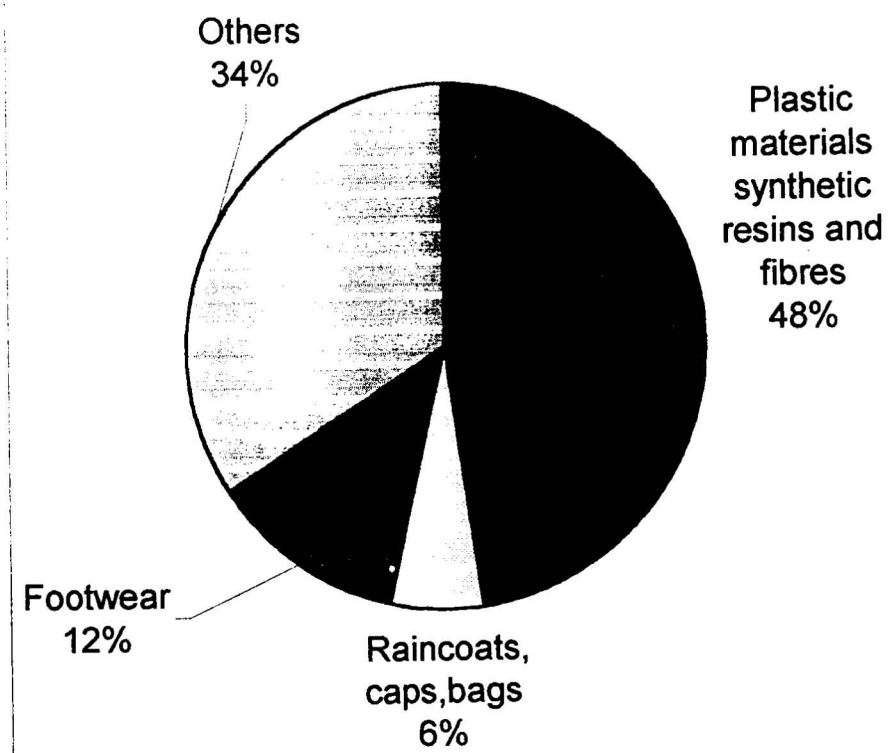
B. Manufacture of raincoats, hats, caps and school bags etc. from waterproof textile fabrics or plastic sheets.

C. Manufacture of footwear made primarily of vulcanised or moulded plastics.

D. Manufacture of plastic products not elsewhere classified.

The relative role of these product groups in total output is given in the following pi-diagram.

Figure 2.2 Relative role of different product groups



The figure shows that the highest producing sector is the raw material sector producing with a relative share of 48 per cent in output. Now we examine the trend in this sector given in table 2.3

Table 2.3 Manufacture of synthetic resins, plastic materials and synthetic fibers like nylone, torylen etc.

Year	No. of Factories	Percentage Growth	Value of Output (Rs.'000 Lakhs)	Percentage Growth
1985-86	183	-	82681	-
1986-87	235	28.42	145494	75.97
1987-88	243	3.40	173389	19.17
1988-89	250	2.88	178062	2.70
1989-90	346	38.40	207746	16.67
1990-91	264	-23.70	245873	18.35
1991-92	221	-16.29	88874	-63.85
1992-93	249	12.67	228802	157.45
1993-94	235	-5.62	165168	-27.81
1994-95	232	-1.28	376224	127.78
1995-96	295	27.16	428459	13.88
1996-97	271	-8.14	512286	19.56
1997-98	309	14.02	1094538	113.66
1998-99	242	-21.68	827864	-24.36
1999-2000	278	14.88	1695023	104.75

Source: Annual Survey of Industries

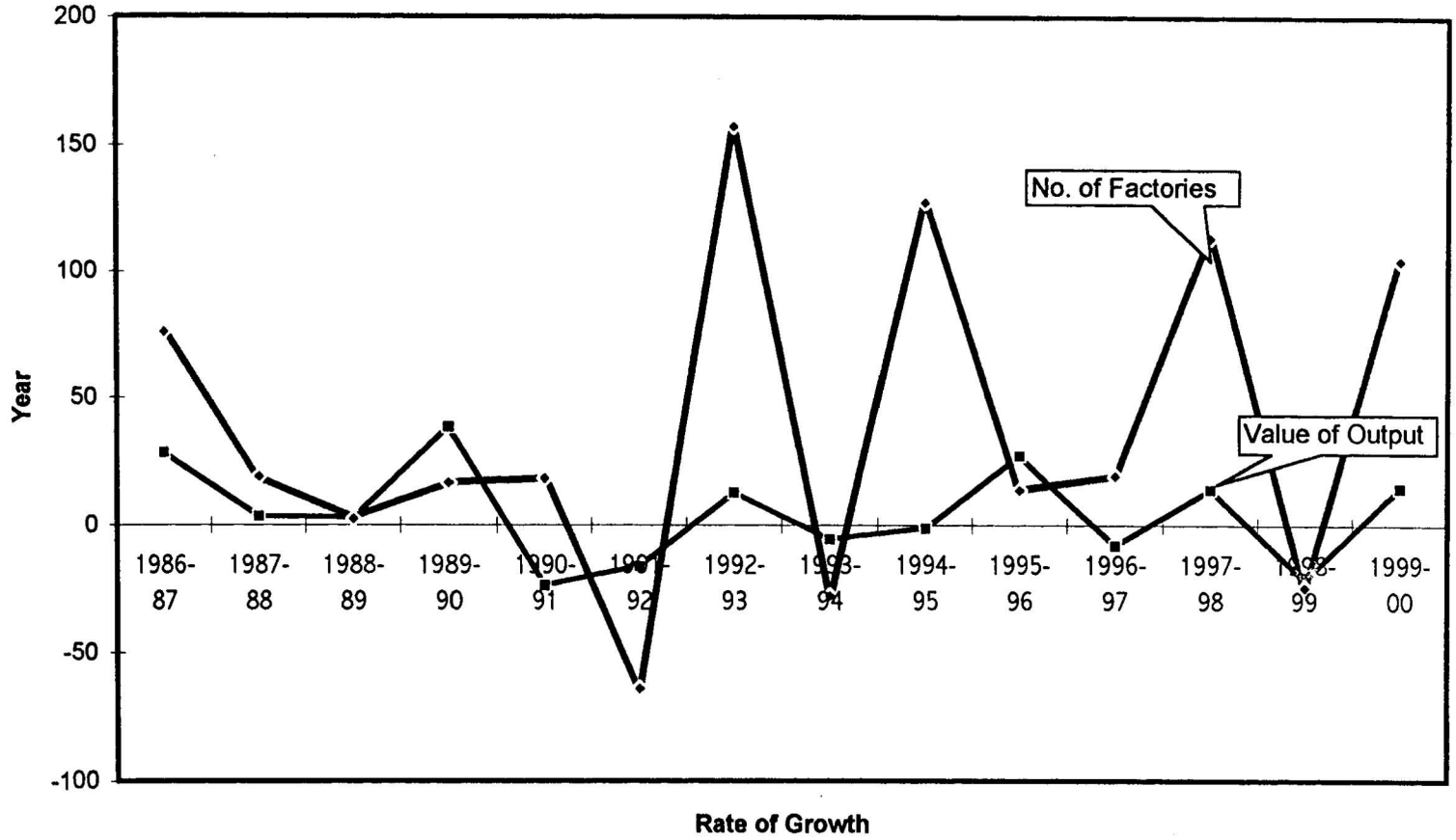
The synthetic resin sector is very week in India compared to western countries. This is evident from the data, which shows a very disturbing trend both in terms of the number of units and value of output.

The compound growth rates in number of units and value of output are 1.42 per cent and 18.98 per cent respectively. The growth of the industry is not normal even have negative trends in some years.

The very deviating trend in the output is due to the problems faced by the petroleum sector during the past. The changes in petrochemical prices and the important restrictive government policies were also contributed to this.

The trend in the number of units and output is graphically represented in the following figure.

Figure 2.3 Growth of plastics resin sector in India



The second largest sector in output is the manufacture of raincoats, hats, caps, school bags etc. They are made out of waterproof textile fabrics or plastic sheets. The growth rate of this sector is given in table 2.4. and the figure 2.3.

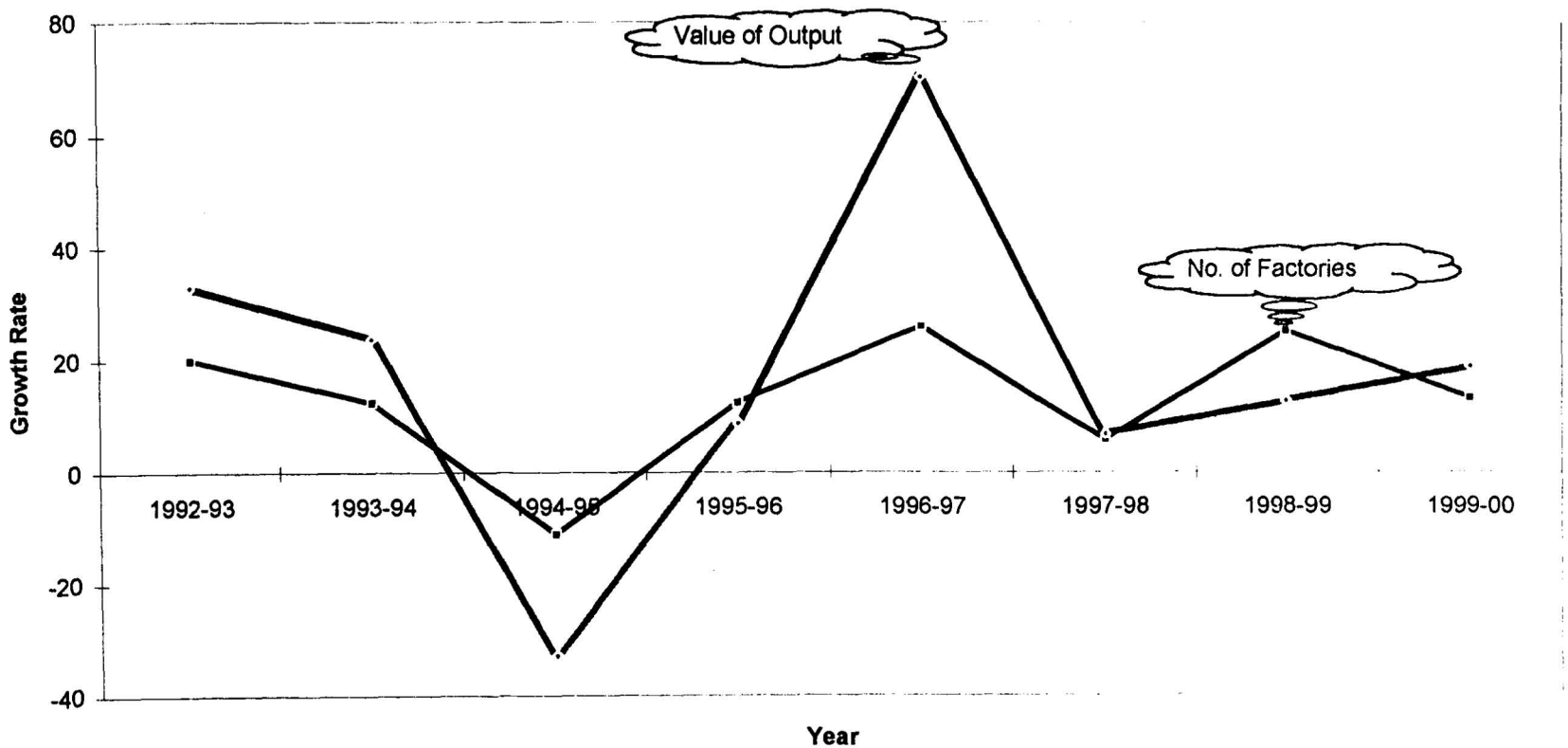
2.4 Manufacture of rain coats, hats, caps and school bags etc. from waterproof textile fabrics or plastic sheets

Year	No. of Factories	Percentage Growth	Value Of Output (Rs.'000 Lakhs)	Percentage Growth
1991-92	20	-	1803	-
1992-93	24	20.00	2400	33.11
1993-94	27	12.50	2973	23.88
1994-95	24	-11.11	2000	-32.73
1995-96	27	12.50	2179	8.95
1996-97	34	25.93	3716	70.54
1997-98	36	5.88	3968	6.78
1998-99	45	25.00	4477	12.83
1999-00	51	13.33	5327	18.99

Source: Annual Survey of Industries

This industry using plastic thick films to produce Plastic bags, Raincoats, hats, caps etc. is very met with low demand compared to other products of plastics. The compound growth rate in number of units and output of this sector are 23.87 and 36.63 respectively. These products also registered a negative growth rate during 1994-95.

Figure 2.4 Growth of Manufacture of rain coats, hats, caps and school bags etc. from waterproof textile fabrics or plastic sheets



The figure shows that the industry is not showing a steady growth rate during the period. This is due to unexpected fluctuations in availability and price of raw materials due to fluctuations in international petroleum market. Import of raw materials could not be carried out effectively in order to run the factories unaffected. The production have to be stalled for weeks or even months due to lack of raw materials. The foreign exchange crisis and changes in industrial policy were also reasons for week import.

Although there exist a large number of unregistered units as cottage industries and a large number of persons making coats, bags, caps, belts, etc, from flexible plastic sheets, they do not come under the purview of Annual Survey of Industries. There is also a practice of using plastics with leather, rubber, jute etc for making such products, which are often accounted in the respective industries.

Another important sector where plastics have made use is the foot wear industry. Plastic footwear industry is one of the most growing industries in India. This industry includes units producing chappals, shoes, etc out of pure plastics only. A large number of unregistered units are also exists in this sector.

It is an important sector in small-scale industries in the country. The growth of this industry is given in the following table.

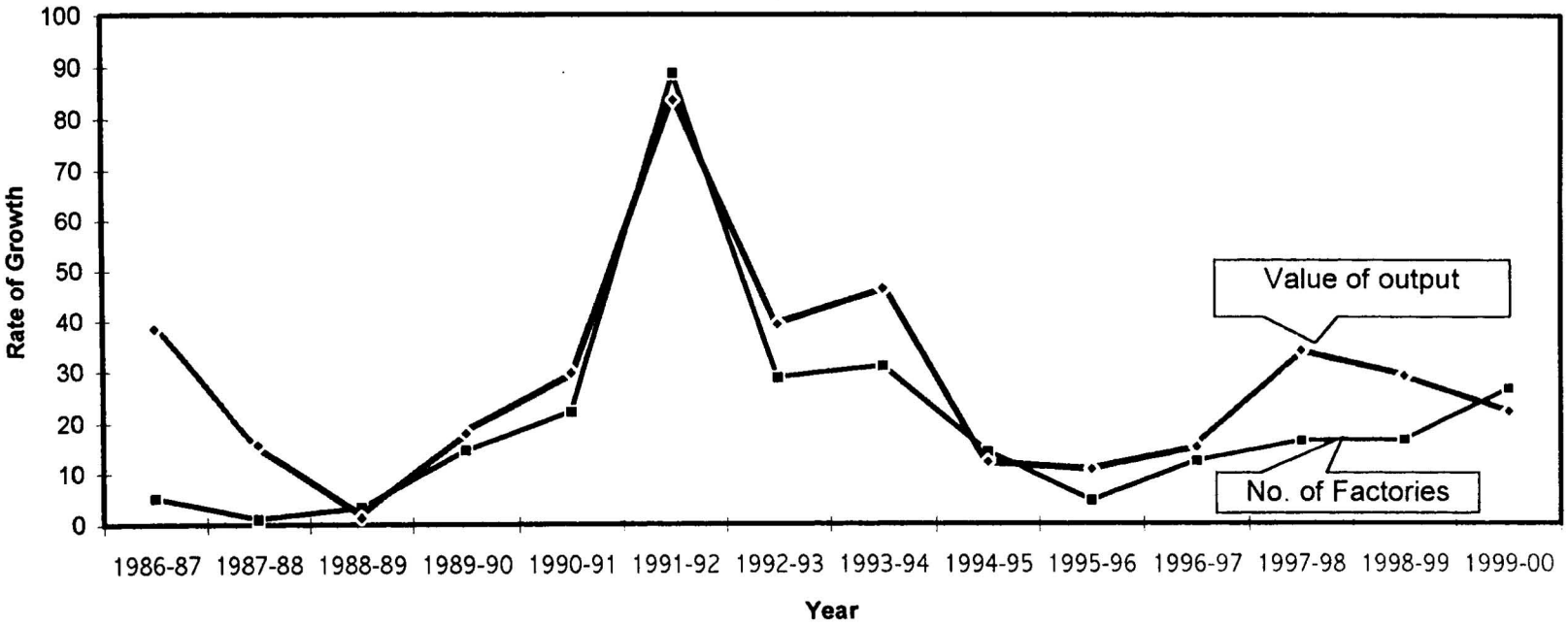
Table 2.5 Manufacture of footwear made primarily of vulcanised or moulded plastics

Year	No. of Factories	Percentage Growth	Value Of Output (Rs.'000 Lakhs)	Percentage Growth
1985-86	176	-	18,800	-
1986-87	185	5.11	26,057	38.60
1987-88	187	1.08	30,140	15.67
1988-89	193	3.21	30,575	1.44
1989-90	221	14.51	36,110	18.10
1990-91	270	22.17	46,894	29.86
1991-92	510	88.89	86,178	83.77
1992-93	657	28.8	120,138	39.41
1993-94	861	31.05	176,083	46.57
1994-95	983	14.17	197,474	12.15
1995-96	1028	4.58	218,622	10.71
1996-97	1154	12.26	251,790	15.17
1997-98	1343	16.38	337,985	34.23
1998-99	1565	16.53	437,088	29.32
1999-2000	1981	26.58	533,969	22.17

Source: Annual Survey of Industries

The growth rate of this industry is graphically plotted in the figure given below.

Figure 2.5 Growth of plastics Footwear sector in India



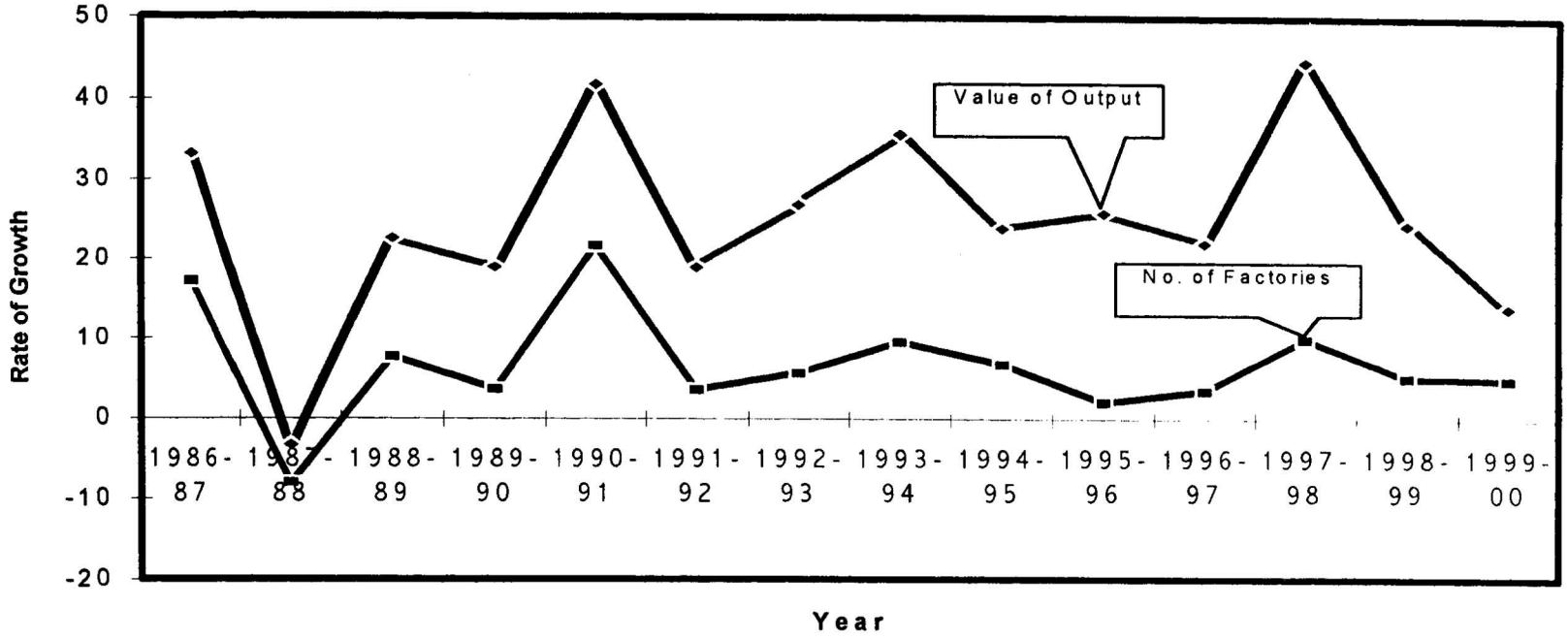
Footwear constitutes a major share of plastic products produced in the country. The plastic footwears are very much popular among common man due to its beauty, lightweight, less cost, and lasting. The compound growth rate of this industry in terms of number of units and output are 25.14 per cent and 26.08 per cent respectively. The growth rate of plastic footwear industry is very high compared to the footwear industry as a whole.

Table 2.6 Manufacture of plastic products not elsewhere classified

Year	No. of Factories	Percentage Growth	Value Of Output (Rs.'000 Lakhs)	Percentage Growth
1985-86	1683	-	56543	-
1986-87	1972	17.17	75342	33.25
1987-88	1813	-8.06	72843	-3.32
1988-89	1953	7.72	89342	22.65
1989-90	2023	3.58	106324	19.01
1990-91	2463	21.75	150737	41.77
1991-92	2550	3.53	179368	18.99
1992-93	2694	5.65	227713	26.95
1993-94	2953	9.61	309143	35.76
1994-95	3153	6.77	383341	24.00
1995-96	3217	2.03	482543	25.88
1996-97	3330	3.51	589224	22.11
1997-98	3665	10.06	852217	44.63
1998-99	3855	5.18	1060488	24.44
1999-00	4046	4.95	1209682	14.07

Source: Annual Survey of Industries

Figure 2.6 Growth of plastics products not elsewhere classified in India



This group constitute a large number of products made of plastics, which includes household utensils, toilet wears, small bottles, packaging, etc. The large chunk of small-scale sector units is included in this category. The compound growth rate of the number of units and value of output are 7.19 per cent and 26.76 per cent respectively. This sector of modern small-scale industries registered a high growth rate during recent times.

2.5 Investment

Plastic processing is a most modern industry, which requires less capital and less labour. The industry is mainly engaged in processing of plastic raw materials in to different shapes by applying heat and or pressure. The technology is so simple so that an unskilled man can run the industry with a very short-term training. Financial requirement is also less compared to other industries like metals, glass, ceramics, etc. This is the reason for the rapid growth of the industry as part of modern small-scale sector.

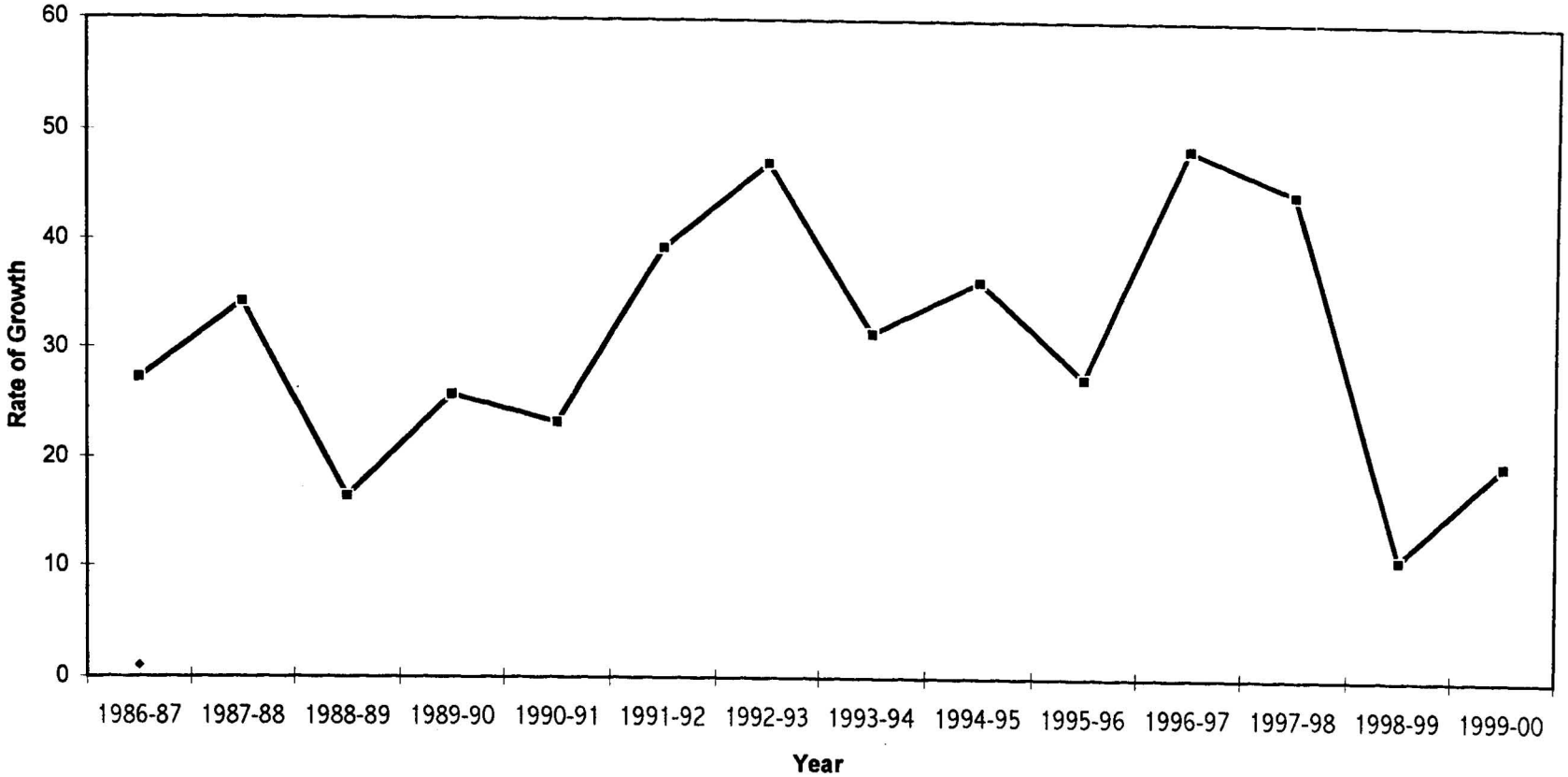
The following table gives the investment in the industry for different product groups according to the Annual Survey of Industries. The tables are given for different product groups, which are mentioned above.

Table 2.7 Growth of Investment in Manufacture of synthetic resins, plastic materials and synthetic fibers like nylone, torylen etc.

Year	Fixed Capital (Rs.'000 Lakhs)	Working Capital (Rs.'000 Lakhs)	Total Investment (Rs.'000 Lakhs)	Percentage Growth
1985-86	31,477	22,032	53,509	-
1986-87	40,574	27,485	68,059	27.19
1987-88	61,412	29,895	91,307	34.16
1988-89	79,315	26,971	106,286	16.41
1989-90	96,788	36,791	133,579	25.68
1990-91	128,752	35,801	164,553	23.19
1991-92	188,736	40,457	229,193	39.28
1992-93	283,462	53,737	337,199	47.12
1993-94	371,463	71,656	443,119	31.41
1994-95	511,438	92,103	603,541	36.20
1995-96	648,343	120,418	768,761	27.38
1996-97	986,611	154,943	1,141,554	48.49
1997-98	1,387,937	260,327	1,648,264	44.39
1998-99	1,537,049	290,859	1,827,908	10.90
1999-00	1,865,478	323,464	2,188,942	19.75

Source: Annual Survey of Industries

Figure 2.7 Growth of Investment in plastics resin sector in India



The investment in this industry has been increased at a compound growth rate of 30.82. This shows that the plastic industry has attracted investment at very high rate than any other industry in the manufacturing sector of India. During the same period the growth rate of investment in the manufacturing sector as a whole was only 15.10.

Following table gives the trends in investment in the manufacturing of raincoats, hats, caps and school bags in India.

Table 2.8 Growth of Investment in Manufacture of rain coats, hats, caps and school bags etc. from waterproof textile fabrics or plastic sheeting

Year	Fixed Capital (Rs.'000 Lakhs)	Working Capital (Rs.'000 Lakhs)	Total Investment (Rs.'000 Lakhs)	Percentage Growth
1991-92	1005	205	1210	-
1992-93	1153	231	1384	14.38
1993-94	1166	445	1611	16.40
1994-95	1177	634	1811	12.42
1995-96	1269	866	2135	17.90
1996-97	1705	1154	2859	33.91
1997-98	2741	1163	3904	36.55
1998-99	3609	1258	4867	24.67
1999-00	4359	1583	5942	22.09

Source: Annual Survey of Industries

Figure 2.8 Growth of Investment in Manufacture of rain coats, hats, caps and school bags etc. in India

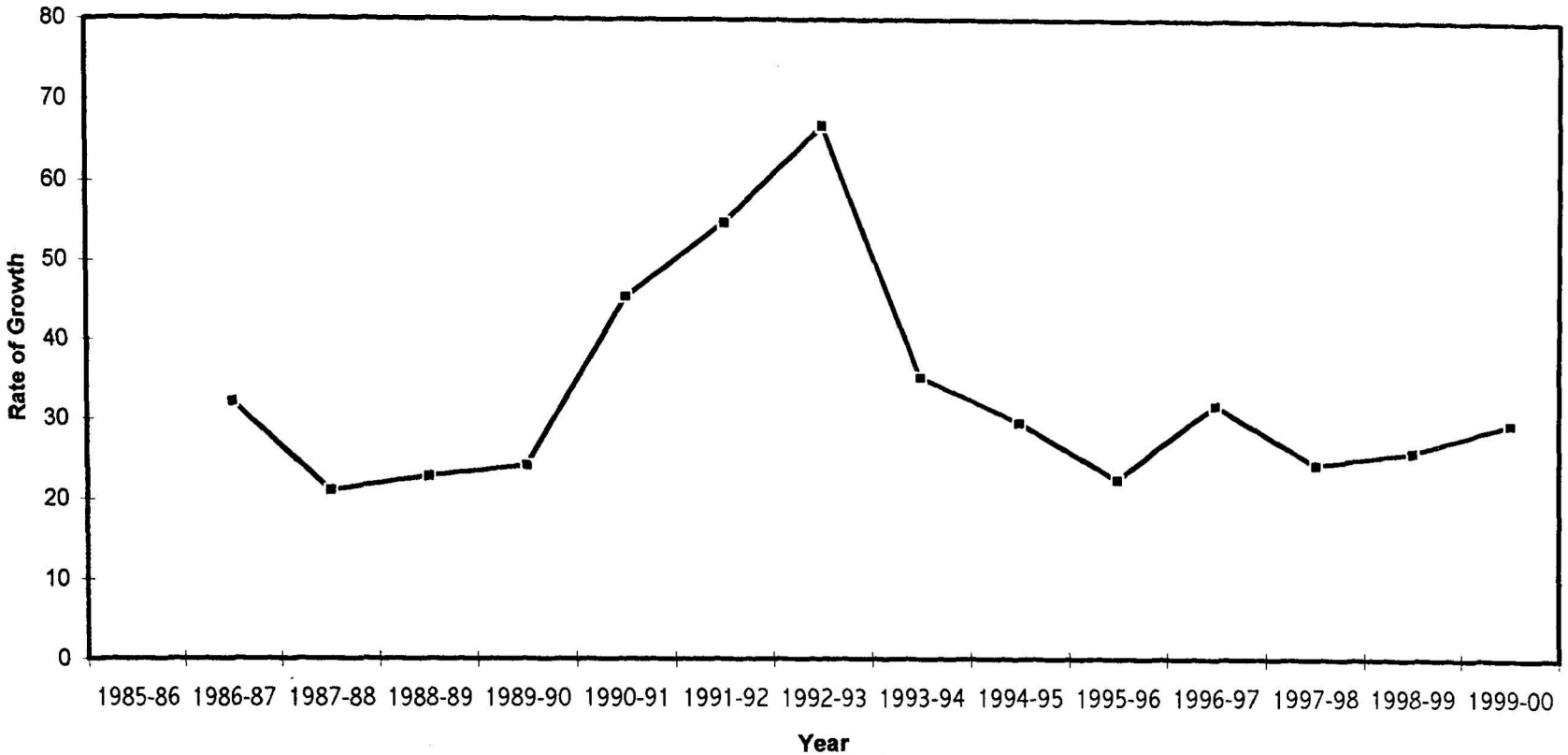
This sector showed almost a steady growth rate in investment during the period from 1992-93 to 1999-2000. The average annual growth rate in investment was 22.29 per cent. This is again a higher rate than the overall industrial sector of India during the same period.

Table 2.9 Growth of Investment in Manufacture of footwear made primarily of vulcanized or moulded plastics

Year	Fixed Capital (Rs.'000 Lakhs)	Working Capital (Rs.'000 Lakhs)	Total Investment (Rs.'000 Lakhs)	Percentage Growth
1985-86	2,356	1,558	3,914	-
1986-87	3,505	1,666	5,171	32.12
1987-88	4,458	1,801	6,259	21.04
1988-89	5,709	1,977	7,686	22.80
1989-90	6,720	2,821	9,541	24.13
1990-91	9,313	4,560	13,873	45.40
1991-92	13,312	8,163	21,475	54.80
1992-93	23,543	12,276	35,819	66.79
1993-94	28,140	20,302	48,442	35.24
1994-95	35,262	27,425	62,687	29.41
1995-96	45,107	31,671	76,778	22.48
1996-97	65,483	35,575	101,058	31.62
1997-98	75,639	50,029	125,668	24.35
1998-99	90,896	67,245	158,141	25.84
1999-00	116,392	88,148	204,540	29.34

Source: Annual Survey of Industries

Figure 2.9 Growth of Investment in Plastic Footwear industry in India



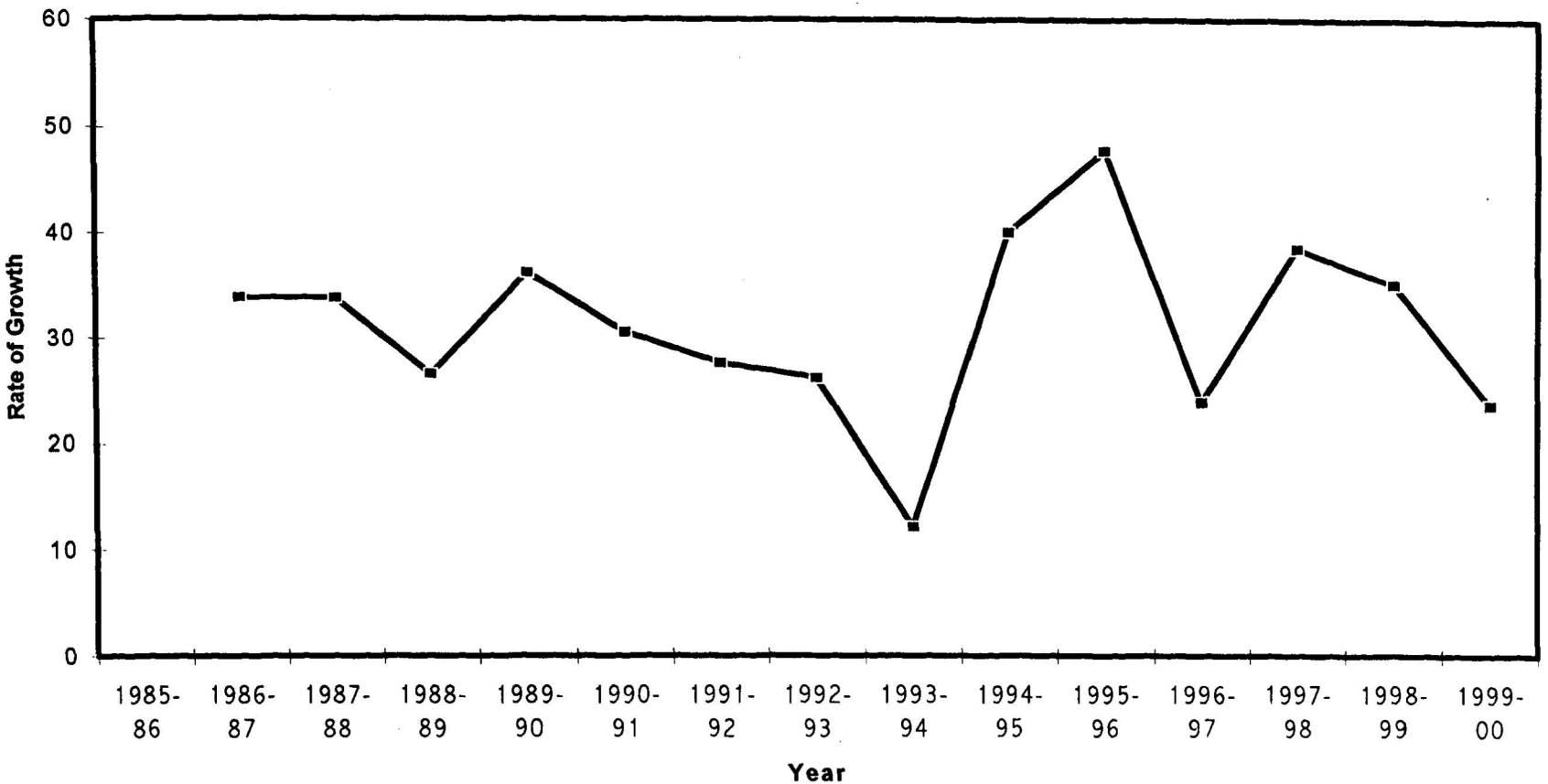
The investment in plastic footwear industry has been rapidly increased in recent years. The average annual growth rate of this sector is 33.24 percent and is higher the average of the manufacturing sector for the same period. The footwear industry, which has attracted huge amounts of investment, also has a good export performance during the period.

Table 2.10 Growth of Investment in Manufacture of plastic products not elsewhere classified

Year	Fixed Capital (Rs.'000 Lakhs)	Working Capital (Rs.'000 Lakhs)	Total Investment (Rs.'000 Lakhs)	Percentage Growth
1985-86	13,688	9,005	22,693	-
1986-87	18,406	11,948	30,354	33.76
1987-88	23,346	17,240	40,586	33.71
1988-89	29,277	22,057	51,334	26.48
1989-90	45,802	24,071	69,873	36.11
1990-91	64,538	26,658	91,196	30.52
1991-92	76,576	39,759	116,335	27.57
1992-93	105,497	41,301	146,798	26.19
1993-94	110,415	54,170	164,585	12.12
1994-95	138,060	92,419	230,479	40.04
1995-96	235,980	104,604	340,584	47.77
1996-97	271,538	150,290	421,828	23.85
1997-98	414,359	169,705	584,064	38.46
1998-99	582,507	206,070	788,577	35.02
1999-00	719,461	255,442	974,903	23.63

Source: Annual Survey of Industries

Figure 2.10 Growth of Investment in Plastic products not elsewhere classified in India



2.6 Employment

In a country lime India with high and increasing levels of unemployment, investment become more effective only if it generates considerable level of employment. The relationship between investment and the resulting employment generation depend mainly on the technology of production. Thus technologies are classified into capital intensive and labour intensive technologies. This is according to the employment generated per unit of investment.

Even though plastics industry is technically more capital intensive, it created more employment opportunities direct or indirect in the recent period in India. It is an industry with high degree of linkage effect. Plastics have changed and added high value to their products in most of the industries. The automobile, the textile, the footwear, the food processing, the soft drinks, mineral water, pharmaceuticals are a few examples. The indirect employment due to the growth of plastic industry is infinite as it includes lakhs of roadside sellers, door-to-door sellers and kabuliwalas or rag pickers, the used good dealers, the re-processors, etc. Here in the tables given below we account only the number of direct employment in the factory sector of the Annual Survey of Industries only.

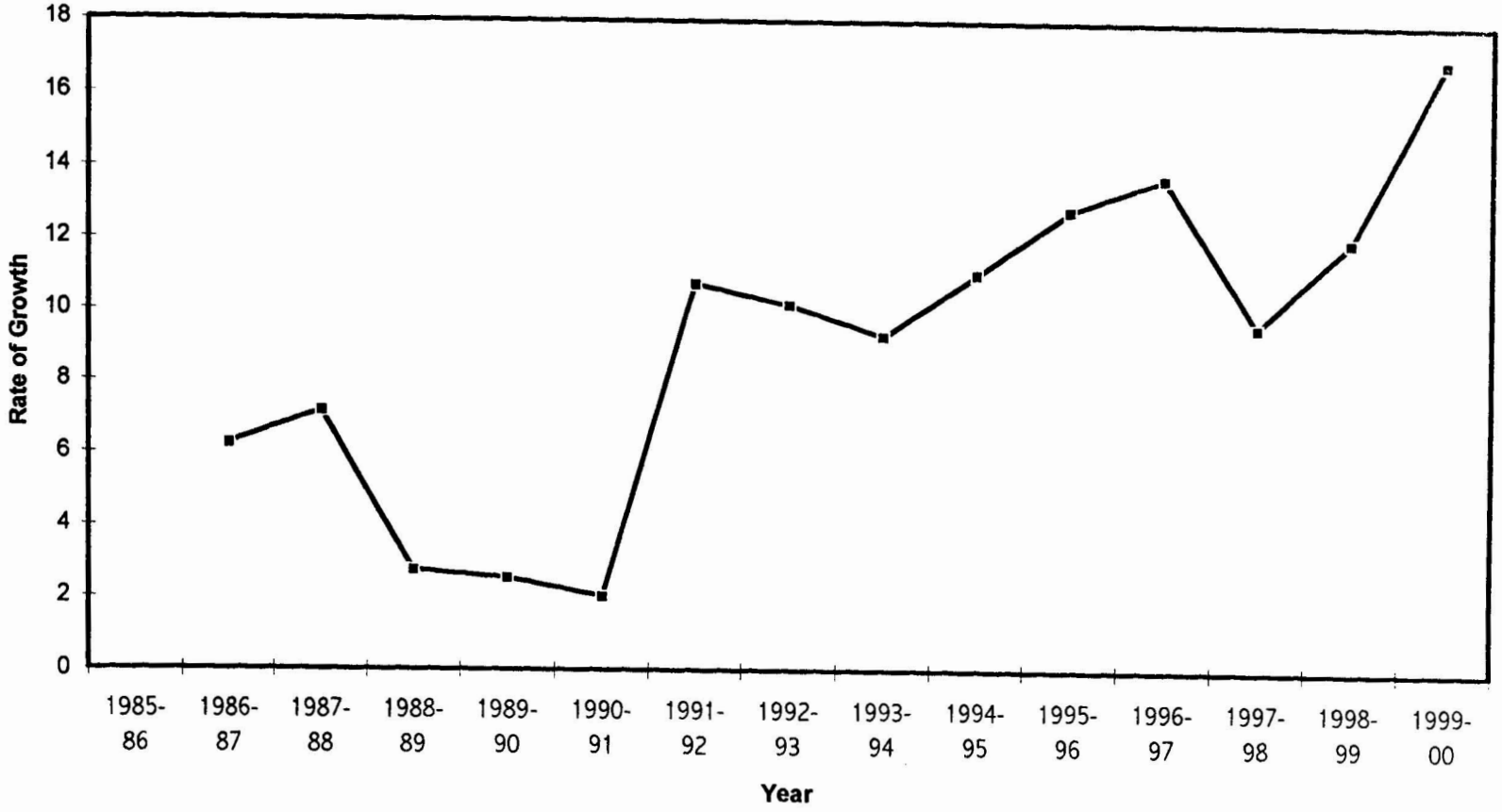
Table 2.11 Growth of Employment in Manufacture of synthetic resins, plastic materials and synthetic fibers like nylone, torylen etc.

Year	No. of Workers	No. of Employees	Total Persons Engaged	Percentage Growth
1985-86	56011	37596	93,607	-
1986-87	60436	39008	99,444	6.24
1987-88	66548	40011	106,559	7.15
1988-89	68423	41063	109,486	2.75
1989-90	69430	42827	112,257	2.53
1990-91	70806	43733	114,539	2.03
1991-92	80741	46097	126,838	10.74
1992-93	85895	53829	139,724	10.16
1993-94	92929	59767	152,696	9.28
1994-95	107003	62525	169,528	11.02
1995-96	126197	65093	191,290	12.84
1996-97	147153	70452	217,605	13.76
1997-98	163615	74825	238,440	9.57
1998-99	182344	84728	267,072	12.01
1999-00	218966	93462	312,428	16.98

Source: Annual Survey of Industries

This industry showed a moderate growth rate in employment during the period. The average annual growth in employment is 9.09 per cent.

Figure 2.11 Growth of Employment in Plastics resin sector in India



The industry showed a progressive growth rate in employment during 1985-86 to 1999-2000 and it is the highest in the year1999-2000. The following table gives the growth rate of employment in manufacture of raincoats, hats, caps, and schoolbags out of plastics.

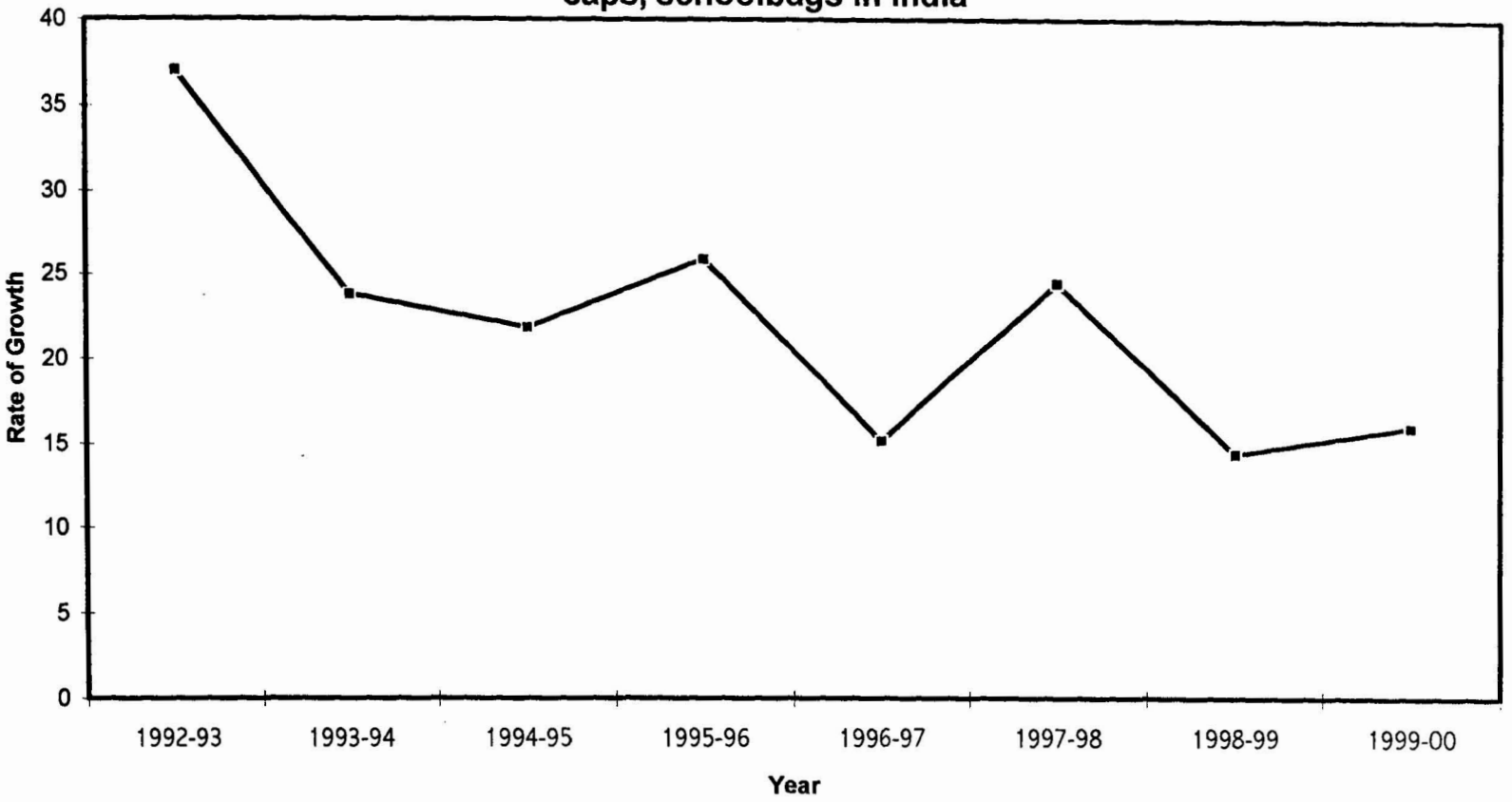
2.12 Growth of Employment in Manufacture of rain coats, hats, caps and school bags etc. from waterproof textile fabrics or plastic sheeting

Year	No. of Workers	No. of Employees	Total Persons Engaged	Percentage Growth
1991-92	947	494	1441	-
1992-93	1427	547	1974	36.99
1993-94	1618	826	2444	23.81
1994-95	1989	989	2978	21.85
1995-96	2305	1444	3749	25.89
1996-97	2654	1663	4317	15.15
1997-98	3531	1842	5373	24.46
1998-99	3872	2276	6148	14.42
1999-00	4477	2655	7132	16.01

Source: Annual Survey of Industries

This sector also had a continuous growth in employment during the recent period. The average annual growth rate was 22.32 per cent.

Figure 2.12 Growth of Employment in manufacturing of Plastics raincoats, hats, caps, schoolbags in India



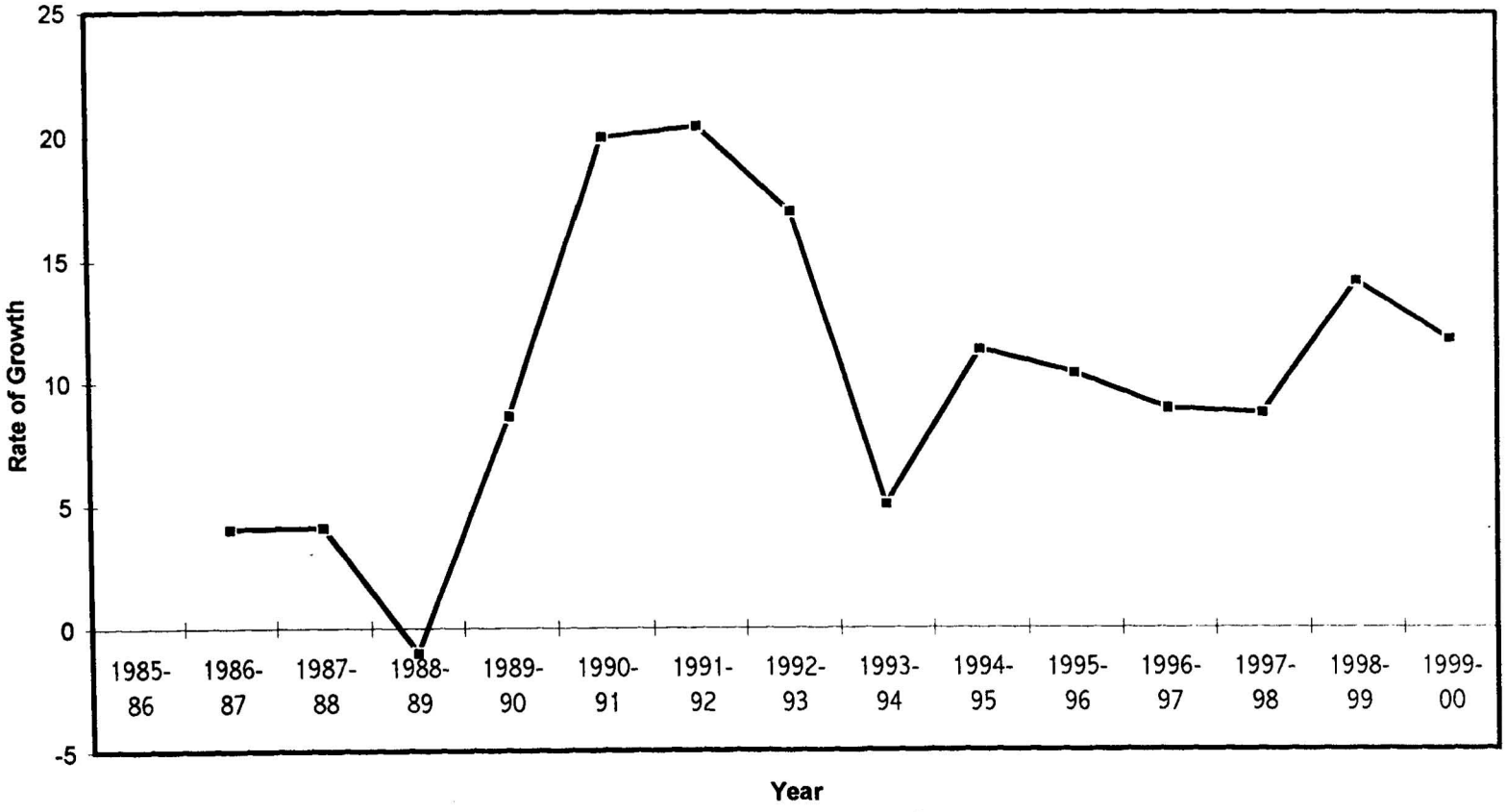
Though the growth rate was positive throughout the period there is a tremendous decline in growth of employment in this sector. This may be due the improvement in technology and introduction of new raw materials. The following table gives the growth of employment in plastic footwear industry in India.

Table 2.13 Growth of Employment in Manufacture of footwear made primarily of vulcanised or moulded plastics

Year	No. of Workers	No. of Employees	Total Persons Engaged	Percentage Growth
1985-86	34104	28081	62,185	-
1986-87	35309	29388	64,697	4.04
1987-88	36295	31054	67,349	4.10
1988-89	36077	30593	66,670	-1.01
1989-90	38730	33683	72,413	8.61
1990-91	45703	41166	86,869	19.96
1991-92	47516	57078	104,594	20.40
1992-93	55106	67302	122,408	17.03
1993-94	63243	65338	128,581	5.04
1994-95	74966	68180	143,146	11.33
1995-96	87764	70197	157,961	10.35
1996-97	94616	77452	172,068	8.93
1997-98	106297	80808	187,105	8.74
1998-99	135367	78191	213,558	14.14
1999-00	162862	75720	238,582	11.72

Source: Annual Survey of Industries

Figure 2.13 Growth of Employment in Plastics foot wear industry in India



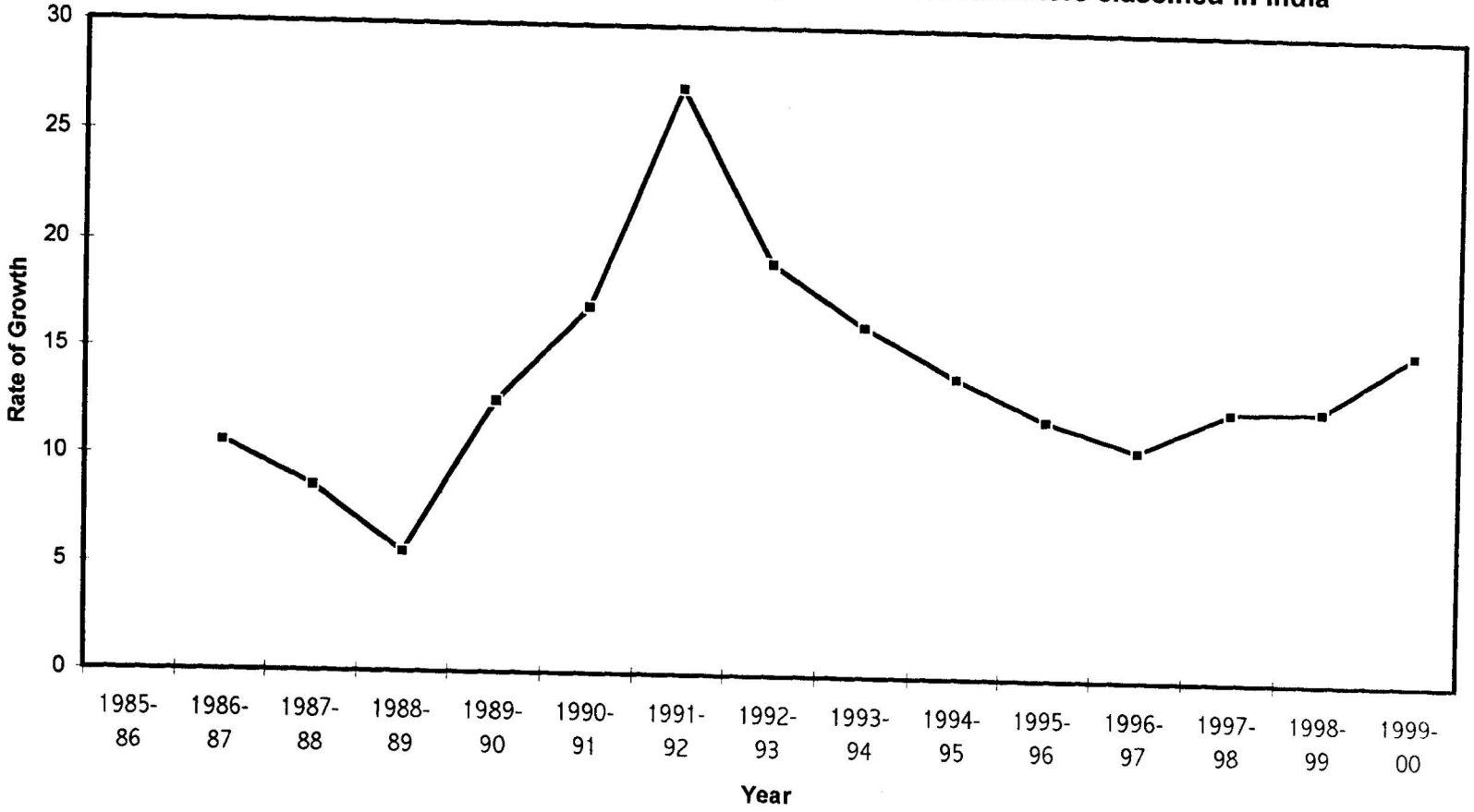
The plastics footwear generated more employment than the other sectors in plastics industry. It registered a highest growth rate in employment i.e., 20.04 per cent during 1991-92. The average annual growth rate in employment was 10.24.

Table 2.14 Manufacture of plastic products not elsewhere classified

Year	No. of Workers	No. of Employees	Total Persons Engaged	Percentage Growth
1985-86	35024	35786	70,810	-
1986-87	39488	38856	78,344	10.64
1987-88	41145	43945	85,090	8.61
1988-89	43272	46555	89,827	5.57
1989-90	47420	53758	101,178	12.64
1990-91	55167	63287	118,454	17.07
1991-92	83417	67240	150,657	27.19
1992-93	99750	79859	179,609	19.22
1993-94	123111	85807	208,918	16.32
1994-95	146515	91586	238,101	13.97
1995-96	168953	97897	266,850	12.07
1996-97	193929	101512	295,441	10.71
1997-98	216002	116717	332,719	12.62
1998-99	245238	129840	375,078	12.73
1999-00	298182	134861	433,043	15.45

Source: Annual Survey of Industries

Figure 2.14 Growth of Employment in Plastic products not elsewhere classified in India



This sector showed the highest growth rate in employment, that is, 27.19 per cent during 1991-92. The average annual growth rate in employment in this period was 13.92. Thus we can see that even though it is technically known as a capital-intensive industry, it showed a great employment potential in India in the last two decades. This is mainly due to its nature of less investment and hence attracted by a large number of small investors. Being a major sector of the Modern Small Scale Industries of India, Plastic industry very much helped in opening more investment and employment opportunities.

2.7 International Trade in Plastics

The plastics industry worldwide has gown at a remarkable pace making it a 100 million tonne industry today (which was three million tonnes in 1955). The world consumption of plastics reached the level of 10 billion tonnes by the turn of the last century (Financial Express, 19th February, 1994, Mumbai). India plays a significant role in the international trade of plastics. Even though the country is not self reliant in terms of raw materials, export of plastics goods has been increasing year after year.

Exports

The plastics industry has fared and continues to fare credibility in the sphere of exports. The exports of plastics may be said to have

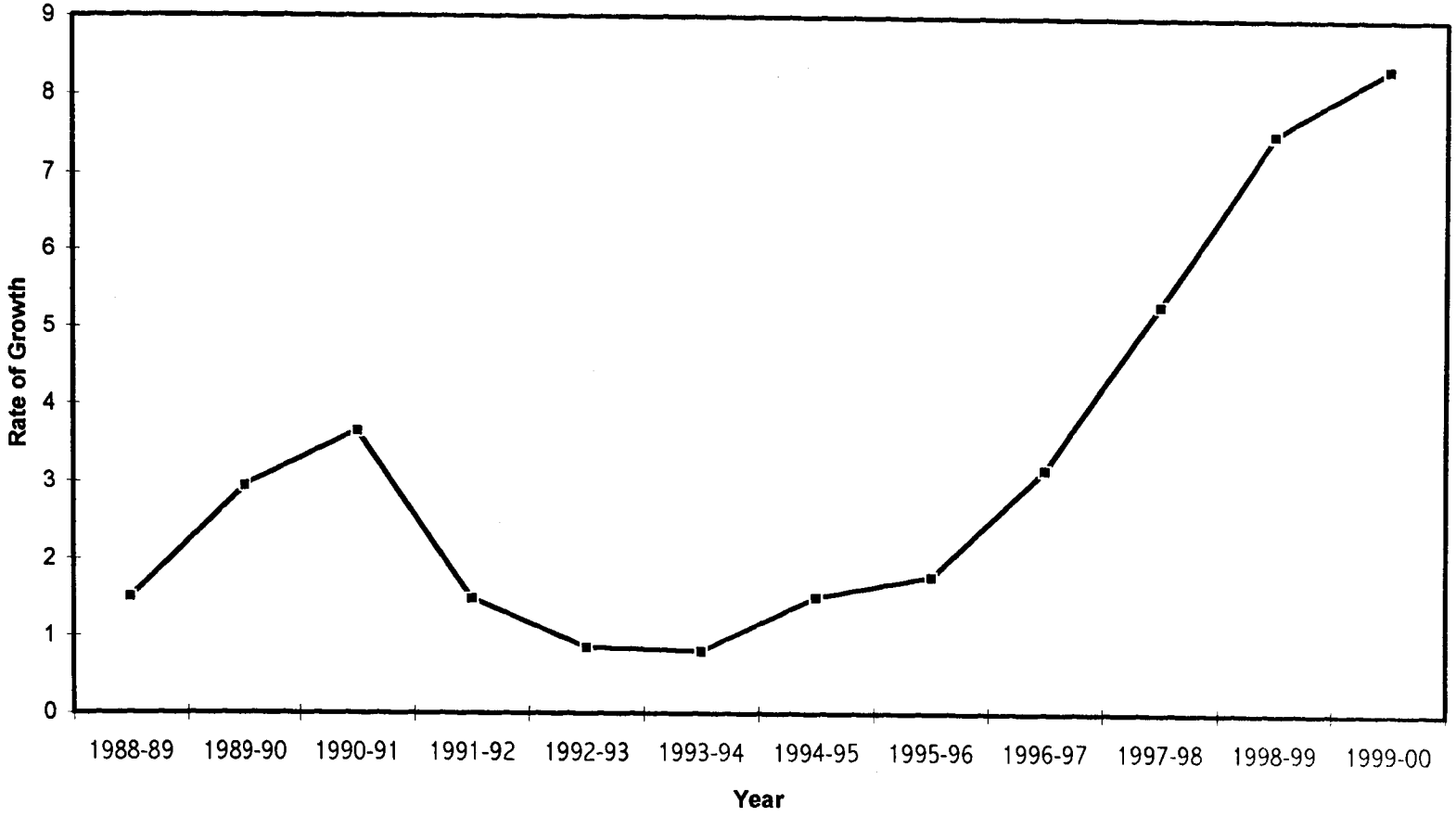
commenced about three decades ago, when in 1956-57 the exports valued at Rs.7.5 lakhs. Since then, the exports have continued to expand at very rapid rate. In 1974-75, it is Rs.1.548 lakhs, out of which, Rs.750 lakhs were the share of small-scale sector. The export reached the value of Rs.12,266 lakhs in 1994-95 and increased to Rs.2,60,400 lakhs in 2000-2001.

Table 2.15 Percentage Share of Plastic Industry in Exports

Year	Total Exports (Rs.lakhs)	Share of Plastics (Rs.lakhs)	Percentage Share of Plastics in Total Exports
1987-1988	15,674	128	0.82
1988-1989	20,232	303	1.50
1989-1990	27,681	814	2.94
1990-1991	32,527	1,188	3.65
1991-1992	111,256	1,652	1.48
1992-1993	270,047	2,303	0.85
1993-1994	446,712	3,605	0.81
1994-1995	580,465	8,779	1.51
1995-1996	686,150	12,266	1.79
1996-1997	894,567	28,369	3.17
1997-1998	1,123,564	59,642	5.31
1998-1999	1,546,531	116,458	7.53
1999-2000	2,187,946	183,265	8.38
2000-2001	2,864,522	260,452	9.09

Source: Plastics and Linoleum Export Promotion Council, Mumbai.

Figure 2.15 Growth of Export of Plastic products as percentage of total exports



Exports constitute 9 per cent of the total production of plastic goods in the country. The quality of plastic goods produced in the country is good; they are encountering keen competition in the overseas especially from Japan, Israel and Hong Kong. Their disability is particularly great in the matter of prices. The major share of Indian plastics exports is to U.A.E, U.S.A, Russia, Hong Kong, Germany, U.K, Singapore, Saudi- Arabia, Brazil and Sri Lanka

Composition of Exports

Even though India is not a traditional producer of plastic goods, its export is gaining momentum in recent years. The per capita consumption of plastics in India is less than those countries to which India exports plastics. But whenever plastics industry is started India its export have been also started. India is exporting plastic goods to these countries only because of cost advantage. Indian plastic goods are very less price compared to that of industrialised countries. Thus even if the quantum of exports is high it is very less as we take the value of exports.

Major plastic products exported from India includes Plastic ropes, nets, sacks, fabrics, bags, writing instruments, laminates, film, PVC pipes, sheet, floor coverings, imitation jewellery, toys, electrical accessories and toys. The following table gives the list of plastic items exported during four consecutive years.

Table 2.16 Comparative study of exports of plastic products (in Rs. Lakhs)

Item	1998-99	1999-2000	Percentage share in Total
Plastic moulded extruded goods	75850	69300	26.12
Ropes, Twines, yarn, bristles	9020	10500	3.51
Fishnets, Fishing Line	0	2100	0.38
Soft Luggage items	2460	4200	1.20
Sacks, Fabrics, Bags	25010	25200	9.03
Polyester Film	34850	33600	12.32
Writing instruments	25010	16800	7.52
Laminates	11480	12600	4.33
PVC pipe and fittings	6970	4200	2.01
Polythene pipes and fittings	205	1680	0.34
PVC leather cloth	11480	8400	3.58
PVC sheeting Film	5330	2100	1.34
Floor coverings	11480	10500	3.95
FRP products	3280	3360	1.19
Poly-lined Jute goods	4100	2100	1.12
Spectacle frames	1230	1260	0.45
Hard resilene lenses	2460	2100	0.82
PVC fabricated goods	2050	1260	0.60
Plastic imitation jewellery	1435	1260	0.48
Electrical accessories	1435	2520	0.71
Toys, Dolls, Games	2050	2100	0.75
Hair bands	5125	9420	2.62
Plastic raw materials	52480	33600	15.49
NES* item	410	420	0.15
Total	295200	260580	100.00

Source: Plastics and Linoleum Export promotion Council, Mumbai

The plastics resin sector constitute major share of exports of plastics, i.e., 26.12 per cent of the total. The second most export is plastics raw materials with a share of 15.49 per cent. The third position in case of exports goes to the polyester film, which constitutes 12.32 per cent of the total.

Destination of Exports

The major share of Indian plastics exports is to U.A.E, U.S.A, Italy, Hong Kong, Germany, U.K, Singapore, Saudi-Arabia, Brazil, Russia and Sri Lanka.

Being the largest importer of Indian plastic goods, the US, share in total exports has been continued at around 19 per cent throughout the study period. The second position goes to UAE with a share of 11 per cent of our plastics export. The Italy (5 per cent), the UK (5 Per cent), the Saudi Arabia (4 per cent), Belgium (4 per cent) and Germany (4 per cent) are the other major export destinations of Indian plastics goods.

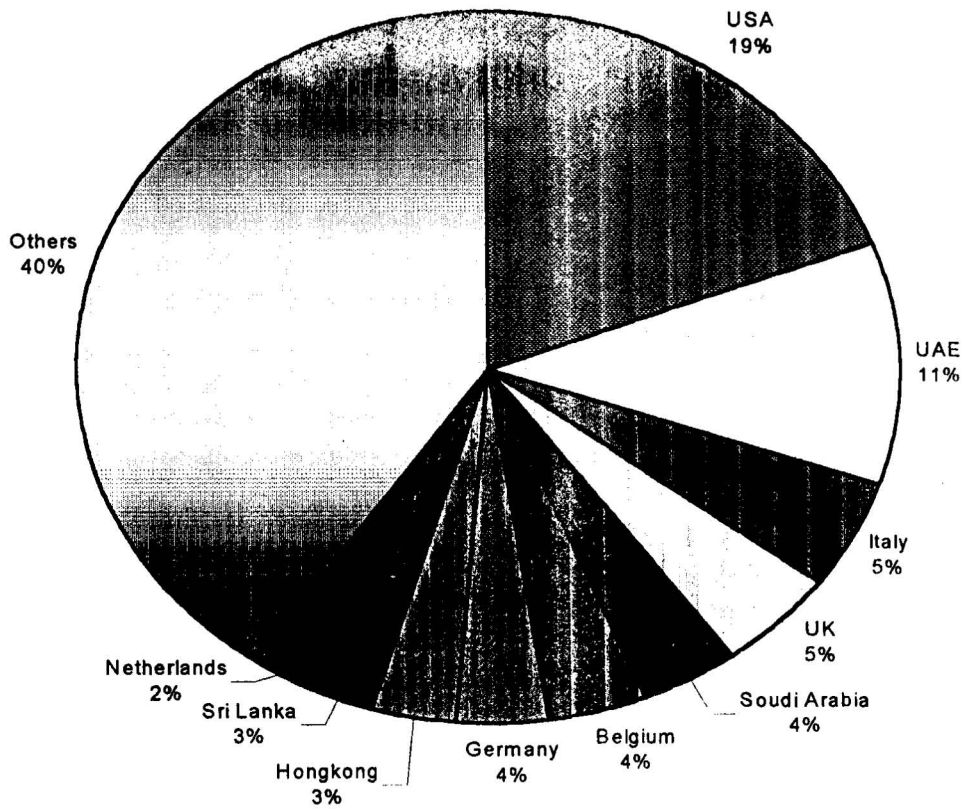
Russia's share was considerably declined after 1998-99. It has a share of 7.56 per cent in 1996–96 but declined to 1.51 per cent in 1999-2000.

Table 2.17 Destination of Indian Plastics Export (in US $ Million)

Country	1996-97	1997-98	1998-99	1999-2000	Compound Growth Rate
USA	45.65	91.77	99.39	98.35	36.10
UAE	52.17	87.6	78.52	56.96	10.03
Italy	28.48	16.28	31.85	25.86	11.33
UK	31.59	36.2	30.35	25.08	-6.31
Saudi Arabia	28.64	21.59	21.6	19.75	-11.04
Belgium	17.32	6.82	21.02	19.44	46.69
Germany	23.03	23.23	17.2	18.39	-6.06
Hong Kong	20.56	20.22	17.3	17.41	-5.15
Sri Lanka	12.72	15.47	19.22	15.39	8.64
Netherlands	27.07	18.88	10.28	10.14	-25.72
Spain	10.76	8.12	9.35	9.67	-1.99
France	7.55	9.6	8.86	9.3	8.14
Australia	6.76	10.3	9.27	8.43	11.10
China	8.92	4.99	8.75	8.31	8.75
Singapore	8.22	9.69	20.77	8.28	24.03
Kenya	5.72	9.33	8.5	7.97	15.99
Russia	36.63	36.11	28.63	7.78	-31.65
South Africa	5.84	7.59	13.9	6.63	20.27
Oman	2.99	4.07	4.22	6.04	27.64
Taiwan	9.24	8.5	7.08	35.48	125.47
Turkey	1.33	8.49	5.73	5.02	164.48
Tanzania	2.37	4.42	3.9	4.87	33.20
Israel	1.16	1.09	3.42	4.87	83.37
Egypt	2.61	8.31	12.64	4.81	69.52
Kuwait	3.37	4.1	3.34	4.77	15.31
Sudan	5.24	2.93	5.4	4.67	8.90
Bangladesh	3.13	3.82	5.73	4.64	17.67
Indonesia	7.1	5.16	2.94	4	-11.43
Brazil	4.63	3.05	7.08	3.95	17.93
Yemen	1.34	2.48	6.24	3.64	65.01
Total Exports	484.81	578.32	620.38	514.48	3.16

Source: Plastics and Linoleum Export promotion Council, Mumbai

Figure 2.16 Destination of Plastics Export from India



Imports

In India, a major share of plastics raw materials is imported from abroad. The country is not self sufficient in case of petrochemicals. The indigenous raw material production represent about 65 per cent of the total domestic demand and the balance of 35 per cent is made of imports. The main raw materials imported are Cellulose Nitrate, Cellulose Acetate Sheets, Cellulose Acetate Butyrate Moulding Powder, Polypropylene, Nylon, Polystyrene, P V C Compound Resins and Polythene Compound Resins. The materials that are imported for use in processing are anodising colours, fibre tip inks, iridium alloy for pens, mirror finish stainless steel sheets, adhesive coated metallic foils for laminates, phosphor bronze sheets, neon bulbs, porcelain bases, gliding chemicals, glass cartons, stabilizers, pigments, solvents, blouring agents, aluminium flakes, glassine paper, polishing powders, etc. The import is amounted to Rs.18.24 crores in 1974-75. It was Rs.435 crores in 1987-88 and Rs.855 crores in the year 1992-93.

2.8 Government Policy Towards Plastic Industry

During the past four decades, the government policy towards plastic industry had very much helped in the expansion of the industry. Government used the plastic industry to meet the law cost living, development of small-scale sector and employment generation. The government recognised plastic industry as a *sunrise* industry and continuously supported it in its growth path.

In June 1949, the Government of India commissioned a Tariff board to go into the question of protecting plastic industry. On the recommendations of the Board, the government granted protection to the industry in 1950 by levying protective duties at 30 per cent ad valorum on plastic products. The protection of some of the plastic products was withdrawn in 1959. In 1961 an excise duty of 20 per cent was levied ad valorum on plastic materials.

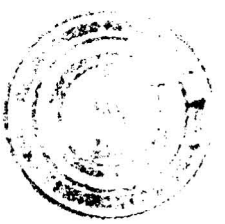
IMPORT POLICY

The import policy of 1960's was bold and pragmatic in approach. Small-scale sector have been accorded a most

favoured treatment. They got import licences for adequate raw materials and components. The pre-scrutiny of the items to be imported was reduced to a minimum and samples can be freely imported. Imports of eight plastic items of raw materials were canalised through the State Trading Corporation (STC). Canalisation of plastic raw materials had not given any benefit to the industry. On the contrary, it had multiplied the problems of the small sector and cottage industries of the country. Lacking in market intelligence and expertise, STC had not imported raw materials in time and it had not been able to satisfy the customers in regard of price, quality and standard of materials and timely delivery. This made curious raw materials shortage problem and consequent stagnation in the industry. This has been the major reason for the narrow growth and non-popularity of the plastic industry up to eighties in the country while the western countries gown through a rapid growth period in the plastic production and consumption. As a result the per capita consumption of plastics is very low in the country compared to the world average.

In 1976 the import of Cellulose Nitrate sheets, Acrylic Moulding powder, CAB Moulding powder, Cellulose Acetate

sheets and PVC resin were decanalised from the STC list. The import duty reduced from 145 per cent to 75 per cent. The export oriented growth strategy of the eighties has felt as a great boost to the modern industries like plastic industry. The Import Substitution Export policy has made great opportunities to the industry to diversification and development. The new and new raw materials have been imported and adequate technology and machinery (moulds) have been also imported and utilised to produce new products. Import of the most of the plastic raw materials were liberalised and import duties were cut. This policies lead to a rapid growth of the industry in India during the last two decades.



EXPORT POLICY

For a country like India, with persistent adverse trade balances, exports are a must. The policy of the government was export oriented. Several incentives in the form of replenishment licences, duty drawback, availability of local raw materials at international prices and cash subsidy are offered to export oriented industries. The Plastics and Linoleum Export Promotion Council was set up in 1982. The Council is playing creditable role in promoting export of plastic goods. The plastic

products of Indian origin are exported to nearly 70 countries including U.S.A., France, Japan, Bulgaria and the Middle-east countries.

The government has also decided to issue *green licences* to exporter-manufacturers to enable them to import raw materials without prior permission. This is a step in right direction which will help not only boosting exports but also overcoming the shortage of indigenous raw materials. Majority of the raw materials were covered by duty exemption scheme.

2.9 Future Prospects of the Industry

Plastics have now become a key and dynamic industry and technology and science are changing the very mode of modern life all over the world. India could not stand idle in utilising the benefits of industrialisation and fast changing modern world. Plastics industry has developed recently in India. About 25 years ago no one could predict that this infant industry could grow to a stature it has now attained. Its growing importance in the making of our national economy strong is being recognised by one and all.

In industrially advanced countries, plastics industry is playing an important role even in complicated fields such as building of Missiles and Space Programmes. While Indian plastic industry has reached a critical stage in its growth phase, it needs well-structured, long-term policies in the interest of the growth of the industry and our country. Long-term policies alone could help the plastic industry to fulfil its role in the national economy.

The development of both domestic and export market depends on the timely policies of the government. India has made a good progress in the use of commodity plastics to serve some important sectors like agriculture and packaging. If plastics are to support other important sectors like transportation, electronics, aerospace and defence, considerable efforts are needed on the use of engineering plastics. Use of plastics could also be increased in areas like housing sanitation, food processing, water management, and automobiles.

With the globalisation of Indian economy, the demand for better energy efficiency has meant greater need of plastics. Even in the remotest village or town of India plastics have become the preferred choice, whether it is for fertiliser packaging

in woven sacks, or the medicine tablets in blister packing or the water tank remoulded or installed in plastics in the hilly regions of Assam and Himachal Pradesh. The agriculturists in Himachal Pradesh and Kashmir insist on plastic crates for apples and pears, as they do not want their beautiful forests denuded to meet the demand for packaging boxes. The smallest farmer in Andhra or Gujarat insists on plastic pipes for irrigating their farms, whether it is groundnut or rice, cotton or sugarcane.

Research can and does play a decisive role in the economics of production. The truth of this remark has been fully tested in many advanced countries, where the research bodies are the main stay of the industrial enterprises. India has certainly taken a big stride in that direction, but much more still remains to be done. It is equally necessary that adequate facilities should be made available for the training of the technicians so that really competent men may run our factories.

The future development of the industry would also be governed by,

i. The availability of raw materials at low cost.

ii. Diversification and modernisation of processing sector.

iii. Establishment of production facilities for dies, moulds and tools.

iv. Improving export performance.

The plastic industry in India has developed employment opportunities for even unskilled men and women in addition to qualified people. The growth of plastic industry will automatically generate more employment, as the applications of plastics are endless. The growth of plastics industry is therefore of vital national importance and no considerations regional or other should hamper its onward march.

The improvements in general standard of living and economic growth would ensure higher levels of plastic consumption. In the ensuing decades the plastic industry has a big role to play in the development of various industries and would become a giant in the industrial scenario of the country.

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ECONOMIC PERFORMANCE OF PLASTIC INDUSTRY IN KERALA

M.S.Suresh Kumar " Economics of plastic industry in India with special reference to Kerala " Thesis. Department of Economics , Dr.John Matthai Centre , University of Calicut, 2003

Chapter III

ECONOMIC PERFORMANCE OF PLASTIC INDUSTRY IN KERALA

CONTENTS

3.1 INTRODUCTION

Kerala is generally not an industrially developed State. The state is lagging behind most of the states in industrial development. According to media reports and some studies the industrial climate in the state is not encouraging for investors. The state could not achieve industrial growth rate, which witnessed in 1940's during the fifty years of independence. This is a shameful thing to the State, which is in the forefront of all Indian states in socio- economic indicators. The generally accepted perception is that the State could not retain its position in socio-economic status during the coming decades if creative steps were not taken for industrial development.

However the past history of the state speaks about a glorious picture of industrialized state of Kerala. During Nineteenth century and First half of the Twentieth century of Kerala has a wide spectrum of traditional industries like Handlooms, Coir, Clay, Wood, Bamboo, Paper, Coconut Oil, etc. The coir industry alone provided an employment opportunity to over1.5 lakh people.

Kerala witnessed industrial development only in the middle of 19th century. The first industries emerged are coir industry, processing of tea, spinning and weaving, coconut oil making, paper, bell metal processing, cashew nut processing, ilimenite and monazite processing and clay products. These were some of the areas where resource based industrial activities organised from very early times.

During 30,s and 40's a number of basic industries were started in Kerala. These include Fertilisers And Chemicals Limited Travancore, Travancore Sugars and Chemicals Limited, Travancore Ogale Glass Factory, Forest Industries Travancore, Perumbavoor Rayons, Indian Aluminium Company, Travancore Titanium, Trivandrum Rubber Works, Punaloor Paper Mills, Travancore Ply Works, Travancore Cements, Indian Rare Earths, etc.

The golden era of Kerala's industrial development was the Ten years period ending in 1946 when C.P.Ramaswami Iyyar ruled the then state of Travancore as Divan. Three major industries, namely, FACT, HIL, IRE and 71 other industrial units were started during this period. The capital investment and employment in these units started during this period was more

than the combined investment and employment in all the subsequent units put together.

Units based on weaving, coir, coconut oil, timber and tiles were popular along Cochin region, while coconut oil, timber, and tiles industries were emerged in the forefront in Malabar. A large number of weaving units were there around Kannur as cottage industry. Beedy making was another well-developed activity in South Malabar. Overall industrial development during pre independent period was very much impressive in Kerala.

During the first Five Year Plan there was less emphasis on industrial development of Kerala. During the second Five Year Plan the industrialisation process started picking up momentum slowly. The Hindustan Insecticides Limited (Alwey), Traco Cable Company (Karukutty), Co-operative Spinning Mill (Kannur), Premier Tyres (Kalamassery) were among the units started during this period.

During the subsequent Five Year Plans, a large number of industrial units in various sectors were established. The HMT, Cochin Shipyard, The Cochin Refineries Limited, The Hindustan Paper Corporation, Apollo Tyres, The Cominco Binani, The

Carbon and Chemicals Limited and KELTRON were some of the units started during these periods.

As per the latest information available Kerala has 173 large and medium units, giving employment to 90,000 persons. This is not a satisfactory trend along the past history of the state. Thus we can see that the industrialisation process was almost stalled in the subsequent periods of Forth Five Year Plan.

At the same time there was stagnation in village and cottage industries including coir, handloom, etc. But their role in employment and income generation could not be ruled out. During the last two decades the development in modern small-scale industrial sector of Kerala is not negligible. It is the hope and livelihood of a number of self-employment seekers in Kerala. It is estimated that over 2 lakh persons are employed in this sector. This sector constitute mainly of electronics, plastics and food processing.

Plastic industry, which has only a short history in Kerala, is assumed to be a suitable industry for the state on many counts. The factors behind this proposition are the large domestic market, comparatively low capital requirement, easy technology, relatively

inexpensive raw material and less requirement of energy. This industry recorded a high growth rate in the state during the last decade. The annual growth rate of plastic industry is 8 per cent. However the production of plastic goods has not improved to meet the increasing demands within the state. The large share of plastic commodities marketed in the state is produced outside the state. The state's share is only less than 20 per cent. The plastic goods of variety, ranging from furniture to toys are vigorously flowing to the state from states like Maharashtra, Rajasthan, Tamil Nadu and Delhi. Kerala has first place in the consumption of plastic goods among Indian states.

The present study is concentrating on the positive aspects of the plastics industry as a modern small-scale industry, which can be developed in the State to meet the challenges of industrial stagnation, because the demand for plastics is very high in Kerala. The study is based on a sample survey of 60 industrial units producing various types plastic products and representing different levels by size. The sample units are classified according to the investment as shown in the table given below.

Table 3.1 Classification of Units according to Investment

Class	Fixed Investment (Rs.)
I	Up to 1,00,000
II	1,00,000 to 2,00,000
III	2,00,000 to 5,00,000
IV	5,00,000 to 10,00,000
V	10,00,000 to 20,00,000
VI	Above 20,00,000

Source:- Computed From Sample Survey

The sample units are selected from the three districts of Kerala say Thrissur from the middle zone, Alappuzha from the south zone and Kozhikkode from the north zone. Twenty units are selected from each of the three districts. The investment wise classification of the selected sample is given in table 3.2.

Table 3.2 Distribution of Sample units according to Investment

District	I	I	III	IV	V	VI	Total
Kozhikkode	5	4	4	2	3	2	20
Thrissur	4	3	4	3	3	3	20
Alappuzha	5	5	4	3	2	1	20
Total	14	12	12	8	8	6	60

Source:- Computed From Sample Survey

The sample units are selected in such a way that all investment groups and product groups are included from each of the three districts.

3.2 Origin and development of the industry

In Kerala, the plastic industry is only Two decades old. This is evident from the data also. The following table gives the origin if the sample units chronologically.

Table 3.3 Period of starting sample units

Period of starting	Number of Units	Percentage to Total
1981-1985	4	6.67
1986-1990	27	45.00
1991-1995	28	46.67
1996-2000	1	1.67
Total	60	100.00

Source:- Computed from Sample Survey

The plastic industry units are located both urban as well as rural areas of the State. The area wise classification the sample units in the three districts are given in table 3.4.

Table 3.4 Location of sample units

District	Area	Number of Units	Percentage No. of Units
Thrissur	Rural	9	45
	Urban	11	55
Alappuzha	Rural	8	40
	Urban	12	60
Kozhikkode	Rural	4	20
	Urban	16	80
Total	Rural	21	35
	Urban	39	65

Source: Computed from Sample Survey

35 per cent of the units are in rural areas where as 65 per cent are in urban areas. This is a usual phenomenon as far as industrialization in concerned. Many of the small-scale units are concentrated in the industrial estates set up by the government for the development of small-scale sector. Most of these industrial estates are situated in urban areas.

3.3 Entrepreneurship

Small-scale industries are generally originated from those people who are looking for self-employment. Also those with

years of experience in the same industry may also think of starting new units of their own. Some of them may start units individually while those with inadequate finance may start units on a partnership with like-minded people. The following table gives the classification of entrepreneurship of the sample units.

Table 3.5 Ownership of sample units

District	Type of Ownership	Number of Units	Percentage No. of Units
Thrissur	Proprietorship	11	55
	Partnership	9	45
Kozhikkode	Proprietorship	13	65
	Partnership	7	35
Alappuzha	Proprietorship	15	75
	Partnership	5	25
Total	Proprietorship	39	65
	Partnership	21	35

Source: Computed from Sample Survey

Units working under partnership agreement are 35 per cent while those working under entrepreneurship are 65 per cent of the total. This proves the general feeling that most of the people want units of their own and it is the inadequate finance compels them to start joint ventures.

Age of Entrepreneurs is very important as far as small-scale industries are concerned. The following table gives the age wise distribution of the entrepreneurs.

Table 3.6 Age wise distribution of entrepreneurs

Age Group	No. of Entrepreneurs	Percentage
Below 30	0	0.00
31-35	8	13.33
36-40	22	36.67
41-45	9	15.00
46-50	12	20.00
51-55	2	3.33
Above55	7	11.67
Total	60	100.00

Source:- Computed From Sample Survey

Around 50 percent of the entrepreneurs are of the age below 40 years. Most of the small industries are those started by youngsters after a long search for a gainful employment or due to the dissatisfaction in the previous employment. 15 per cent of them are in the age group of above 50. There are 11.67 percent of the entrepreneurs are of age above 55. Most of them are

those who started the business after retirement from the same or other fields of work.

Education level of the entrepreneurs are given in table 3.6

Table 3.7 Education Level of Entrepreneurs

Education Level	No. of Entrepreneurs	Percentage
Primary	0	0.00
SSLC	26	43.33
PDC	5	8.33
Degree	11	18.33
PG	2	3.33
ITI	7	11.67
Diploma	3	5.00
Eng.Degree	6	10.00
Total	60	100.00

Source:- Computed From Sample Survey

43 per cent of the entrepreneurs have the education to the level of SSLC. While 28 per cent of them are Degree holders of which 10 per cent are graduated in engineering disciplines. 16 per cent of them are either ITI Certificate holders or Engineering Diploma holders. Only 2 i.e. 3 per cent are Post Graduates.

Industrial Training

Industry is a business, which needs proper training. Only those entrepreneurs with adequate training in production technologies and marketing methods can lead the firms to continuous growth.

Table 3.8 Training of Entrepreneurs

Entrepreneurs Who obtained Training	21 (35)
Entrepreneurs Who do not obtained any kind of Training	39 (65)
Total	60 (100)

Source:- Computed From Sample Survey

Figures given in parenthesis are the percentages to total. Only 35 percent of the entrepreneurs are obtained at least any kind of training. The major training centers are Small Industry Service Institute (SISI), Thrissur and Kerala Industrial and Technological Consultants (KITCO), Kochi. While, SISI conducts intensive training for short duration from three to six months at its Center in Thrissur, KITCO conducts Entrepreneurial Workshops of two or three days at different district headquarters.

Understanding the occupation of the entrepreneurs before starting the unit will be useful to know what prompted them to starting an industry.

Table 3.9 Occupation before starting the unit

Occupation	Number of Entrepreneurs	Percentage
Nil	25	41.67
Operator	13	21.67
Manager	7	11.67
Abroad	1	1.67
Govt. Service	9	15.00
Casual Labor	1	1.67
Farmer	2	3.33
Ex-Service Men	2	3.33
Total	60	100.00

Source:- Computed From Sample Survey

From the table we can see that 42 per cent of the entrepreneurs were unemployed. They may be started the industrial unit in search of self-employment. While, 22 per cent of the entrepreneurs were machine operators, 12 per cent of them were working as managers in similar units. 15 per cent of the entrepreneurs are retired Government servants.

3.4 Capital Structure

As far as small industries are concerned, the capital may be secured from internal sources as well as external sources. The following table gives the ratio of external capital to internal capital in the sample units.

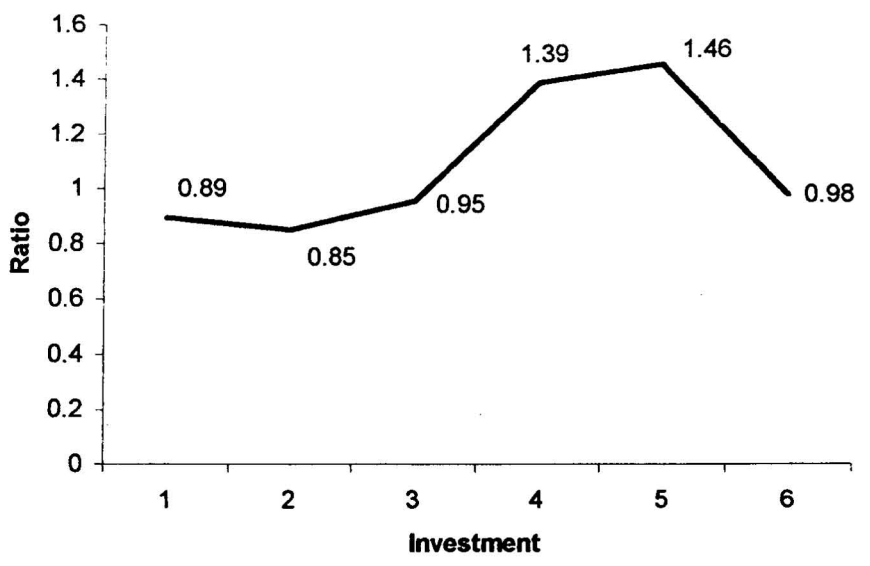
Table 3.10 The Ratio of External Capital to Internal Capital (Average)

District	Class	Internal Capital (Rs.)	External Capital (Rs.)	Ratio of External Capital to Internal Capital
Thrissur	I	20250	16250	0.80
	II	105000	75000	0.71
	III	171250	145000	0.85
	IV	400000	416667	1.04
	V	833333	766667	0.92
	VI	1186667	1200000	1.01
Kozhikkode	I	21000	22500	1.07
	II	90333	41667	0.46
	III	150000	103750	0.69
	IV	200000	333333	1.67
	V	566667	500000	0.88
	VI	1200000	1033333	0.86
Alappuzha	I	32500	26250	0.81
	II	48333	66667	1.38
	III	81250	107500	1.32
	IV	183333	266667	1.45
	V	233333	600000	2.57
	VI	933333	1000000	1.07
Average		358699	373403	1.04

Source: Computed from Primary Survey

The ratio of external capital to internal capital is comparatively high in large units than small units. For Class I it ranges from 0.80 to 1.07, for class II from 0.46 to 1.38, for class III from 0.85 to 1.32, for class IV from 0.81 to 1.45, for class V from 0.88 to 2.58 and for class VI from 0.86 to 1.07. It increases as investment goes up. Average ratio is 1.04, which means that external capital is 104 percent of the internal capital. That is only up to 50 per cent of the investment is obtained as loan. This is an unfavourable thing as the availability of capital is a major boost for industrialization. The ratio of external capital to internal capital is given in the chart given below.

Chart 3.1 Ratio of External Capital to Internal Capital



Investment

Investment mainly goes to Land, Building, and Machinery. The following table gives the investment in Land and Building.

Table 3.11 Percentage Expenditure on Land & Building (Average)

District	Class	Fixed Investment	Land & Building	As percentage of Fixed Investment
Thrissur	I	36500	6250	17.12
	II	180000	53333	29.63
	III	316250	68750	21.74
	IV	816666	250000	30.61
	V	1600000	500000	31.25
	VI	2386666	520000	21.79
Kozhikkode	I	52000	16000	30.77
	II	168750	42500	25.19
	III	387500	162500	41.94
	IV	750000	250000	33.33
	V	1333333	516667	38.75
	VI	2550000	600000	23.53
Alappuzha	I	67000	21000	31.34
	II	155000	46000	29.68
	III	318750	156250	49.02
	IV	833333	250000	30.00
	V	1333333	516667	38.75
	VI	2550000	600000	23.53
Average		879727	254218	30.44

Source: Computed from Primary Survey

Firms, other than those working in rented buildings, investment is necessary in land and building. Average investment inland and building is 30.44 per cent of the total investment. It ranges from 17.12 per cent to 49.02 per cent. Generally, it increases first and then decline as investment increases. For larger firms investment in land and building will be a less proportion of total investment.

The investment in plant and machinery is given in the following table 4.5. The investment in plant and machinery increases as plant size increases. For the sample units it ranges from 36.36 per cent to 82.88 per cent. The average investment in plant and machinery is 67.33 per cent of the total investment. The average ratio for each district is as follows. Thrissur – 74.64, Kozhikkode – 67.75 and Alappuzha – 59.60. There is a significant difference in this ratio for three districts. This may be mainly due to the difference in land value in each district and the Government aided programmes like providing land for industrial purpose with all other infrastructure facilities at the so-called Industrial Estates. As facilities like water, road and electricity are provided; the units at industrial estates have to invest fewer amounts in these purposes. This may be one reason for the ratio of Investment in land and building to be less in some areas.

Table 3.12 Percentage Expenditure on Plant & Machinery (Average)

District	Class	Fixed Investment	Plant & Machinery	As percentage of Fixed Investment
Thrissur	I	36500	30250	82.88
	II	180000	126666	70.37
	III	316250	247500	78.26
	IV	816666	566666	69.39
	V	1600000	1100000	68.75
	VI	2386666	1866666	78.21
Kozhikkode	I	52000	36000	69.23
	II	168750	126250	74.81
	III	387500	225000	58.06
	IV	750000	500000	66.67
	V	1333333	816667	61.25
	VI	2550000	1950000	76.47
Alappuzha	I	67000	46000	68.66
	II	155000	109000	70.32
	III	318750	162500	50.98
	IV	833333	583333	70.00
	V	1333333	816667	61.25
	VI	2550000	927283	36.36
Average		879727	568692	67.33

Source: Computed from Primary Survey

Working Capital

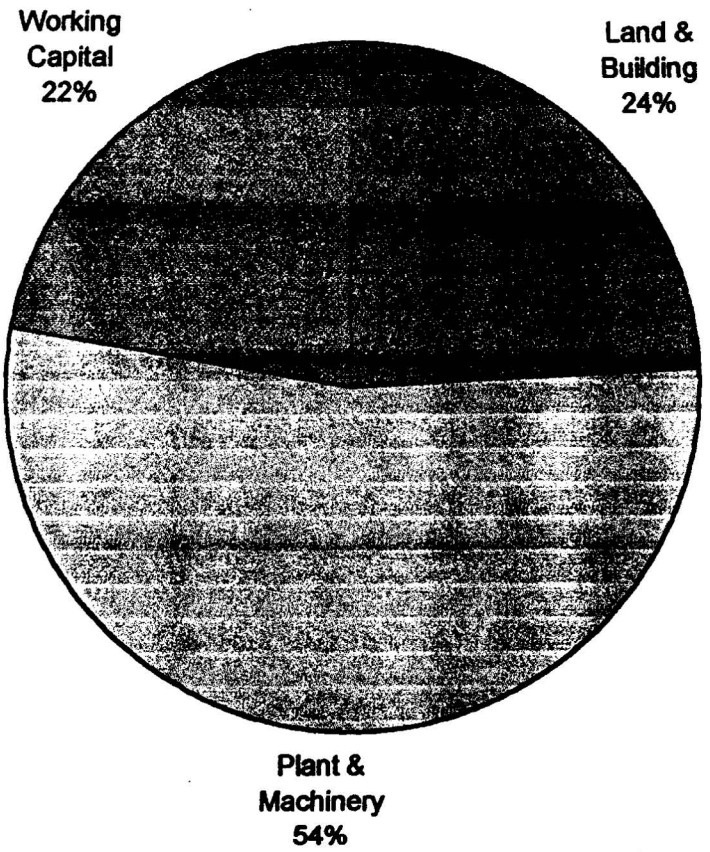
The working capital is an important part of capital investment. It is the capital used for purchasing the inputs.

Table 3.13 Ratio of Working Capital in Investment (Average)

District	Class	Average Working Capital	Total Investment	Working Capital as Percentage of Investment
Thrissur	I	35450	36500	49.27
	II	63333	180000	26.03
	III	173333	316250	17.51
	IV	173333	816666.7	17.51
	V	350000	1600000	17.95
	VI	733333	2386667	23.50
Kozhikkode	I	21360	52000	29.12
	II	45000	168750	21.05
	III	148500	387500	27.71
	IV	175000	750000	18.92
	V	266667	1333333	16.67
	VI	400000	2550000	13.56
Alappuzha	I	38000	67000	36.19
	II	49000	155000	24.02
	III	130000	318750	28.97
	IV	295000	833333.3	26.14
	V	750000	1333333	29.41
	VI	600000	2550000	21.43
Average		247073	879726.9	28.09

Source: Computed from Primary Survey

Figure 3.2 Capital Structure in Plastic Industry



As far small industries are concerned, the working capital forms an important share of investment. Small industries usually deal with the simple processing of raw materials. Small units in plastic industry are the final processing sector of plastics goods. A major share of their capital goes to the purchase of raw materials. This is clearly seen from the table and the figure. At an average 28 per cent of the capital is used as working capital. The share of working capital increases as the size of the unit increases.

3.5 Production

Production is the process by which inputs are transformed into outputs. In plastic industry the technology is so simple that if we input mixed up raw materials from one side and collect the output from the other side. In Kerala, the raw materials are usually brought from states like Rajastan and Gujarat. Now a day it is also available at Ernakulam in Kerala. The Reliance Petrochemicals is the major supplier of plastic raw materials in India. Some public sector units like Petrochemical Corporation

of India and a number of private sector companies are also operating in this field.

Usually the raw materials in plastics industry are available in the form of powder. This raw material is first mixed with relevant quantities of solvents, oils and other components. This mixture is then heated to at high temperature. At this stage colours are added to this mixture and then it is filled into respective moulds. Moulds are metallic shapes available in different sizes for a number of varying products. Then it is allowed to cool. After cooling the product is taken out of the mould. The product is now ready for sale.

Cost of Production

The cost of production includes the cost of raw materials, electricity, oils and fuels and interest on working capital and the cost of transportation. The detailed picture of different costs of production is given in the following table.

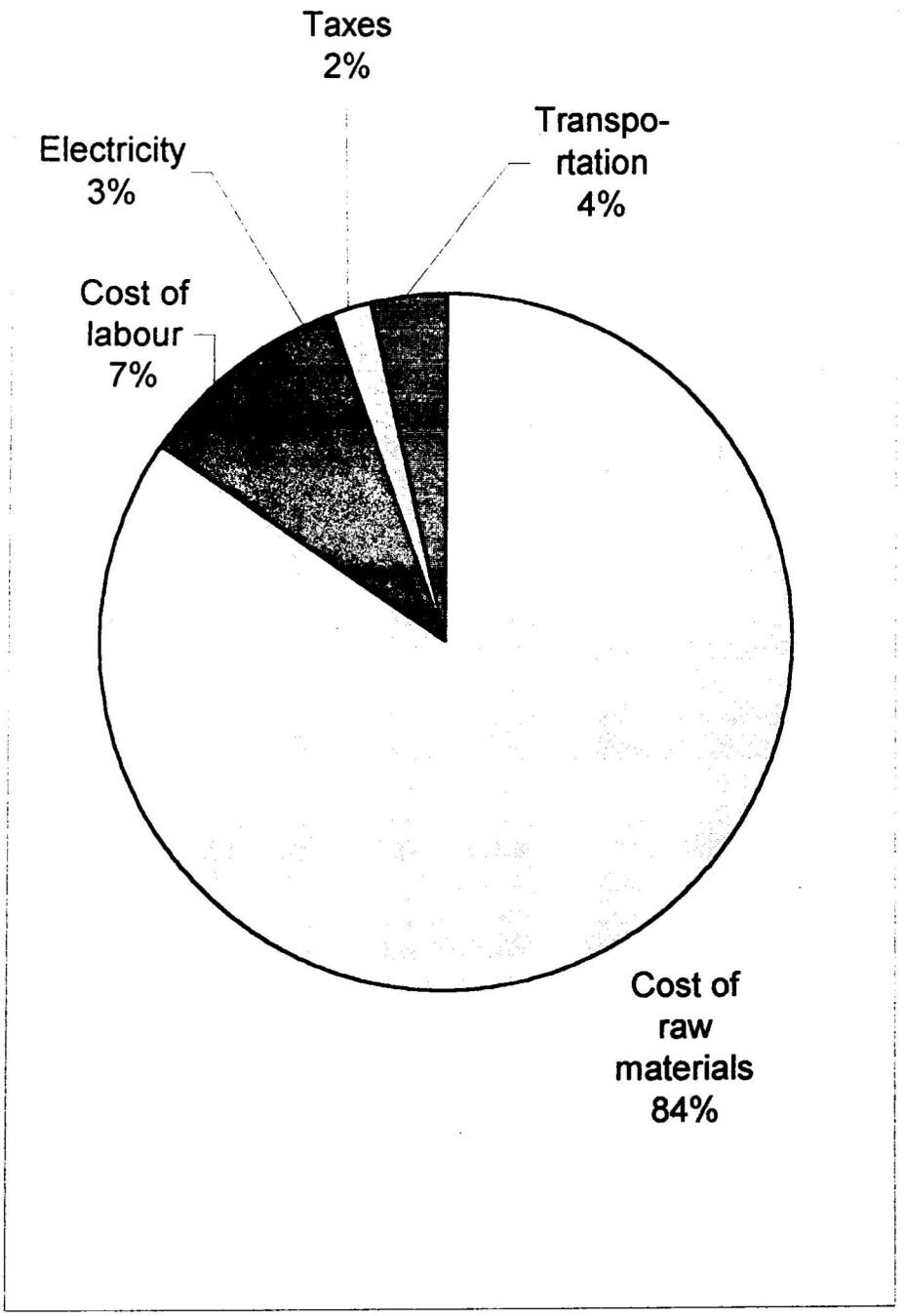
Table 3.14 Different Costs of Production in Plastics industry (Average)

District	Class	Cost of raw materials	Cost of labour	Rent	Electricity	Water, Fuel, oil	Taxes	Transportation	Interest on WC	Others	Total Cost of Production.
Thrissur	I	20311	4425	200	288	0	1050	1925	414	375	28987
	II	52939	6267	0	1733	187	2400	1167	739	767	66198
	III	66700	8294	250	3125	600	1811	5175	799	625	87379
	IV	235458	10467	0	6000	167	1867	3000	2022	1167	260147
	V	334167	11510	0	5833	1667	7333	8167	4083	2333	375093
	VI	1267833	29667	0	8000	667	64800	17667	8556	1515	1398704
Kozhikkode	I	36008	4620	160	734	650	50	2340	249	700	44862
	II	52342	7075	0	2225	1290	217	3175	525	1500	68294
	III	143013	10869	250	6250	250	163	7375	1733	750	170651
	IV	121540	11750	0	9250	500	758	4000	2042	1250	151089
	V	359492	13833	0	10000	1100	167	12667	3111	500	399769
	VI	882000	28000	0	20000	2750	54000	22500	4667	3500	1017417
Alappuzha	I	15900	6700	160	660	1200	220	2600	443	1000	27683
	II	57900	8100	400	2760	652	130	5400	572	1000	76914
	III	101925	10500	0	7250	250	88	6500	1517	1025	129054
	IV	349792	13187	0	11500	1667	167	9000	3442	333	389087
	V	1323750	27300	0	22000	2500	67200	16800	8750	1200	1468300
	IV	1701000	24000	0	12000	1000	86240	12000	7000	1352	1843240
Average		395670	13142	79	7200	950	16037	7859	2815	1161	444604

Table 3.15 Relative shares of different items in cost of production

District	Class	Cost of raw materials		Cost of labour		Electricity Taxes		Transportation		Taxes		Total Cost of Production.	
Thrissur	I	20311	70.07	4425	15.27	288	0.99	1050	3.62	1925	6.64	28987	100
	II	52939	79.97	6267	9.47	1733	2.62	2400	3.63	1167	1.76	66198	100
	III	66700	76.33	8294	9.49	3125	3.58	1811	2.07	5175	5.92	87379	100
	IV	235458	90.51	10467	4.02	6000	2.31	1867	0.72	3000	1.15	260147	100
	V	334167	89.09	11510	3.07	5833	1.56	7333	1.96	8167	2.18	375093	100
	VI	1267833	90.64	29667	2.12	8000	0.57	64800	4.63	17667	1.26	1398704	100
Kozhikkode	I	36008	80.27	4620	10.30	734	1.64	50	0.11	2340	5.22	44862	100
	II	52342	76.64	7075	10.36	2225	3.26	217	0.32	3175	4.65	68294	100
	III	143013	83.80	10869	6.37	6250	3.66	163	0.10	7375	4.32	170651	100
	IV	121540	80.44	11750	7.78	9250	6.12	758	0.50	4000	2.65	151089	100
	V	359492	89.92	13833	3.46	10000	2.50	167	0.04	12667	3.17	399769	100
	VI	882000	86.69	28000	2.75	20000	1.97	54000	5.31	22500	2.21	1017417	100
Alappuzha	I	15900	57.44	6700	24.20	660	2.38	220	0.79	2600	9.39	27683	100
	II	57900	75.28	8100	10.53	2760	3.59	130	0.17	5400	7.02	76914	100
	III	101925	78.98	10500	8.14	7250	5.62	88	0.07	6500	5.04	129054	100
	IV	349792	89.90	13187	3.39	11500	2.96	167	0.04	9000	2.31	389087	100
	V	1323750	90.16	27300	1.86	22000	1.50	67200	4.58	16800	1.14	1468300	100
	IV	1701000	92.28	24000	1.30	12000	0.65	86240	4.68	12000	0.65	1843240	100
Average		395670	88.99	13142	2.96	7200	1.62	16037	3.61	7859	1.77	444604	100

Figure 3.3 Relative Shares in Cost of Production



From the figure above we get a clear idea about the relative shares of different items in cost of production. Around 84 per cent of the total cost goes to the consumption of raw materials. This is due to the following facts.

The plastics industry can be divided into three sectors. Firstly, the basic raw material sector, which uses materials like Naphtha, Benzene, Alcohol, Carbide, etc. to produce Intermediates, which are used in the manufacture of rexins. Secondly there is Plastic rexin sector which producing thermosetting and thermoplastic rexins. Thirdly, the ultimate conversion sector, which manufactures plastic products of utility such as household and electrical appliances, decorative, laminates, fittings, etc. Our study includes only firms in the ultimate conversion sector where only processing of plastics raw material, which is shaping it to different products of convenience, is taking place. This is done with the help of machines and moulds, which require less labour and other inputs. Here the cost of labour is only 7per cent.

Other important items of cost are electricity and transportation. Tax is also having a less share because the Government exempts most of the firms from taxation on account of different incentives. A small industry does not have to pay tax for the first 5 years of starting.

3.6 Economic Performance of Units

Profitability is the simple and widely used index of assessing business efficiency of the firm. Profit is usually estimated as the difference between the total expenses involved in making or buying a commodity and the total revenue accruing from its sales. This difference when expressed as a proportion of invested capital or current outlay or sales, shows the profitability of the business. Average gross profit of the different classes of plastic industry is given below.

Table 3.16 Monthly Gross Profit (Average)

District	Class	Sales Revenue (Rs.)	Cost of Production (Rs.)	Gross Profit (Rs.)
Thrissur	I	40792	27562	13230
	II	86667	65431	21235
	III	123662	86754	36907
	IV	300833	257114	43719
	V	466667	373093	93573
	VI	1620000	1397189	222811
Kozhikkode	I	56333	44112	12222
	II	91500	66632	24868
	III	204037	169739	34298
	IV	180700	149082	31618
	V	500000	399436	100564
	VI	1350000	1017417	332583
Alappuzha	I	33500	26463	7037
	II	90700	76784	13916
	III	145208	127942	17267
	IV	450000	388920	61080
	V	1680000	1468300	211700
	VI	2156000	1843240	312760
Average		532033	443623	88411

Source: Computed from Primary Survey

Gross profit increases with the size of the firm in all the three districts. It ranges from Rs.13,000 to Rs.2 lakhs in Thrissur district, from Rs.12,000 to Rs.3 lakhs in Kozhikkode district and from Rs.7,000 to Rs.3 lakhs in Alappuzha district.

Gross Profit Margin

Gross profit margin is an important measure of the financial performance of the firm it is the ratio of gross profit to net sales. The gross profit margin for different classes of plastic industry is given in the following table.

Table 3.17 Gross Profit Margin (Average)

District	Class	Gross Profit (Rs.)	Net Sales (Rs.)	Gross Profit Margin
Thrissur	I	13230	40792	32.43
	II	21235	86667	24.50
	III	36907	123662	29.85
	IV	43719	300833	14.53
	V	93573	466667	20.05
	VI	222811	1620000	13.75
Kozhikkode	I	12222	56333	21.70
	II	24868	91500	27.18
	III	34298	204037	16.81
	IV	31618	180700	17.50
	V	100564	500000	20.11
	VI	332583	1350000	24.64
Alappuzha	I	7037	33500	21.00
	II	13916	90700	15.34
	III	17267	145208	11.89
	IV	61080	450000	13.57
	V	211700	1680000	12.60
	VI	312760	2156000	14.51
Average		88411	532033	16.62

Source: Computed from Primary Survey

Gross profit margin as envisaged from the table slightly declines with the size of the firm. In class I it ranges from 21 to 32 percent of the net sales. It ranges from 15.34 per cent to 27.18 per cent in class II, from 11.89 per cent to 29.85 per cent in class III, from 14.53 per cent to 15.70 per cent in class IV, from 12.60 per cent to 20.11 per cent in class V and from 13.75 per cent to 24.64 per cent in Class VI.

The gross profit as percentage of net sales first declines and lastly increases with the increase in net sales.

Operating Margin

This is a short-term measure of profitability showing the operating efficiency of the firm. This is defined as the ratio of ratio of net sales to total operating expenses. The operating margin for the plastic industrial units is given in the following table.

Table 3.18 Operating Margin (Average)

District	Class	Gross Profit (Rs.)	Operating Expenses (Rs.)	Operating Margin
Thrissur	I	27562	40792	48.00
	II	65431	86667	32.45
	III	86754	123662	42.54
	IV	257114	300833	17.00
	V	373093	466667	25.08
	VI	1397189	1620000	15.95
Kozhikkode	I	44112	56333	27.71
	II	66632	91500	37.32
	III	169739	204037	20.21
	IV	149082	180700	21.21
	V	399436	500000	25.18
	VI	1017417	1350000	32.69
Alappuzha	I	26463	33500	26.59
	II	76784	90700	18.12
	III	127942	145208	13.50
	IV	388920	450000	15.71
	V	1468300	1680000	14.42
	VI	1843240	2156000	16.97
Average		88411	443623	19.93

Source: Computed from Primary Survey

Operating Margin is found to be decreasing with increase in total expenses. The average is 19.93 for plastic industry. The firms could not run profitably of operating margin is below 10 per cent. It is a comparatively good ratio as compared to many other industries.

The operating margin ranges from 26.59 per cent to 48.00 per cent in class I, from 18.12 per cent to 37.32 per cent in class II, from 13.50 per cent to 42.54 per cent in class III, from 15.71 per cent to 21.21 per cent in class IV, from 14.42 per cent to 25.18 per cent in class V and from 15.95 per cent to 32.69 per cent in Class VI.

Return on investment

This is defined as the gross profit as the percentage of total fixed assets of the firm. The ratio reflects the long-term profitability of the firm.

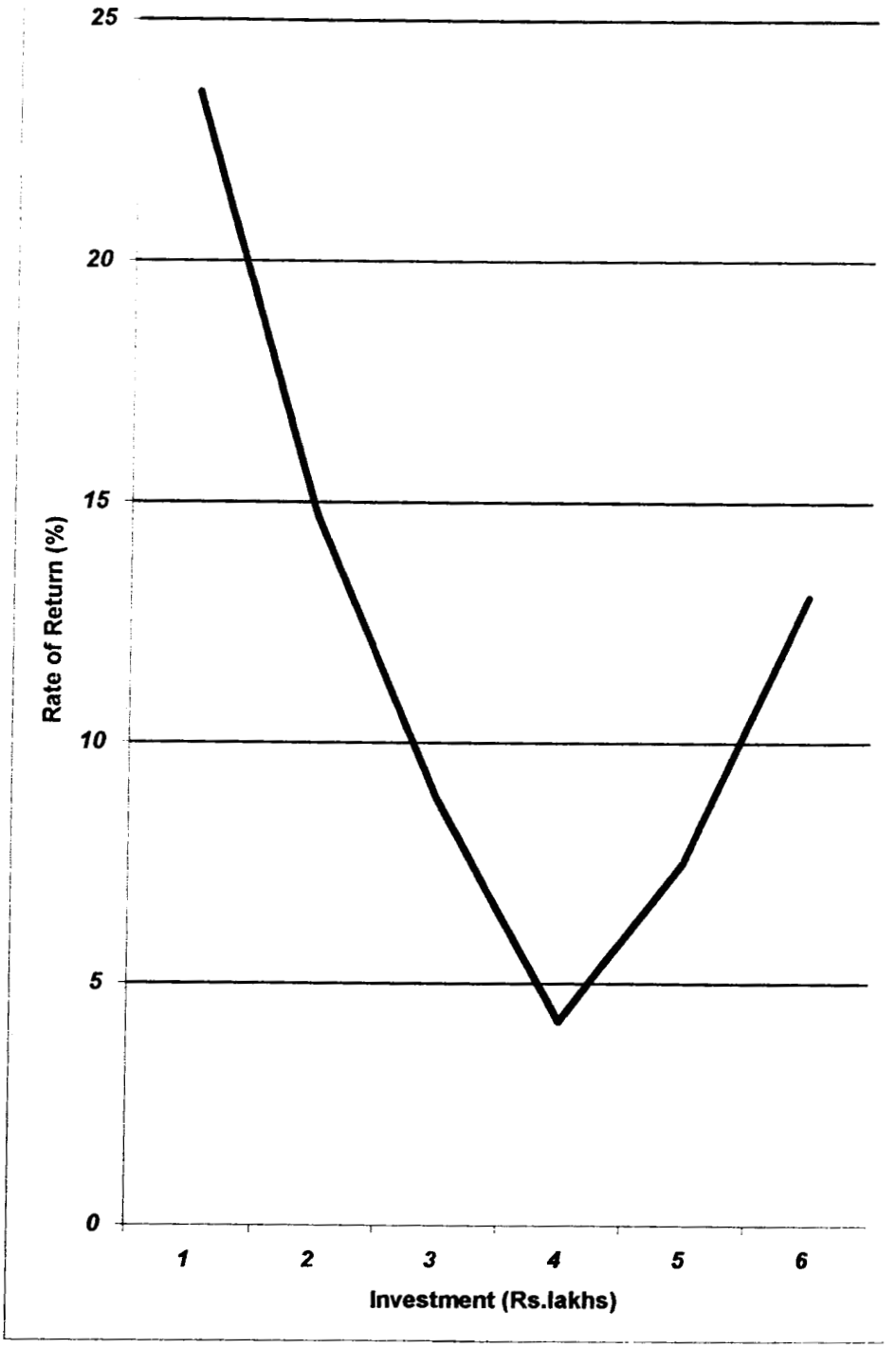
The following table and chart gives the ratio Return on Investment in the plastic industrial units in the three districts.

Table 3.19 Rate of Return on Investment (Average)

District	Class	Gross Profit (Rs.)	Total Investment	The Rate of Return
Thrissur	I	13230	36500	36.25
	II	21235	180000	11.80
	III	36907	316250	11.67
	IV	43719	816667	5.35
	V	93573	1600000	5.85
	VI	222811	2386667	9.34
Kozhikkode	I	12222	52000	23.50
	II	24868	168750	14.74
	III	34298	387500	8.85
	IV	31618	750000	4.22
	V	100564	1333333	7.54
	VI	332583	2550000	13.04
Alappuzha	I	7037	67000	10.50
	II	13916	155000	8.98
	III	17267	318750	5.42
	IV	61080	83333300	7.33
	V	211700	1333333	15.88
	VI	312760	2550000	12.27
Average		88411	879727	10.05

Source: Computed from Primary Survey

Figure 3. 4 Rate of Return on Investment



The rate of return on investment is declining with increasing investment. This is the general tendency we can see from the table. The average rate of return is only 10.05 per cent, which corresponds with the general rate of interest in the economy. So we can conclude that investing in this industry gives a marginal benefit to the investors in the state. Almost all the industrial units are providing a positive rate of return. This is also due to the fact that most of these units have started within a period of 10 years.

It is also clear from the figure that rate of return first decreases with investment and then increases as investment become higher. Small investment returns speedily while it will take a long term to get a higher returns from industries with large investment. The capacity utilisation is also a determinant factor in this sense. Only a few of the small scale units are running three shifts while others are running a single shift of operation. This leads to less capacity utilisation. Further there are times when production has to be stopped because of power shortage and raw material shortage. Even though the plastic processing industry provided a comparatively greater rate of return to those invested in it.

3.7 Conclusion

The analysis of the financial performance of the units, which is worked out in this chapter, can be summarised as follows.

The study showed that around 90 per cent of the units have started within the period of 1986 to 1995 when there was a boom in the number of plastic industry units. Around 50 percent of the entrepreneurs are in the age group of below 40 years. Most of the small industries are those started by youngsters after a long search for a gainful employment or due to the dissatisfaction in the previous employment. 42 per cent of them were unemployed when starting the unit while 22 per cent were employed as operators in similar units. 15 per cent of the entrepreneurs are retired government servants.

The ratio of external capital to internal capital is 1.04. This shows that the share of external capital in total capital is more than 50 percent. It increases as investment goes up. The average investment in plant and machinery is 67.33 per cent of the total investment. This shows the capital intensity of the industry. The investment in plant and machinery increases as plant size

increases. At an average 28 per cent of the capital is used as working capital. The share of working capital increases as the size of the unit increases. Average investment inland and building is 30.44 per cent of the total investment. It declines with increase in investment.

From the analysis of cost of production we can see that 83 per cent of the total cost goes to the consumption of raw materials. The share of wages is only 7 percent.

Gross profit margin as envisaged from the analysis slightly declines with the size of the firm with an average of 16.62 per cent of the net sales. Operating Margin is found to be decreasing with increase in total expenses. The average is 19.93 for plastic industry.

The rate of return on investment is declining with increasing investment. It ranges from 5 per cent to 24 per cent. The average rate of return on investment is only 10.05 per cent, which corresponds with the general rate of interest in the economy.

PRODUCTIVITY AND EFFICIENCY IN PLASTIC INDUSTRY

M.S.Suresh Kumar " Economics of plastic industry in India with special reference to Kerala " Thesis. Department of Economics , Dr.John Matthai Centre , University of Calicut, 2003

Chapter - IV

PRODUCTIVITY AND EFFICIENCY IN PLASTIC INDUSTRY

CONTENTS

4.1 Introduction

The core of any economic activity is to strive for the maximum possible efficiency. Since our objective to study the economic behaviour of the industry we have to examine the efficiency of the firms or industrial efficiency. The productive efficiency has been defined in terms of technical efficiency and factor price efficiency. Technical efficiency means the production of a given level of output from the lowest possible combination of inputs. Technical efficiency is a pre-requisite for economic efficiency of a firm.

Technology means how much of various outputs can be produced using specified quantities of various inputs. Potentially, the descriptions and lists of the inputs and outputs can be long and detailed. Typically economists simplify and abstract this in a familiar way to a single output production function that specifies the maximum quantity of output producible from given quantities of *labour* and *capital,* where these inputs are aggregate or abstract representatives of a complex reality.

4.2 Productivity of Capital

Capital is considered to be the most important factor of production. It is the sum of all kinds of heterogeneous physical goods, like tools, equipments, machinery land and building, etc. Any industry needs a certain level capital investment. The investment decisions of any industrialist depend on the productivity of capital in that industry. It is also the main component of industrial efficiency.

Productivity, in general, is defined as the ratio of what comes out a production process to what goes into the process. Total output in physical or value terms divided by the value of physical units of capital is known as capital productivity. In this case the total output of all factors of production, say, land, labour, capital, etc. is attributed to a single factor of production, capital. Thus this ratio does not reflect the contribution of one factor alone but something more than that. They are used as surrogate ratios for the total factor productivity or industrial efficiency of the firm.

Capital Output Ratio

Capital Output Ratio (COR) is defined as the ratio of total fixed capital to total output. It measures the capital required for

producing one unit of output. The average Capital Output Ratio in the plastic industrial units is given in the following table.

Table 4.1 The Capital Output Ratio (Average)

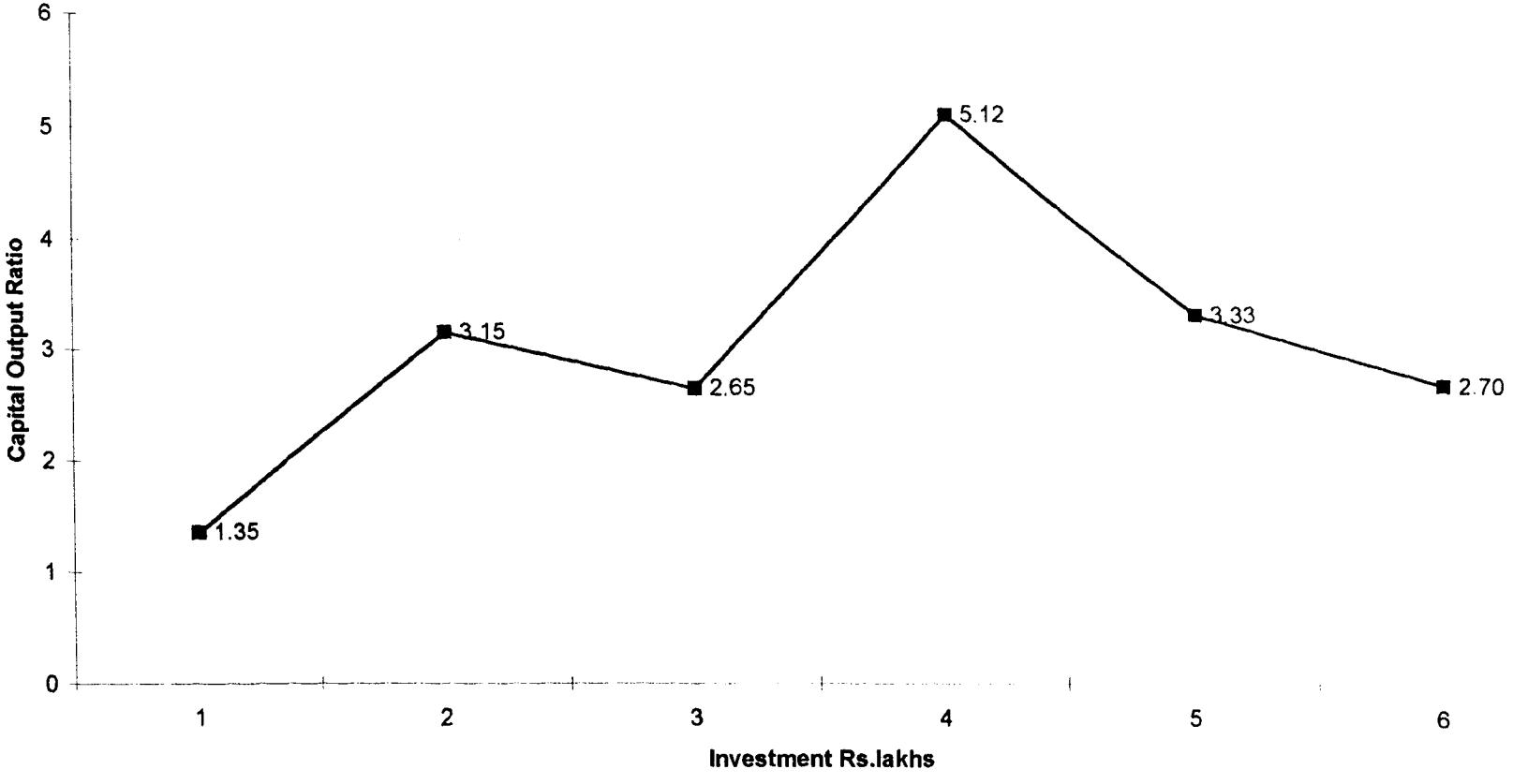
District	Class	Total Capital (Rs.)	Value Added (Rs.)	Ratio of Capital to Output
Thrissur	I	71950	40792	2.02
	II	243333	86667	3.98
	III	384750	123662	3.89
	IV	990000	300833	3.96
	V	1950000	466667	4.56
	VI	3120000	1620000	2.18
Kozhikkode	I	73360	56333	1.35
	II	213750	91500	3.15
	III	536000	204037	2.65
	IV	925000	180700	5.12
	V	1600000	500000	3.33
	VI	2950000	1350000	2.70
Alappuzha	I	105000	33500	3.21
	II	204000	90700	2.53
	III	448750	145208	3.84
	IV	1128333	450000	2.66
	V	2550000	1680000	1.61
	VI	2800000	2156000	1.30
Average		1127457	532033	3.00

Source: Computed from Primary Survey

Here we can see that capital output ratio ranges from 1.35 to 5.12. The reason for this high variation is that though we taken the industrial units in category as plastics industry, they are heterogeneous in nature. The only similarity among them is that they use a common set of raw materials whereas they produce different kind of products in different kinds of machines for different applications. For example these includes units producing PVC pipes, Buckets and Mugs, PVC insulated cables, fancy items, Polythene bags, Large containers, Hoses and so on. On account of these the labour requirement and hence the labour productivity may vary among them.

The average capital output ratio when all these units put together irrespective of size is 3. The capital output ratio for Indian industry for the same period is around 5.0. Thus we cane see that the plastics industry performs in a better way among Indian industries ensuring a good return on investment. The industry also starts giving returns earlier than any other industries. The capital required per unit of output is less than most of the other industries in small-scale sector. That is the reason for attraction of a number of new investors and entrepreneurs to plastic industry.

figure 4.1 Capital Output Ratio



4.3 Labour Productivity

Labour is an important and, in fact, indispensable factor of production. An industrial firm employs workers to do several types of jobs. Some of them are required to maintain the plant and machinery of the firm and some do manual works where the use of machines is not possible or it is uneconomical. Apart from workers, the firm would be employing persons to manage its offices, to guard its properties and for several other works. A hundred per cent automation is not possible in any industry.

Labour is thus an unavoidable input. Considering the importance of the labour input, it will be quite natural for the firm to lay emphasis on its efficient utilisation. Labour productivity is often used as a test of industrial efficiency and even as an index of economic development of a society.

Labour productivity is a ratio of output to labour input for a specific time period, say, a day, a week or a month or a year. The input of labour may be taken as number of workers or man-hours worked during the period. This ratio may be computed for a worker or a group of workers or for the plant as a whole. Some times the labour productivity may be also defined as the a ratio of labour input to output, that is, the input of labour required

for turning out one unit of output. Thus an increase in labour productivity means a reduction in this ratio. An increase in Output Labour Ratio or a decrease in Labour Output Ratio means an increase in labour productivity.

Output Labour Ratio

Table 4.2 The Output Labour Ratio (Average)

District	Class	Labour (Man-hours)	Out put (Value Added - Rs.)	Output Labour Ratio
Thrissur	I	40	40792	41
	II	48	86667	72
	III	64	123662	77
	IV	64	300833	188
	V	80	466667	233
	VI	160	1620000	405
Kozhikkode	I	40	56333	56
	II	56	91500	65
	III	64	204037	128
	IV	64	180700	113
	V	72	500000	278
	VI	128	1350000	422
Alappuzha	I	40	33500	34
	II	48	90700	76
	III	64	145208	91
	IV	72	450000	250
	V	136	1680000	494
	VI	128	2156000	674
Average		72	532033	296

Source: Computed from Primary Survey

It is clearly drawn from the table that the output labour ratio is steadily increasing with investment. The ratio is calculated taking labour in man-hours and output in Rupees. The ratio gives the value of output in Rupees per one man-hour.

The increasing labour output ratio with increasing investment means that what make labour more productive is the machine or investment.

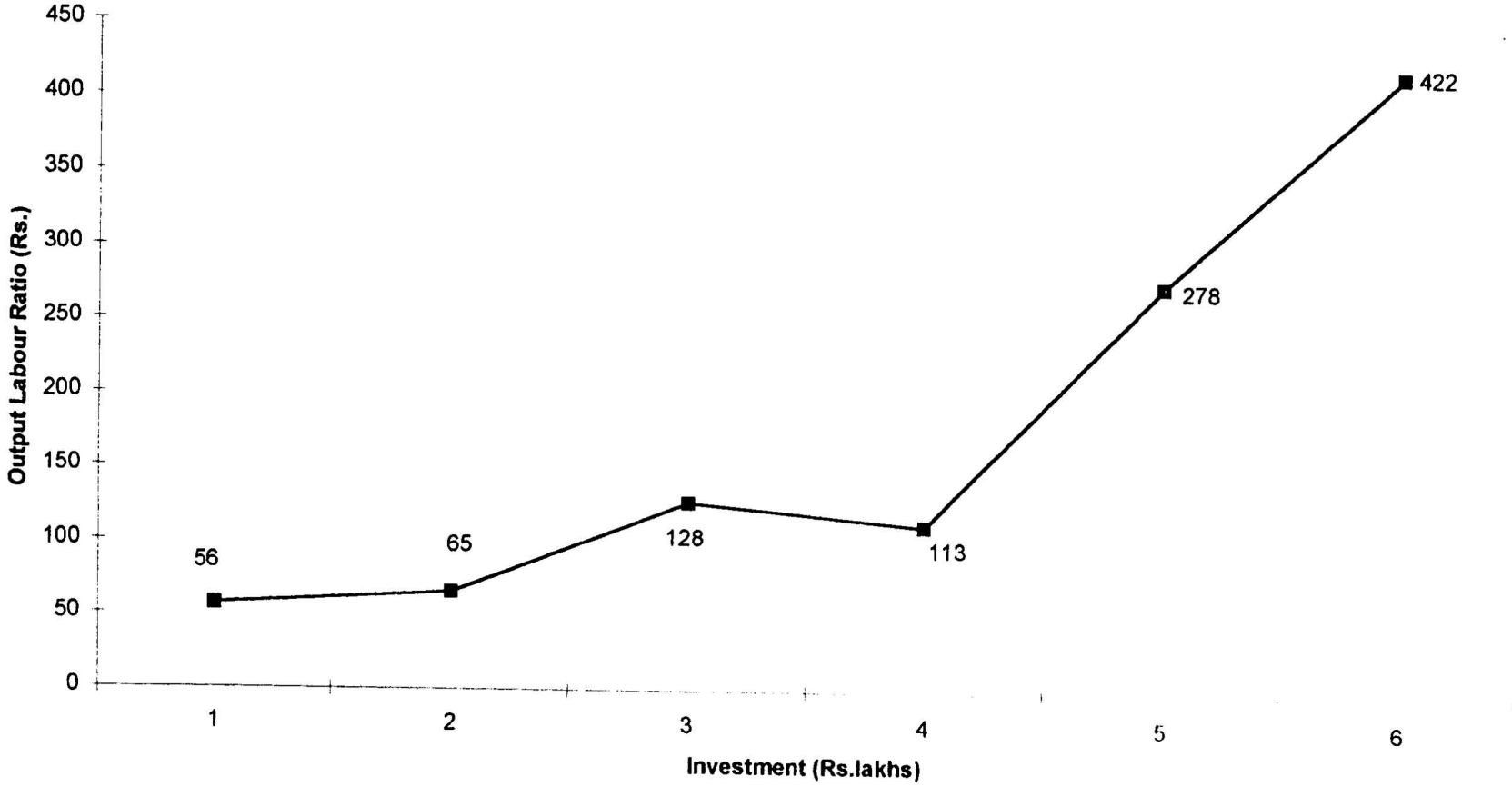
The output labour ratio, which is around Rs.40 per man-hour in class I with an investment less than Rs.1 lakh increases to around Rs.400 per man-hour in class VI with an investment greater than Rs.20 lakhs. The average output labour ratio is Rs.296 per man-hour.

The nature of the plastic industry is like that the output mostly depends on machine and less on worker. Even a single worker can produce output worth lakhs of Rupees in a month provided proper machines are used.

The number of machine operators is less in each unit but most are unskilled workers who are engaged in loading and unloading of both the raw material and product, mixing and colouring of raw materials.

From figure 4.2 we can see that output labour ratio first increases slowly and then steeply. As investment increases, more and more new machines are introduced not only for production but also mixing raw material, cutting and shaping the product, etc. Hence productivity of labour increases in more automated units.

figure 4.2 Output Labour Ratio



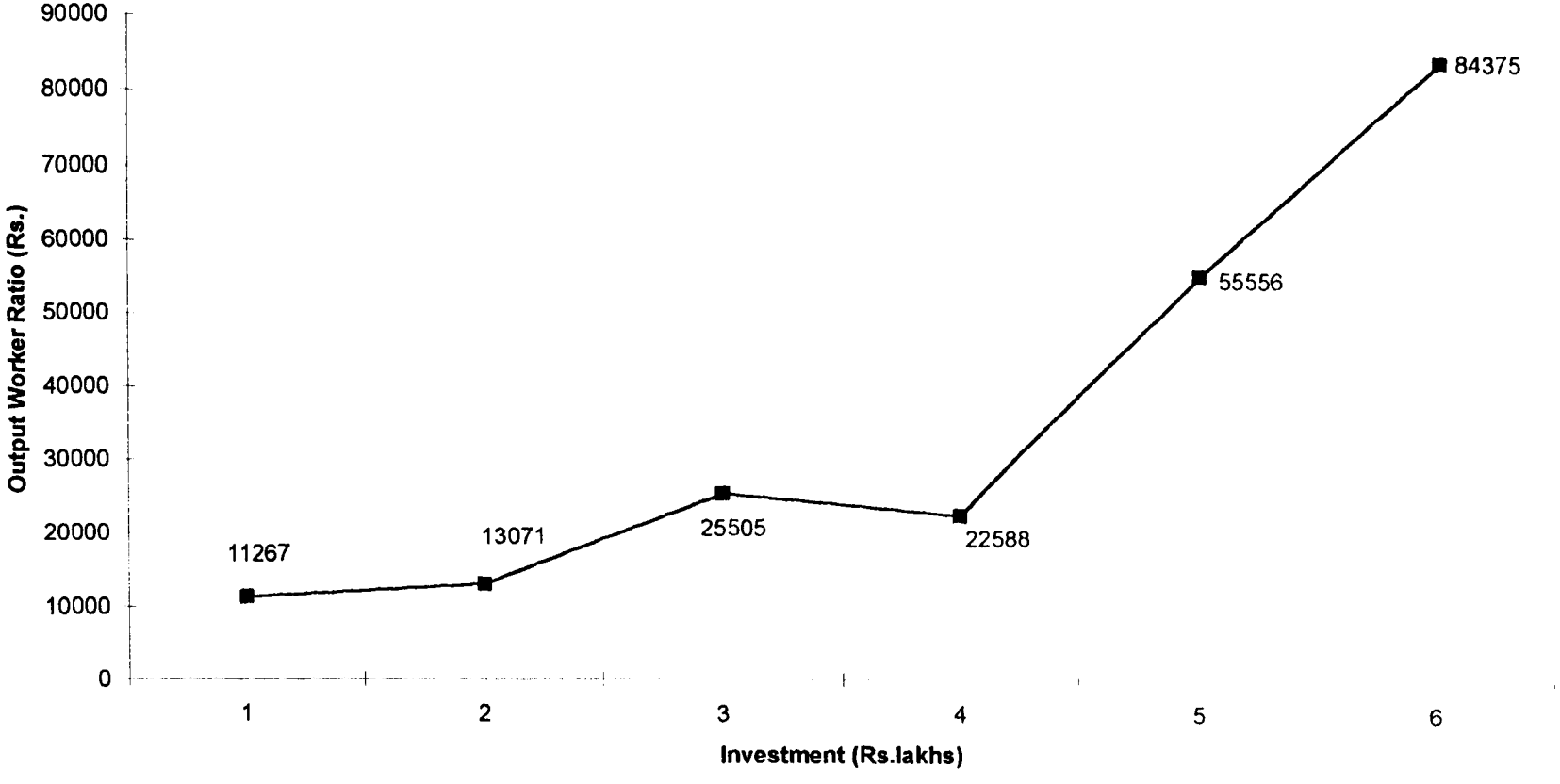
The productivity of labour is also measured using the number of workers as a measure of labour. Then we obtain the output per worker for a given time period, here a month. This is given in the following table.

Table 4.3 The Output per Worker Ratio(Average)

District	Class	Labour (No. of Workers)	Out put (Value Added -Rs.)	Output per worker
Thrissur	I	5	40792	9226
	II	6	86667	12566
	III	8	123662	16354
	IV	8	300833	35437
	V	10	466667	49537
	VI	20	1620000	81453
Kozhikkode	I	5	56333	12242
	II	7	91500	12883
	III	8	204037	27112
	IV	8	180700	23195
	V	9	500000	58333
	VI	16	1350000	79091
Alappuzha	I	5	33500	6575
	II	6	90700	14788
	III	8	145208	18504
	IV	9	450000	52315
	V	17	1680000	117500
	VI	16	2156000	134750
Average		9	532033	42325

Source: Computed from Primary Survey

Figure 4.3 Output per Worker Ratio



In practice, firms will rely on labour productivity than capital productivity. This is because output per worker is the easiest basis for comparison. The firms can make decisions on employment and investment based on labour productivity. The entrepreneurs always try to increase labour productivity, which means utilise maximum capacity of the machines using manpower.

The output per worker is calculated for a month. It ranges from Rs.9, 226 to Rs.1, 34,750 per month. The average ratio is Rs.42325 per month. The output per worker ratio is very high plastic industry compared to other industries. This means that even less is invested plastics give more returns for that.

Labour Output Ratio

The labour productivity can also be measured using labour output ratio. It measures the ratio of labour input to total output. Here cost of labour is taken as the labour input and value added as output. This ratio gives the return on the cost of

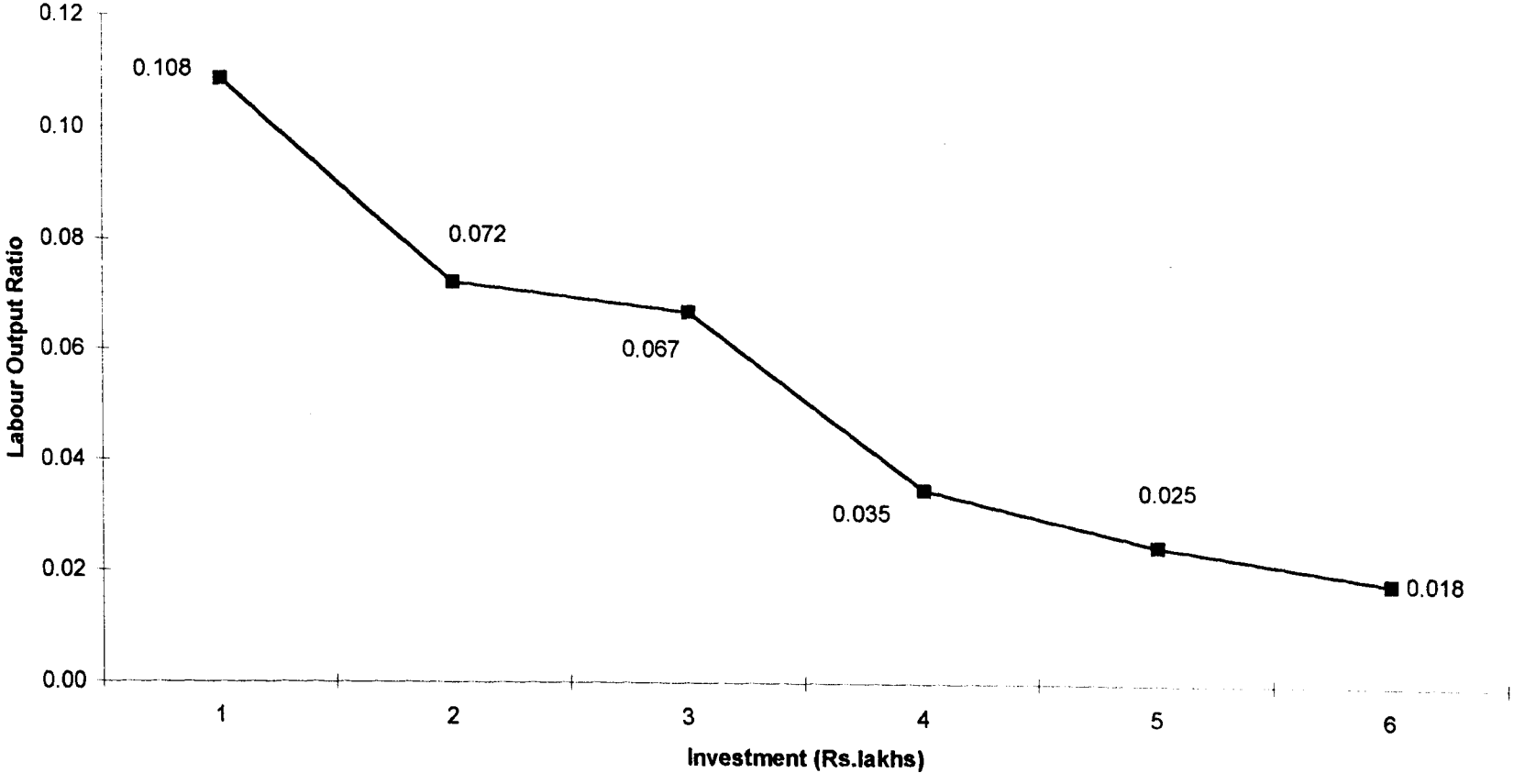
labour. A decrease in labour output ratio means an increase in labour productivity. The labour output ratio for plastic industry units is given in the following table.

Table 4.4 The Labour Output Ratio (Average)

District	Class	Cost of Labour (Rs.)	Out put (Value Added -Rs.)	Labour Output Ratio
Thrissur	I	4425	40792	0.108
	II	6266.7	86667	0.072
	III	8293.8	123662	0.067
	IV	10467	300833	0.035
	V	11510	466667	0.025
	VI	29667	1620000	0.018
Kozhikkode	I	4620	56333	0.082
	II	7075	91500	0.077
	III	10869	204037	0.053
	IV	11750	180700	0.065
	V	13833	500000	0.028
	VI	28000	1350000	0.021
Alappuzha	I	6700	33500	0.200
	II	8100	90700	0.089
	III	10500	145208	0.072
	IV	13187	450000	0.029
	V	27300	1680000	0.016
	VI	24000	2156000	0.011
Average		13142	532033	0.025

Source: Computed from Primary Survey

Figure 4.4 Labour Output Ratio



The labour output ratio is very less in plastic industry. It ranges from 0.011 to 0.2. The highest labour output ratio is seen in units with less investment. These units generally use hand moulding and machines and semi mechanised production system.

When we go the higher classes with higher levels of investment labour output ratio gradually decreases. The average labour output ratio is 0.025. The labour output ratio is very less in plastic industry. Lesser is the ratio higher is the productivity of labour.

4.4 Total Factor Productivity

Total Factor Productivity is the ratio of the gross revenue to the total cost of production. Total factor productivity has been used many times as a measure of technical change. The Total Factor Productivity Growth (TFPG) has considered as a measure on industrial development of a country. The Total Factor productivity will be generally higher in industries with a better growth potential.

Table 4.5 The Total Factor Productivity (Average)

District	Class	Total Cost of Production (Rs.)	Total Revenue (Rs.)	TFP
Thrissur	I	27562	40792	1.48
	II	65431	86667	1.32
	III	86754	123662	1.43
	IV	257114	300833	1.17
	V	373093	466667	1.25
	VI	1397189	1620000	1.16
Kozhikkode	I	44112	56333	1.28
	II	66632	91500	1.37
	III	169739	204037	1.20
	IV	149082	180700	1.21
	V	399436	500000	1.25
	VI	1017417	1350000	1.33
Alappuzha	I	26463	33500	1.27
	II	76784	90700	1.18
	III	127942	145208	1.13
	IV	388920	450000	1.16
	V	1468300	1680000	1.14
	VI	1843240	2156000	1.17
Average		443623	532033	1.20

Source: Computed from Primary Survey

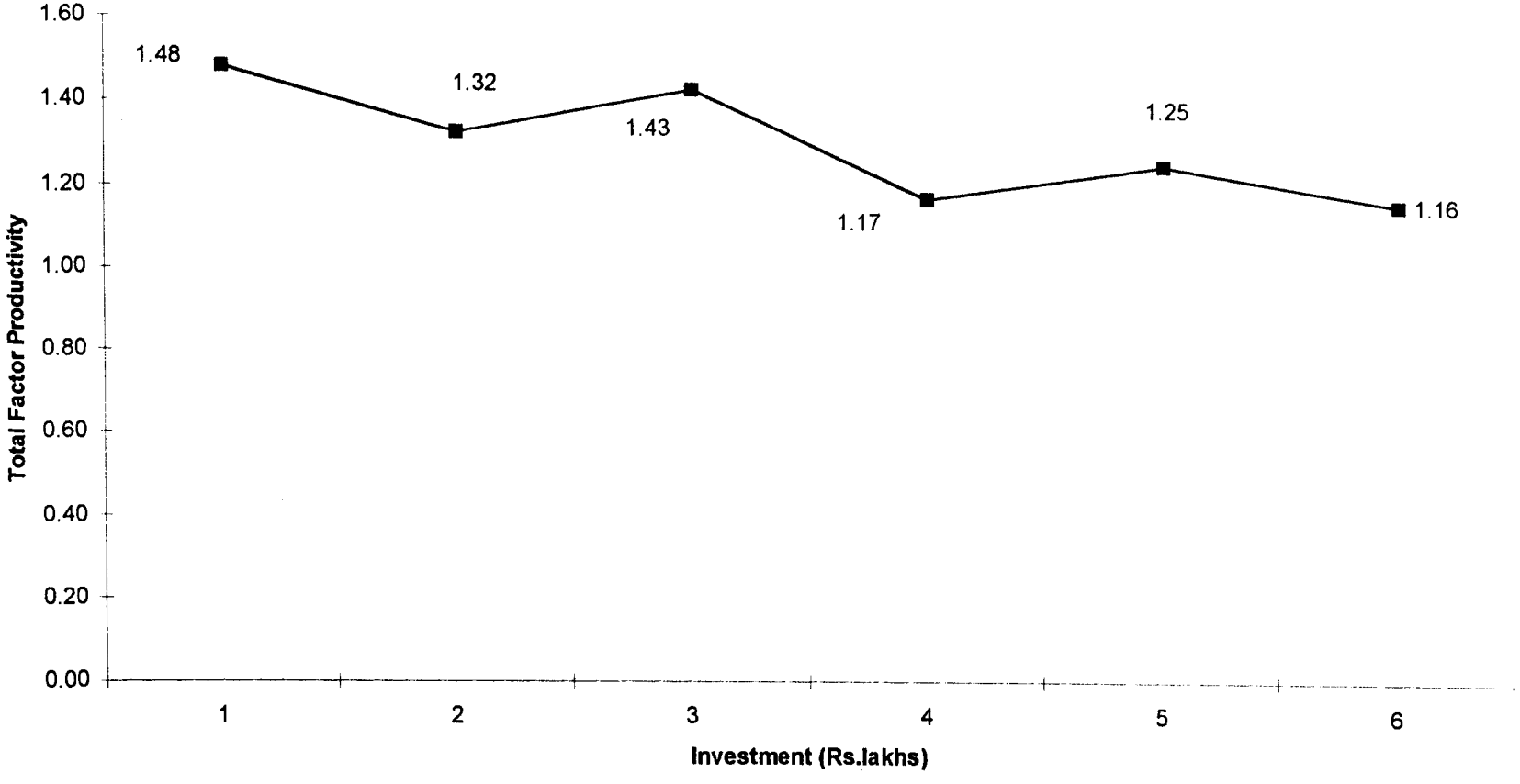
The Total Factor Productivity is greater than unity in plastic industry. It is a good trend compared to many of the industries in India. The average Total Factor Productivity ranges from 0.28 to 0.99 if we take the Indian industry as a whole.

The Total Factor Productivity in our sample units ranges from 1.13 to 1.48. No class have Total Factor Productivity less than unity. This means that the industry provides increasing returns to scale.

Total Factor Productivity decreases as investment increases. It is around 1.5 in class I with investment less than Rs.One lakh and declines to around 1.2 in class VI with investment greater than Rs.20 lakhs.

The movement of Total Factor Productivity with increase in investment is given in the following figure.

Figure 4.5 Total Factor Productivity



4.5 Distribution of Labour

An industrial firm employs workers to do several types of jobs. Some of them are required to maintain the plant and machinery of the firm and some do manual works where the use of machines is not possible or it is uneconomical. Apart from workers, the firm would be employing persons to manage its offices, to guard its properties and for several other works. Canvassing sales orders is an important job in the current era of competition. If it has not been properly done the produced output will not be sold out completely. So most of the small firms employ sales personnel also among their employees.

The productivity of labour will be high if the workers are employed in a perfect assignment. The assignment of sufficient and efficient workers in each job is the duty of a good entrepreneur.

The following table gives the distribution of labourers in plastic industrial units.

Table 4.6 Distribution of Labourers

District	Class	Manager	Sales Personnel	Skilled Workers	Unskilled Workers	No. of Workers
Thrissur	I	1 (21.05)	1 (21.05)	2 (47.37)	3 (63.16)	5
	II	1 (15.79)	2 (23.68)	4 (57.89)	1 (15.79)	6
	III	1 (13.33)	2 (26.67)	2 (23.33)	4 (56.67)	8
	IV	1 (12.00)	2 (20.00)	3 (36.00)	3 (32.00)	8
	V	1 (10.34)	2 (17.24)	3 (34.48)	4 (37.93)	10
	VI	2 (8.33)	4 (20.00)	5 (23.33)	10 (48.33)	20
Kozhikkode	I	1 (21.74)	1 (21.74)	2 (39.13)	2 (43.48)	5
	II	1 (14.29)	2 (21.43)	3 (39.29)	3 (39.29)	7
	III	1 (13.33)	1 (16.67)	3 (40.00)	2 (30.00)	8
	IV	1 (12.50)	2 (18.75)	4 (50.00)	2 (18.75)	8
	V	1 (11.54)	2 (23.08)	2 (26.92)	4 (46.15)	9
	VI	2 (9.38)	3 (18.75)	7 (40.63)	5 (31.25)	16
Alappuzha	I	1 (19.23)	1 (19.23)	2 (42.31)	2 (38.46)	5
	II	1 (16.67)	1 (16.67)	2 (30.00)	3 (53.33)	6
	III	1 (12.50)	1 (15.63)	3 (34.38)	3 (34.38)	8
	IV	1 (11.54)	2 (23.08)	3 (34.62)	3 (30.77)	9
	V	2 (9.09)	4 (24.24)	5 (27.27)	7 (39.39)	17
	VI	1 (6.25)	2 (12.50)	8 (50.00)	5 (31.25)	16
Average		1 (13.27)	2 (20.02)	3 (37.61)	4 (38.35)	9

Source: Computed from Primary Survey

*Figures in parentheses are percentages to total

From the table we can see that more than 37.60 per cent of the workers are skilled labourers. They are possessing qualifications like ITI certificate of Diploma in different trades. Skilled workers contribute a major share in production because the machines are carefully operated. Most of the machines are advanced in nature and imported from abroad. Fitters are essential in fitting and operating a number of moulds. They are paid salary in between Rs.2000 and Rs.3000 per month in most of the firms.

10.27 per cent of the workers are managers. Most of them are the entrepreneurs of the firms. They are paid a salary in between Rs.3000 to Rs.5000 per month. More than 20 per cent of the workers are sales personnel. Their role is very important because high level of competition exists in the market of plastic goods. In some of the units the entrepreneur himself or any of his family members take this crucial job. They are paid the same as skilled workers and often get other benefits like incentives for sales.

38 per cent of the workers are unskilled workers. They help the machine operators in running the unit, mixing the raw material and also do the loading and unloading of the raw materials and the products. They are generally paid less. Their wages in most of the firms is around Rs.1000 per month.

Capital Labour Ratio

Capital labour ratio is used as a measure of technology and the capacity utilisation of the firm. The firm is more capital intensive if this ratio is high and relatively labour intensive if this ratio is ~~high~~ low. The ratio is high in plastic industry than most of the other industries. The following table gives the capital labour ratio measured using cost of labour as labour.

Table 4.7 The Capital Labour Ratio (Average)

District	Class	Cost of Labour (Rs.)	Cost of Capital (Rs.)	Capital Labour Ratio
Thrissur	I	4425	71950	18
	II	6267	243333	88
	III	8294	384750	45
	IV	10467	990000	95
	V	11510	1950000	172
	VI	29667	3120000	122
Kozhikkode	I	4620	73360	15
	II	7075	213750	69
	III	10869	536000	50
	IV	11750	925000	81
	V	13833	1600000	115
	VI	28000	2950000	119
Alappuzha	I	6700	105000	16
	II	8100	204000	26
	III	10500	448750	44
	IV	13187	1128333	86
	V	27300	2550000	105
	VI	24000	2800000	117
Average		13142	1127457	77

Source: Computed from Primary Survey

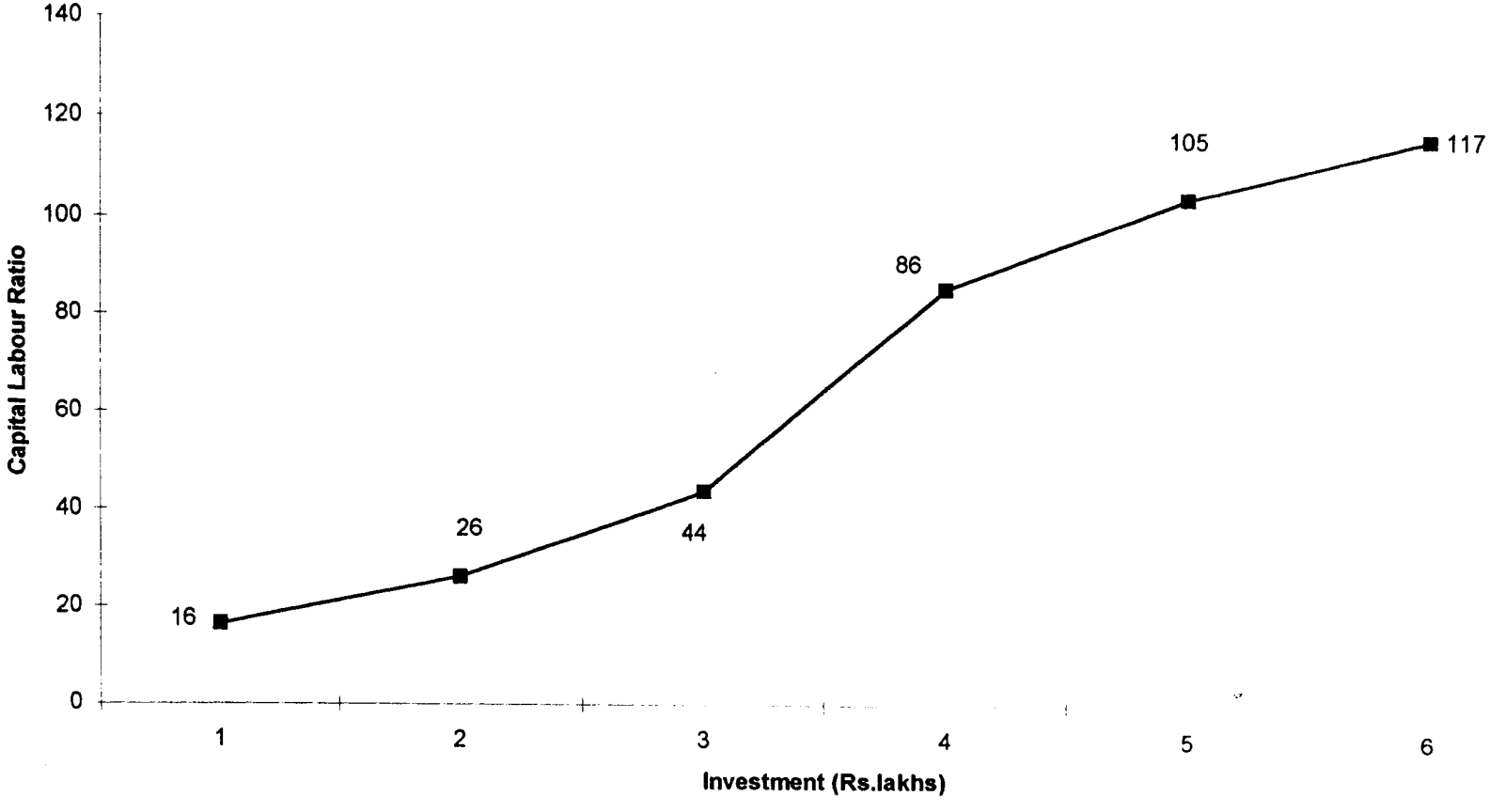
The capital labour ratio is increasing with investment. This means that the employment is not increasing proportionately to investment. More investment could generate more employment less than proportionately. That is more investment means more machines and automated machines, which requires less labour. Therefore investment means development of labour saving technology. This again shows the capital-intensive nature of the plastic industry.

The capital labour ratio is less than 20 in units in class I with an investment less than Rs.1 lakh. This increases to around 120 in units in class VI with an investment greater than Rs. 20 lakhs. The average capital labour ratio is 77.

The technological change in the plastic industry is so that the technology is becoming more capital intensive. In earlier stages hand moulding machines were used to produce small size goods, while now automated machines replace them. The mixing of the raw material and bending and cutting of the product especially in PVC pipe fittings were done by hand in earlier. Now these works are mechanised in small-scale units too.

The capital labour ratio in the sample units is given in the following figure.

Figure 4.6 Capital Labour Ratio



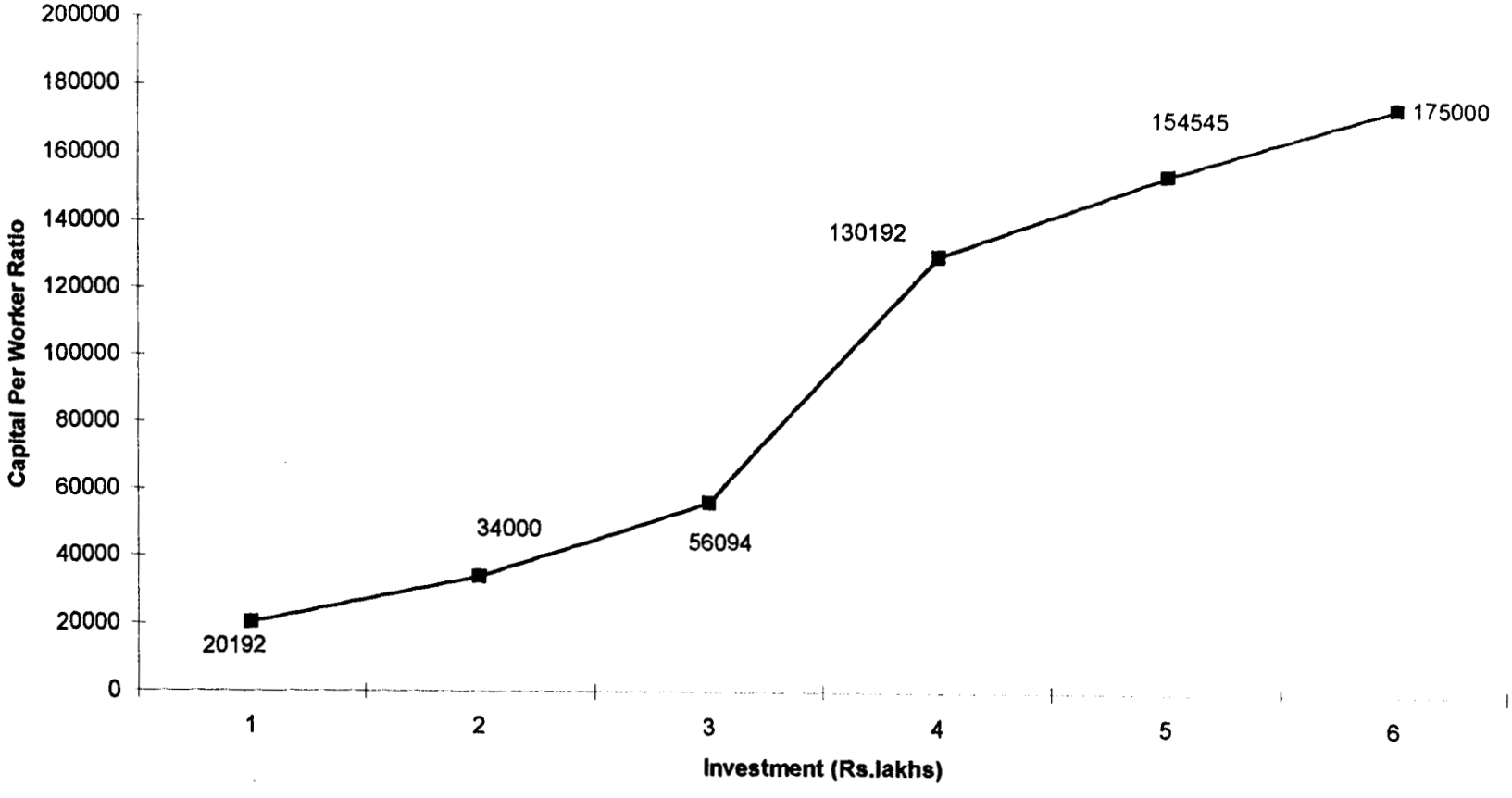
The ratio of capital per worker in the industry is given in the table 4.11 and is represented graphically in figure 4.7.

Table 4.8 The capital per worker Ratio (Average)

District	Class	No. of workers	Value Added (Rs.)	Capital per worker
Thrissur	I	5	71950	15147
	II	6	243333	38421
	III	8	384750	51300
	IV	8	990000	118800
	V	10	1950000	201724
	VI	20	3120000	156000
Kozhikkode	I	5	73360	15948
	II	7	213750	30536
	III	8	536000	71467
	IV	8	925000	115625
	V	9	1600000	184615
	VI	16	2950000	184375
Alappuzha	I	5	105000	20192
	II	6	204000	34000
	III	8	448750	56094
	IV	9	1128333	130192
	V	17	2550000	154545
	VI	16	2800000	175000
Average		9	1127457	120286

Source: Computed from Primary Survey

Figure 4.7 Capital Per Worker Ratio



The ratio gives the requirement of capital investment to employ one more person in the firm. It is the investment required to create one unit of employment. This ratio is important as far as governments are concerned. The government and the planning commission seek to create additional employment opportunities by industrialisation. But this aim will be possible if the government stress the promotion of industries with a lower capital per worker ratio.

The table and figure shows that the capital per worker ratio first moderately and then steeply increases with increase in investment. This means that more and more investment is needed to create any additional employment.

4.6 The production Function

Production function analysis gives direct measures for the productivity and efficiency of the industry. The linear homogeneous production function, say, Cobb-Douglas Production Function is used for this purpose.

The Cobb-Douglas Production Function is of the form

$$Q = AK^{\alpha}L^{\beta}U$$

Where Q is the total output,

K is the total capital

L is the total wages

α and β are the elasticity of production with respect to capital and labour. A is the efficiency coefficient. U is the random element.

Cobb-Douglas Production Function can be expressed in the logarithmic form as follows.

$$\text{Log } Q = \log A + \alpha \log K + \beta \log L + \log U$$

$$\text{i.e., } q = a + \alpha k + \beta l + u$$

The model is now in the linear form with parameters, a, α and β. This model can be estimated using ordinary least square method.

The linear regression of the Cobb Douglas Production is used. The following is a model with two inputs capital and labour. The model is fitted for the three districts separately and then the sample as a whole.

Thrissur District

$$\ln Q = -1.645 + 0.743 \ln K + 0.434 \ln L$$
$$(-1.355) \quad (6.116)^* \quad (2.126)^*$$

Figures in parentheses are t values. (* Significant at 5% level)

$R^2 = 0.897$

Adjusted $R^2 = 0.884$

The regression is highly significant as R^2 is 0.897 and adjusted R^2 is 0.884. The inputs in the production process in the industry can be clearly distributed between capital and labour. The individual coefficients are also significant. This shows that both the inputs are indispensable foe the production process.

The parameters α and β are the partial elasticity of output with respect to capital and labour respectively.

The elasticity of output with respect to capital is 0.743 where as that of labour is 0.434. This shows that output is more dependent capital than labour. 74.30 per cent variation can be made in output by changing the level of capital. Where as 43.40 per cent output can be varied by changes in labour input. Both capital and labour together can vary the output by 89.70 per cent as the value of R^2 indicates.

We can compute the rate of return on investment by simply adding the output elasticity.

$$\text{Rate of return} = \alpha + \beta = 0.743 + 0.434 = 1.177$$

As Rate of return on investment is greater than unity, the industry provides increasing returns to scale.

Factor Intensity, in the production technique can be computed using the formula,

$$\text{Factor Intensity} = \alpha / \beta = 0.743 / 0.434 = 1.712$$

Factor intensity measures the capital intensity in the firm. If the factor intensity is less than one the production technology is labour intensive, if it is greater than unity the production technology is capital intensive and if it is equal to one the technology is neither capital intensive nor labour intensive and has equal importance for both the factors in production.

Factor intensity is higher in plastics industry. It is in favour of the factor capital. This shows the capital intensity of the plastic industry.

The results of regression performed on the data from the industrial units in Kozhikkode are as follows. Figures in parentheses are t values.

$$\ln Q = \underset{(0.151)}{0.144} + \underset{(6.408)^*}{0.564 \ln K} + \underset{(3.358)^*}{0.536 \ln L}$$

* Significant at 5% level

$R^2 = 0.920$

Adjusted $R^2 = 0.910$

The coefficients of both capital and labour are significant in this regression. The elasticity of output with respect to capital and labour are almost equal in these units. The regression also holds overall significance.

The rate of return on investment = 0.564 + 0.536 = 1.100

This shows increasing returns to scale.

Factor Intensity = α / β = 0.564 / 0.536 = 1.052

Factor intensity is slightly in favour of capital.

The regression results on data from industrial units of Alappuzha district is given below. Figures in parentheses are t values.

$$\ln Q = \underset{(-2.921)^*}{-5.256} + \underset{(6.710)^*}{0.987 \ln K} + \underset{(1.388)}{0.484 \ln L}$$

* Significant at 5% level.

$R^2 = 0.943$

Adjusted $R^2 = 0.936$

Here the regression results show the significant dependence of output on capital. The elasticity of capital with respect to capital is 0.987, which is also statistically significant. The coefficient of labour is only 0.484 which is not statistically

significant at 5 per cent level. Even though the regression overall is highly significant which is depicted by high value of R^2.

The rate of return on investment = 0.987 + 0.484 = 1.471

This shows increasing returns to scale.

Factor Intensity = α / β = 0.987 / 0.484 = 2.039

Factor intensity is in favour of capital indicating high degree of capital intensity.

The results of regression performed when the data from the three districts combined together is given below. Figures in parentheses are t values.

$$\underset{}{LnQ} = \underset{(-2.555)^*}{-1.890} + \underset{(11.315)^*}{0.756 lnK} + \underset{(3.592)^*}{0.446 lnL}$$

* Significant at 5% level.

$R^2 = 0.892$

Adjusted $R^2 = 0.889$

The above regression is significant as indicated by R^2 and the individual t values. The elasticity of output with respect to capital and labour are 0.756 and 0.446 respectively.

The rate of return on investment = 0.756 + 0.446 = 1.202

This shows increasing returns to scale.

Factor Intensity = α / β = 0.756 / 0.446 = 1.695

Factor intensity is in favour of capital indicating high degree of capital intensity.

A model with three independent variables

The Cobb Douglas Production Function has also been fitted to a model with three independent variables capital, labour and raw material. The raw material was found to constitute around 80 per cent of the total cost of production. Hence it was decided to fit a model with raw material as an independent variable. This model possessed a high overall significance than the model with two variables. In these regressions raw material is found to be more significant than capital and labour.

The results of the regression performed for the units of Thrissur district is as follows. Figures in parentheses are t values.

$$\underset{}{LnQ} = \underset{(3.960)^*}{1.736} + \underset{(1.066)}{0.066lnK} + \underset{(13.378)^*}{0.748lnR} + \underset{(1.423)}{0.093lnL}$$

* Significant at 5% level.

$R^2 = 0.992$

Adjusted $R^2 = 0.990$

Here the regression has a high degree of overall significance. Only raw material possessed a significant value in the elasticity of output with respect to respective factors of production. The capital and labour become statistically insignificant in this model. This shows the peculiarity of plastics industry that it is may be called processing rather than production.

The result of the regression on plastic industrial units of Kozhikkode district is given below. Figures in parentheses are t values.

$$\underset{}{lnQ} = \underset{(2.843)^*}{1.262} + \underset{(3.182)^*}{0.184lnK} + \underset{(8.676)^*}{0.665lnR} + \underset{(0.896)^*}{0.777lnL}$$

* Significant at 5% level.

$R^2 = 0.986$

Adjusted $R^2 = 0.983$

The regression is statistically significant with high value of R^2. Individual coefficients are also significant at 5 per cent level.

The elasticity of output with respect to capital, raw material and labour are respectively 0.184, 0.665 and 0.777 respectively. Here raw material and labour are found to be more significant than capital.

Following is the results of regression performed on the industrial units of Alappuzha district. Figures in parentheses are t values of the respective coefficients.

$$\ln Q = \underset{(-0.854)}{-0.543} + \underset{(3.065)^*}{0.220 \ln K} + \underset{(13.424)^*}{0.638 \ln R} + \underset{(2.440)^*}{0.254 \ln L}$$

* Significant at 5% level.

$R^2 = 0.995$

Adjusted $R^2 = 0.995$

This regression also possesses overall significance with a high value of R^2. All the three individual coefficients are also statistically significant. The elasticity of output with respect to capital, raw material and labour are 0.220, 0.638 and 0.254 respectively. This again shows the high degree of dependence of output on raw material.

The regression result when all the units from the three districts taken together are as follows.

$$\ln Q = \underset{(4.557)^*}{1.220} + \underset{(4.544)^*}{0.153 \ln K} + \underset{(22.999)^*}{0.707 \ln R} + \underset{(1.778)}{0.075 \ln L}$$

Figures in parentheses are t values (* Significant at 5% level.)

$R^2 = 0.990$

Adjusted $R^2 = 0.990$

The regression is highly significant at the overall level. Individual coefficients of capital and raw material are significant at 5 per cent level. The elasticity of output with respect to capital and raw material are 0.153and 0.707 respectively. That of labour is 0.075 and is insignificant at 5 per cent level.

More significant and influencing factor of production is the raw material. It is followed by capital, which is significant always, and by labour which is insignificant in many cases. The industry provides a higher rate of return. The rate of return ranges from 1.00 to1.471. The factor intensity is in favour of capital, about which the output is highly elastic. In this analysis the cost of raw material is taken under capital. The intensity of capital ranges from 1.052 to 2.039. This shows the high degree of capital intensity in the industry.

4.7 Conclusion

In this chapter the productivity and efficiency aspect of the industry is analysed. The capital output ratio ranges from 1.35

to 5.12. The average capital output ratio when all the units put together irrespective of size is 3. This shows that the capital required per unit of output is less than most of the other industries in small-scale sector. That is the reason for attraction of a number of new investors and entrepreneurs to plastic industry.

The output labour ratio, which is around Rs.40 per man-hour in class I with an investment less than Rs.1 lakh increases to around Rs.400 per man-hour in class VI with an investment greater than Rs.20 lakhs. The average output labour ratio is Rs.296 per man-hour. The increasing labour output ratio with increasing investment means that what make labour more productive is the machine or investment. Hence productivity of labour increases in more automated units.

The output per worker is calculated for a month. It ranges from Rs.9, 226 to Rs.1, 34,750 per month. The average ratio is Rs.42325 per month. The output per worker ratio is very high plastic industry compared to other industries. This means that even if fewer workers are employed plastics give more returns for that.

The labour output ratio, which measures the labour required to produce one unit of output, is very less in plastic industry. It ranges from 0.011 to 0.2. The average labour output ratio is 0.025. The highest labour output ratio is seen in units with less investment. These units generally use hand moulding and machines and semi mechanised production system.

The Total Factor Productivity is greater than unity in plastic industry. It is a good trend compared to many of the industries in India. The average Total Factor Productivity ranges from 0.28 to 0.99 if we take the Indian industry as a whole. The Total Factor Productivity in our sample units ranges from 1.13 to 1.48. No class have Total Factor Productivity less than unity. This again shows that the industry provides increasing returns to scale.

From the study it has been seen that more than 37.60 per cent of the workers are skilled labourers. They are possessing qualifications like ITI certificate of Diploma in different trades. Skilled workers contribute a major share in production because the machines are carefully operated. Most of the machines are advanced in nature and imported from abroad.

The capital labour ratio is less than 20 in units in class I with an investment less than Rs.1 lakh. This increases to around 120 in units in class VI with an investment greater than Rs. 20 lakhs. The average capital labour ratio is 77. The capital per worker ratio ranges from Rs.15,147 to Rs.1,84,375 with an average of Rs.1,20,286. This ratio reflects the capital required for generating a unit of employment. The higher level of capital per worker ratio indicates the capital abundance of the production system and industry. Again this ratio increases with increases in investment. Hence more investment could not generate level of employment proportionately.

The Cobb – Douglas Production Function has been fitted in the cross sectional data of plastics industries. The regression analysis is performed on the data from three districts each and separately. The regression results possess overall significance in general. The R^2 ranges from 0.892 to 0.943 indicating high overall significance of the regressions.

The coefficients of capital and labour are also significant in all the regressions. The elasticity of output with respect to capital ranges from 0.564 to 0.987. It is 0.756 when all the units are taken together. These high values of individual coefficients reflect the great influence of capital in output determination. All these coefficients are statistically significant.

The coefficient of labour is also significant in all the regressions. The elasticity of output with respect to the input labour ranges from 0.434 to 0.536. It is 0.446 when the regression is performed on combined data. All these coefficients are statistically significant.

The production function is also fitted on a model with three explanatory variables, say, capital, raw material and labour. The regression has become more statistically significant when the raw material included among the explanatory variables. The value of R^2 ranges from 0.985 to 0.996. The analysis showed that the raw material is the most determinant factor of production. The elasticity of output with respect to raw material ranges from 0.638 to 0.748 where as that of capital and labour are from 0.066 to 0.220 and from 0.075 to 0.777 respectively.

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ENVIRONMENTAL ISSUES RELATING TO PLASTICS

M.S.Suresh Kumar " Economics of plastic industry in India with special reference to Kerala " Thesis. Department of Economics , Dr.John Matthai Centre , University of Calicut, 2003

Chapter – V

ENVIRONMENTAL ISSUES RELATING TO PLASTICS

CONTENTS

5.1 Introduction

Plastics are invariably accused of polluting natural resources and contributing to our environmental problem thereby affecting eco-balance. Amongst environment issues, throwing away broken and discarded items of use, as wastes through 'garbage' and 'rubbish' are rituals for us concern every one of society. Discarded and used paper, boards/cartons and colourful plastic packaging and related items of consumer use are more prominently spotted in any garbage dump, may it be household, landfills, industrial, and institutional including hospitals. With the constant urbanisation and industrialisation around the world, the problem of discarded items of use and their disposal through garbage has outgrown.

As nation industrialises and its economy develops with prosperity, its people demand and look for a better quality of life. People become more conscious of the air, the water and the land and they express a desire for better standards of health, hygiene and safety. It is a gradual climbing in man's ladder of need hierarchy with greater affluence, and plastics do play an important role in improving modern life.

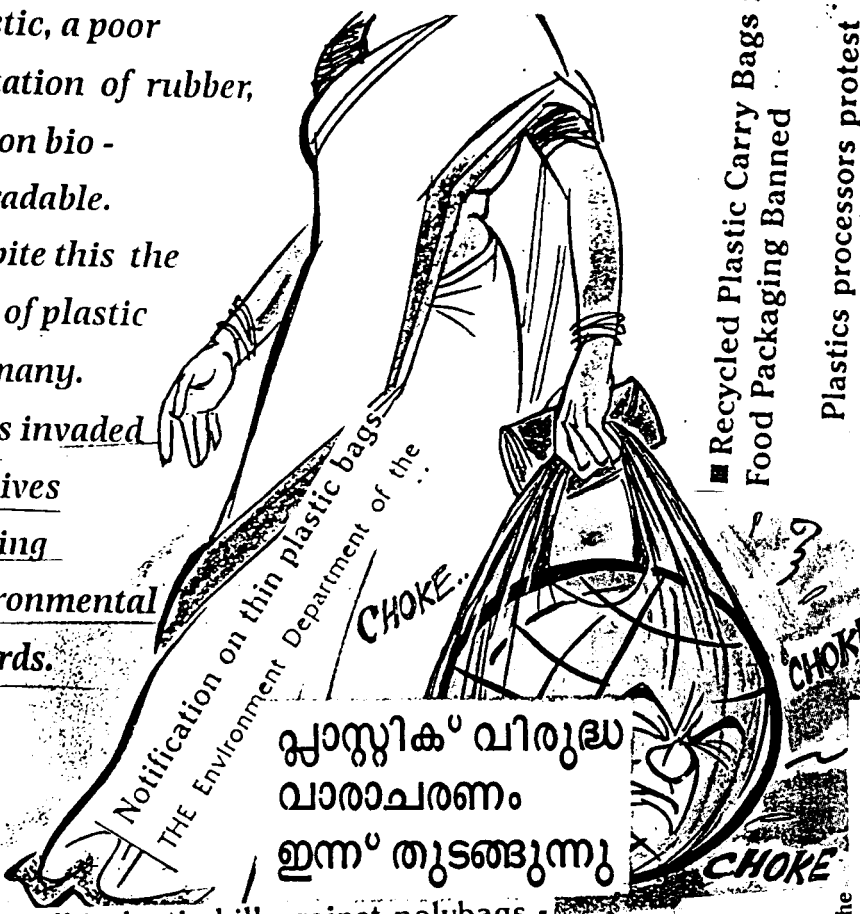
The improvement in general standard of living and economic growth coincides with higher levels of plastics consumption. Plastics as materials have become a natural choice in varied applications due to their versatile qualities, inherent properties and economic value. It benefited in a major way to the low and medium income people. With the use of plastics, the cost of living could be controlled retaining the same or better level of cleanness and beauty in home. For example, the cost of plastics household utensils are very low compared to those items made out of metals, glass etc.

Despite this during the last few years the general image of plastics have become poorer vis-à-vis the environment. Every day major Newspapers of the country are seen having published at least a little news on plastics. It may be either on pollution, or waste disposal or ban on plastics in different states or localities. Day after day reports are coming from different states or territories on the ban on plastics.

Plastics and environment - Indian scene

A silent invasion

Plastic, a poor imitation of rubber, is non bio-degradable. Despite this the uses of plastic are many. It has invaded our lives causing environmental hazards.



Delhi plastic bill against polybags - to be introduced soon

■ Recycled Plastic Carry Bags for Food Packaging Banned

Plastics processors protest

Ban on plastic carry bags

By Our Staff Reporter

THIRUVANANTHAPURAM, OCT. 4. The

Guideline on plastic packaging waste in India*

Biodegradable plastic film

A breakthrough in plastic industry

Synthetically yours

Plastics waste form an important share after paper, metals and glass in any garbage collection dump. The thrown up plastic articles include plastic bottles, chappals, bags, covers etc. PVC chappals account for bulk of plastic waste; that is over 75 per cent. Plastic bags and discarded plastic bottles and packaging film are the next after PVC chappals. The lion share of plastic waste comes from households, hospitals and other consuming sectors. This non-destructible waste debris is common scenery in every town.

However, banning usage of plastics is not a remedy for this problem. Plastics as materials have become a natural choice in varied applications due to their versatile qualities, inherent properties and economic value. Things like plastics being non-degradable, dangerous to environment, having chemical based ingredients and being harmful to health are unfortunately created negative impressions in the minds of ill informed common people. The hundreds of virtues are totally forgotten or intentionally withheld for making a fair judgement.

The public perceptions about plastics being harmful, carcinogenic, toxic and polluting are quite contrary to real facts. Plastics do help save millions of barrels of oil and thousands of

acres of forests and wood. There are various ways plastics products after one use, can be recycled and reused, serving to save our scarce resources. There are numerous ways plastics help conserve water and energy and help control pollution and food waste than any other raw materials but somehow this has not been effectively communicated to common people. In fact plastics are one of the most eco-friendly materials vis-à-vis alternatives like glass, metals, alloys etc.

Many eco-balance studies have proved that plastics application often has the lowest global environmental impact. The following facts are not negligible in this context.

1. Plastics lightweight offers resource saving in transportation.

2. In many applications production process is more energy efficient than alternative materials. Worldwide plastics use only 4 per cent of commercially produced oil.

3. Plastics waste is not injurious to health. They will neither produce nasty smell nor cause any contagious diseases.

At the end of useful service life, plastics can be recovered by recycling or provide an energy source equivalent to coal through energy recovery.

5.2 The Government Policy

There have been tremendous pressures and counter pressures on governments and local bodies to set targets for appropriate measures relating to urban solid waste management. The central Government and Many of the state governments have a taken a series of steps for the use and disposal of plastics especially in packaging.

The Central government issued a notification under Environment (Protection) Act of 1986 on 2nd September 1999 by the Ministry of Environment and Forests. The notification came following a public interest writ in Delhi High Court seeking a ban on recycled plastic material for the supply of food, pleading that this was hazardous to health and could lead to diseases like cancer. The notification has the following important directions on use and disposal of plastics packaging.

1. The prescribed authority for the enforcement of these rules relating to manufacture and recycling shall be the State Pollution Control Boards of respective states.

2. The prescribed authority for enforcement of these rules relating to use, collection, segregation, and transportation will be the District Collector.

3. Use of carry bags or containers of recycled plastics for packaging foodstuffs is prohibited.

4. Carry bags made of virgin plastics shall be in natural shade or white for food application.

5. Carry bags made of recycled plastics and used for non-food purposes will be use colour as IS 9833:1981 entitled *List of pigments and colourants for use in plastics in contact with foodstuff, pharmaceuticals and drinking water.*

6. Manufacturers shall print on each packet of carry bags whether these materials are made of recycled or virgin plastics.

7. Thickness of carry bags made of virgin plastics or recycled plastics shall not be less than 20 microns.

8. Industry associations shall undertake self-regulatory measures.

9. Penalties include fine up to Rs.One Lakh or imprisonment for Five years or both for traders and fine up to Rs.2000 for users.

10. Shop Licence shall be cancelled in case of defaulters.

The ministry of Environment and Forests of the Central Government also issued a Guideline on the Management of Plastics Packaging and Packaging waste in India. This Guideline is given in Appendix. Many of the state governments already issued notifications based on Central government notifications. Some of them had ban the use of plastics in tourist places and temple localities.

The Environment Department of Maharashtra Government issued a notification 8th March 2000 prohibiting the production of polythene bags having thickness of less than 20 microns for new virgin bags and 25 microns for recycled bags. The notification said that the Government of Maharashtra is of the opinion that the use of thin gauge plastic carry bags is causing injury and is detrimental to the environment, flora and fauna and the health of human beings as well as animals and therefore, considers it

necessary to issue immediate directions as provided in Section 5 of the Environment (Protection) Act, 1986.

The Kerala government banned the use of plastics in tourist places and Sabarimala pilgrim centre. The Kerala State Pollution Control Board also issued a notification under Recycled Plastic Manufacturers Rules, 1999 of the Environment (Protection) Act; banning plastics carry bags with thickness below 20 microns. While the PCB entrusted with the implementation of the rules on manufacturing /recycling of plastics, the task of controlling the use of plastics is vested with the District Collectors concerned. The implementation of provisions pertaining collection of plastic waste, its segregation and disposal is the mandate of local bodies.

A number of local bodies have also taken steps to counter the problem of waste management of plastics. The steps taken by the Chennai Metropolitan Corporation in Tamil Nadu is as brilliant example of effective waste control.

In 2002 the Chennai Metropolitan Corporation has assigned its waste management to a Singapore based company named ONYX. The system adopted is really

interesting. Two garbage collecting bins are kept on wheels in each street of Chennai at a distance of 100 to 200 foots on each road. Employees of the company in uniform collect the garbage at regular intervals; lorries of ONYX companies came and mechanically empty the bins into lorry and leave the bins at the same place. Each street has supervisors who keep walking and supervise that all waste is thrown into the bins. The company incinerates this waste to generate power and recycled plastics in order to recover their cost. Modernisation of waste management helps improving our quality of life and public health, where plastics play a key role.

5.3 The Kerala Scene

In Kerala the situation is not so much different as rapid urbanisation is taking place around the state. The consumption of plastics especially for the purpose of packaging is very much high in the state as compared to national level of consumption. The per capita consumption of plastics in Kerala is around 38.73 Kg, which is much higher than the national level of 1.76 Kg. It is higher than the world average of 13Kg and less than that of 60Kg in developed countries. This is due to the tendency in city life

in major parts of the state. The extent and pattern in plastic consumption in Kerala has been studied with the help of a sample survey. The survey was conducted in Thrissur district of Kerala.

The households are classified into four groups according to the area they live. They are Urban, Semi Urban and Rural. The Urban households are again divided into those living in Apartments and those living in independent houses. This is because of the fact that the methods of disposal of waste are very much different in these two sections of households. A total of 100 households are selected for the study. The distribution of these households is as follows.

Table 5.1 Distribution of Sample households

Rural	30
Semi Urban	30
Urban Own House	20
Urban Apartments	20
Total	100

Source:- Computed from Sample Survey

Their consumption of plastics has been recorded for the month of September 2001. The survey was conducted in such manner that the households are requested to record their consumption of plastics for a month. For this purpose a printed schedule has been given to all the households. The schedule is also used to collect more information such as the family income, family size, the methods of disposal of plastic waste and their opinion about impact of plastic consumption on environment. The model of the schedule is given in Appendix.

5.4 Composition of Plastic Consumption

The plastics are generally used in almost all the fields of life. Now a day we cannot avoid plastics from our consumption list. For analytical purpose they are divided into five groups, namely, packaging, footwear, toilet wear, kitchen wear, handbags and others. These are the major purposes of plastic consumption in household sector. The level of consumption of these items in different areas is given in the following table.

Table 5.2 Composition of Plastic Consumption

Major share of Consumption	Rural	Semi Urban	Urban Own House	Urban Apartments	Total
Packaging	17.51	18.58	24.26	21.92	20.06
Footwear	28.62	24.14	21.75	20.11	24.20
Handbags	13.59	12.31	10.87	13.23	12.59
Toilet wear	18.07	20.25	23.23	25.20	21.18
Kitchen wear	7.25	9.50	11.25	14.22	10.12
Others	14.97	15.22	8.64	5.32	11.85

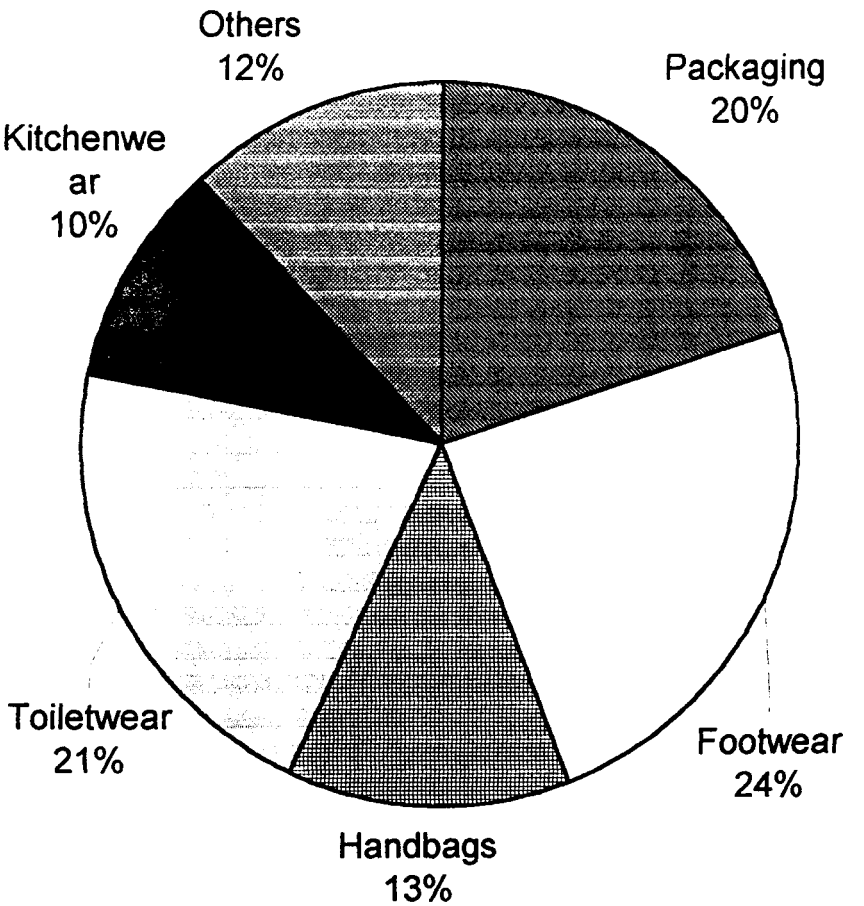
Source:- Computed from Sample Survey

In rural areas the major share of plastic consumption, that is, 28.62 per cent goes to footwear. The rural people usually prefer Plastic footwear than other items of footwear. This is because of the fact that it offers a long life and fewer prices compared to others. They are also light in weight and available in a variety of colours. The least consumed among rural people is Kitchen wears that is only 7.25 per cent of the total. Toilet wears and packaging have a relatively higher share in consumption.

Footwear has a greater share in consumption in Semi-urban households also. Kitchen wears have a least share as in the case of rural households. In contrary, packaging and toilet wears have a greater share in consumption in urban households. Packaging has a higher share because of large-scale consumption of packaged items. In urban areas the milk, vegetable oils, curry powders and all other provisions are available in packets and they are highly demanded. Almost all the provisional stores and super markets in cities use a large amount of plastic covers for packaging.

Urban people generally throw away this carry bags and do not use it for a second time. They have a greater level of plastic consumption too. The relative share of different items in consumption of plastic is clearly shown in the pi-diagram given below.

Figure 5.1 Consumption of Plastics for different applications



5.5 Determinants of Plastic Consumption

Plastics are used almost in all aspects of life. Therefore it is difficult to determine the determinants of plastic consumption. However the major determinant of increased demand for plastic consumption in a society is the rapid urbanization and a series of its repercussions. As urbanization taking place, the tastes and habits of people are continuously changing. The tendency of avoiding all other packaging medias and depends fully on plastics is the major reason for increased consumption of plastics in packaging. Similar is the case of footwear, auto parts, toilet wears, etc. As plastics are available cheaply people generally do not care for a second hand use of them. They are thrown away after use. Here we attempt to find the determinants of plastics consumption in the household level.

5.5.1 Income

Income is the most important determinant of consumption of any product. The relationship between the household income and consumption of plastic goods is given in the following table.

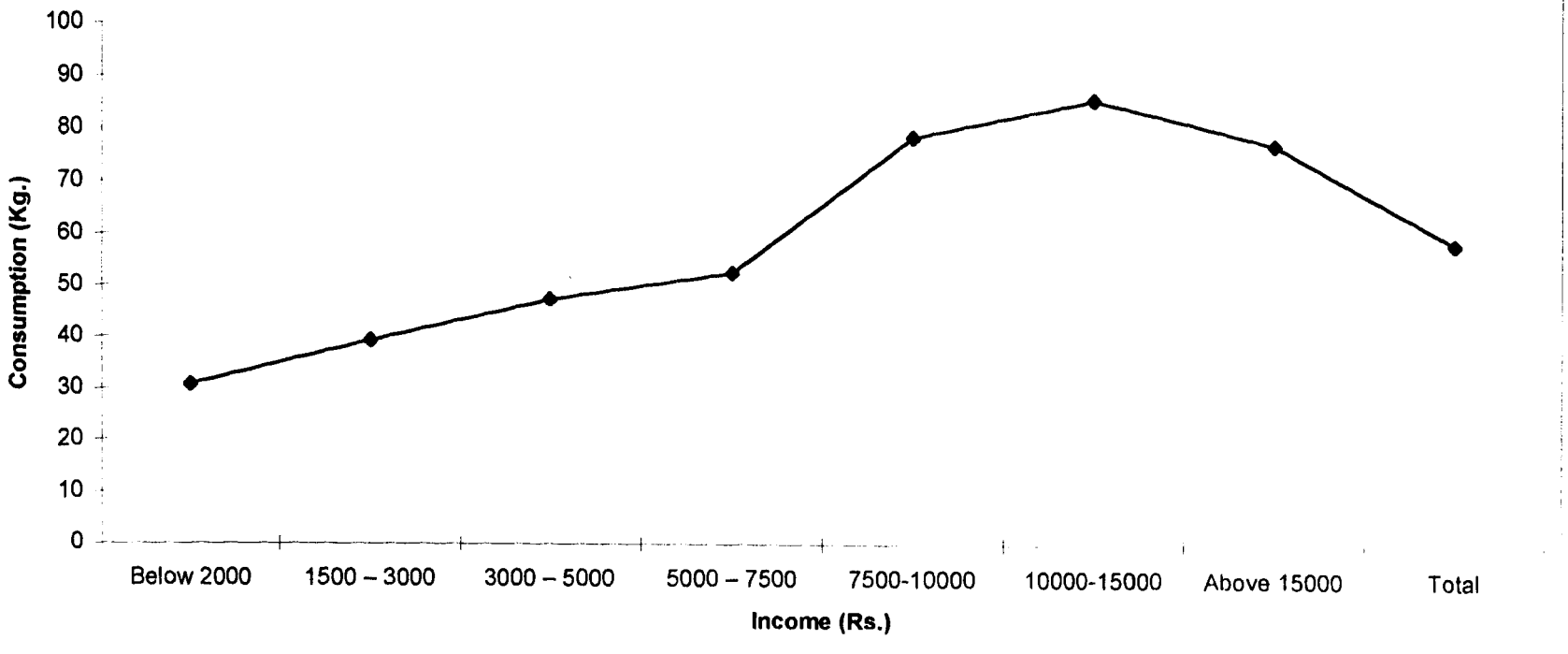
Table 5.3 Consumption of Plastics by income groups

Monthly Income	Rural	Semi Urban	Urban Own House	Urban Apartments	Total
Below 2000	30.771	-	-	-	30.771
1500 – 3000	36.892	41.721	-	-	39.307
3000 – 5000	40.434	54.385	-	-	47.409
5000 – 7500	43.742	61.660	-	-	52.701
7500-10000	-	64.964	69.328	101.796	78.696
10000-15000	-	-	73.664	98.364	86.014
Above 15000	-	-	70.484	84.649	77.567
Total	37.960	55.683	71.159	94.936	58.923

Source:- Computed from Sample Survey

It is clearly seen from the table that the per capita consumption of plastics gradually increases as income increases in Rural and Semi-urban areas whereas it has a deflating trend in urban areas. Similarly consumption level very much higher in urban areas compared to rural and semi-urban areas. While it is 37.960 Kg in rural areas it is 94.936 Kg among urban apartment households. The per capita consumption of plastics increases with income to some extent and then become stable or even declines with increases in income. This is shown in the figure given below.

Figure 5.2 Per capita consumption of plastics by income groups



The average per capita consumption calculated from our analysis is higher than 38.73 Kg, which is the figure given by the Department of Commerce and Industries for the year 2000.

Correlation

We used Karl Pearson's Correlation coefficient and Spearman's Rank Correlation Coefficient to find the correlation between income and consumption of plastics in the sample households.

Table 5.4 Simple Correlation Coefficient between income and consumption of plastics

Rural	0.596
Semi Urban	0.586
Urban Own House	0. 623
Urban Apartments	0.428
Total	0.537

Source:- Computed from Sample Survey

The income of the family and demand for plastics are relatively correlated in rural and semi urban areas. Income is not assumed to be a good determinant of consumption of plastics as they are relatively cheaper. For example it is the poor people who

use plastic footwear than rich people. Similar are the case of handbags and other items of plastics. At the same time high-income people use a relatively higher level of plastic packaging than low-income people.

Table 5.5 Rank Correlation Coefficient between income and consumption of plastics

Rural	0.633
Semi Urban	0.612
Urban Own House	0. 691
Urban Apartments	0.542
Total	0.596

Source:- Computed from Sample Survey

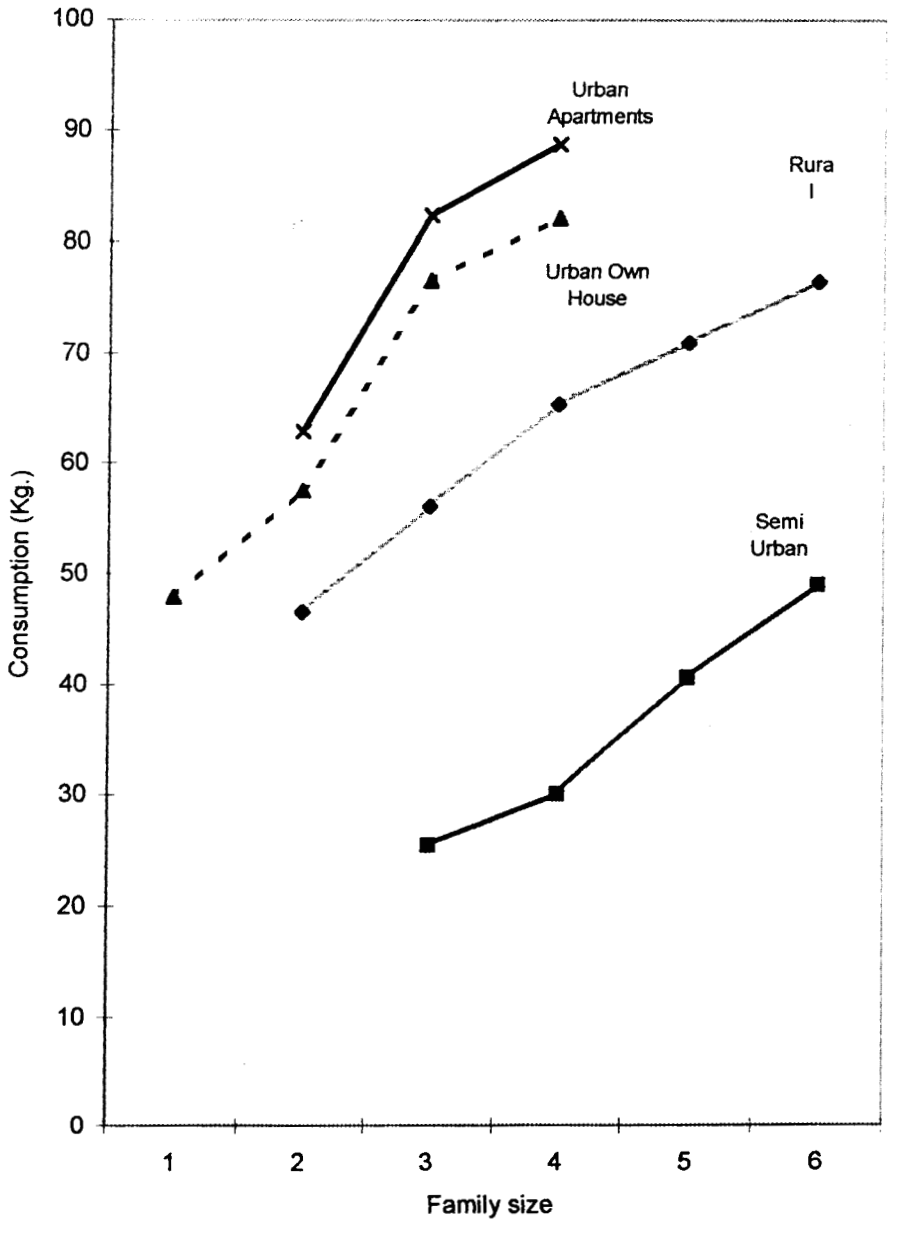
Rank Correlation Coefficient also suggest a moderate correlation between income and consumption of plastics.

5.5.2 Family Size

The level of consumption of any product in a household depends on the size of the family. Here the relation ship between family size and consumption of plastics is given in table 5.5.

The trend in consumption of plastic products in households with respect to family size is graphically plotted in the following figure.

Figure 5.3 Family size and Plastic consumption



In figure 5.3 we can see that the consumption increases gradually as family size increases.

Correlation

The simple correlation coefficient between family size and consumption of plastics is given in the following table.

Table 5.7 Simple Correlation Coefficient between income and consumption of plastics

Rural	0.521
Semi Urban	0.541
Urban Own House	0. 582
Urban Apartments	0.534
Total	0.532

Source:- Computed from Sample Survey

The table shows the positive correlation between family size and consumption of plastics. The correlation is positive in all class of people. It is the highest, that is 0.582 in urban own house section and less that is 0.521 in rural areas. This means that the increasing urban population is a major determinant of increased demand for plastic goods. The following table gives

the rank correlation between family size and consumption of plastic products.

Table 5.8 Rank Correlation Coefficient between Family size and consumption of plastics

Rural	0.534
Semi Urban	0.532
Urban Own House	0. 602
Urban Apartments	0.546
Total	0.537

Source:- Computed from Sample Survey

Rank correlation coefficient also satisfies the above said conclusion.

5.6 Regression Analysis

The regression analysis was performed to understand the influence of income and family size on consumption of plastic goods.

The following Multiple Linear Regression Model is used to regress consumption of plastics on family income and family size.

$$C_t = \beta_0 + \beta_1 Y_t + \beta_2 S_t + U_t$$

Where C_t is the consumption of plastics in a year

Y_t is the monthly income of the family and

S_t is the family size.

The regression results are given in the following table. Figures in parentheses are t values of the coefficients.

Table 5.9 Regression results of consumption on income & family size

	Intercept	Income	Family Size	R^2
Rural	21.688 (3.924)*	0.004 (3.120)*	0.397 (0.491)	0.600461
Semi urban	55.690 (28.11)*	0.001 (0.003)	0.501 (2.978)*	0.090885
Urban Own House	51.706 (1.273)	0.003 (1.081)	0.983 (2.317)*	0.273647
Urban Apartments	147.41 (8.649)	-0.002 (-2.09)*	0.667 (2.519)*	0.451776
Total	30.046 (0.066)	0.006 (1.353)	0.495 (2.850)*	0.664472

Source:- Computed from Sample Survey

*Significant at 5% level

The regression results show that the income is not significant. That is income does not positively influence the consumption of plastics. This is due to the fact that as plastics

are cheaper each and every family whether poor or rich consumes it. The consumption of plastics is more dependent on family size. It has a positive and significant coefficient in all the classes except rural class. In rural areas other packaging materials like paper are still used by many merchants. So there is comparatively less consumption of plastics as compared to urban areas.

5.7 Opinion on Consumption

India uses fewer amounts of plastics compared to other countries. However the problems caused by the use of plastics are not negligible. Per capita consumption of plastics in India is 1.7 Kg while it is 60 Kg in western countries. World average of plastics consumption is 18 Kg. In western countries there is great public opinion against the use of plastics.

In India also some environmentalist are criticising the government policy of promoting plastic industry. Hence, the study also focused on the opinion of the people about the large-scale use of plastics for packaging and other applications. These opinions are tabulated below. The question asked to the respondents is that what is their reason for preference of

plastic covers and bottles in packaging rather than other materials like paper, glass, etc.

Table 5.10 Respondents' opinion about the reason for exclusive use of plastics in packaging

Reason	Rural	Semi Urban	Urban Own	Urban Apartments	Average
Convenience	70.00	40.00	60.00	40.00	52.50
Cheapest	30.00	40.00	20.00	30.00	30.00
No Opinion	00.00	20.00	20.00	30.00	17.50

Source:- Computed from Sample Survey

Most of the respondents (52.50 per cent) are of the opinion that plastic is convenient than glass, paper or other materials. According to some of the respondents they also offer safety and purity. 30 per cent argued that it is the cheapness of plastics, which make them more preferable than any other material. Common man buy and uses, within their budget, almost all the products produced in plastics, say PVC chairs, etc.

Now a day we could not think of the world without plastics. Every thing is packed in plastics and everywhere is plastics. Plastics have been touched each and every corner of human life. So some people believe that the use of plastics is inevitable in

human society. The next question was about the inevitability of the use of plastics in packaging.

Table 5.11 Respondents' opinion about the inevitability of plastics in our day to day life

	Rural	Semi Urban	Urban Own House	Urban Apartments	Average
Strongly Agree	13.00	20.00	0.00	60.00	23.25
Agree	17.00	50.00	40.00	0.00	26.75
Disagree	40.00	20.00	0.00	20.00	20.00
Strongly disagree	13.00	10.00	40.00	20.00	20.75
No Opinion	17.00	0.00	20.00	0.00	9.25

Source:- Computed from Sample Survey

About 50 per cent of the people agreed to the opinion that plastics are inevitable in our life. 23 per cent of them strongly agreed to this argument. About 40 per cent of the respondents disagreed to this opinion. 9 per cent have no opinion about this argument.

Again the respondents have been asked to mark their response to the argument that plastics pollution is a major problem faced by our society. Their opinions are given in the following table.

Table 5.12 Respondents' opinion whether plastics pollution is a major problem faced by our society

	Rural	Semi Urban	Urban Own House	Urban Apartments	Average
Yes	42.00	55.00	77.00	75.00	62.25
No	38.00	32.00	18.00	20.00	27.00
No Opinion	20.00	13.00	5.00	5.00	10.75

Source:- Computed from Sample Survey

More than 60 per cent of the people believe that the pollution plastic is a major problem faced by our society. 27 per cent of the respondents do not agree with this argument. Remaining 10 per cent has no opinion about this argument.

The most important question asked to the households is about their waste disposal habits. They were asked to explain their method of disposing plastic waste.

Table 5.13 Respondents' methods of plastics waste disposal

	Rural	Semi Urban	Urban Own House	Urban Apartments	Average
Incinerator	0.00	0.00	0.00	0.00	0.00
Burning	27.00	40.00	0.00	20.00	21.75
Gather and dispose	40.00	50.00	80.00	80.00	62.50
Carelessly throw away	33.00	10.00	20.00	0.00	15.75

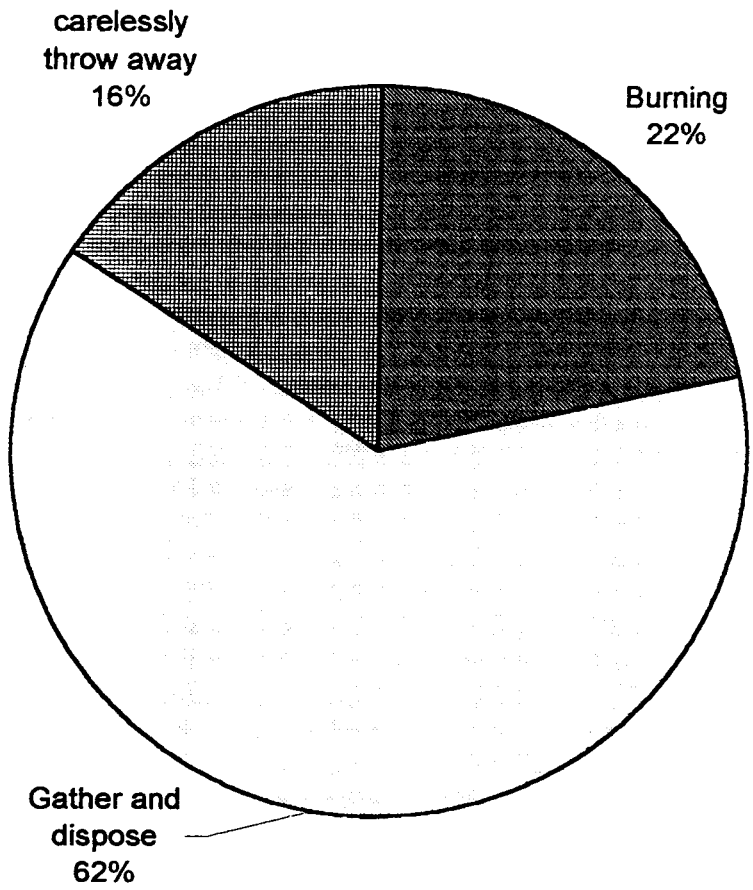
Source:- Computed from Sample Survey

Incinerator is an electrical equipment used for burning solid waste at high temperature without smoke. Event though it is familiar with households in developed countries it is not so common in our country. In the study area no household is using incinerator for waste disposal.

The method adopted by most of the families (62.5 per cent) is to gather the plastic waste and later sell it or dispose it by other ways. About 22 per cent of the people are burning plastic waste in air, which is not a good habit as plastics are concerned. The smoke evoked by burning of plastics is harmful to health.

Around 16 per cent of the respondent agreed that they were carelessly throwing up plastics waste to countryside. Which is again a bad habit, which makes huge mounds of plastic wastes across the roads. The relative importance of plastic waste disposal methods adopted by the respondents is explained by the figure given below.

Figure 5.5 Relative role of Plastic waste disposal methods



5.8 Solutions to the Environmental Problem

Plastic waste management problem has come as a major problem before the local governments throughout the world. Plastics waste could not be deal with other solid waste. If plastics are burned with other wastes as usually seen in our surroundings, many pollutants may be emerged. They include Hydrogen Chloride and Dioxin.

Hydrogen Chloride is formed by burning PVC and this become Hydrochloric Acid when mixed with moisture and make *acid rains*, which affects the plants badly. The toxicity of dioxin is not well understood. Long-term effects of dioxin may include cancer, birth defects and reproductive difficulties, but considerable disagreement still exists.

5.8.1 Recycling and Reuse

Thermoplastic waste can be recycled. At industrial scrap level, recycling of plastics grew rapidly after the increase of oil prices in the mid 70's and it now occupies a common place. There is a trend that many industrialised countries mandate or at least guide industries to recover waste packaging mainly because

of its large contribution in waste stream. This returned product is being recycled by the respective industries.

The concept of recycling came to India in late sixties. Now a days recycling plays an important role in plastics waste management. According to a survey conducted by NCAER in 1999 the plastic reprocessing industry comprised over 35,000 units with an output of 56,34,224 tonnes. This sector provides direct employment to 5 lakh people and indirect employment to over 45 lakh people.

About 40 to 50 per cent of the total plastics consumed in India are being recycled. It is estimated that over 65 lakh tonnes of plastics wastes are received for sale to reprocessors every day in plastic waste collection centres across the country. While PVC chappals account for bulk of plastic wastes (70 per cent by weight) received at these centres. They are closely followed by plastics bags and bottles.

The largest plastic waste market in Asia is in Delhi comprising over 5000 plastics waste traders. There operates over 200 reprocessing units in this city. These types of large

waste markets also occur in Mumbai, Ahemmedabad, Kolkotha, Kanpur, Chennai and Bangalore.

These markets also import large quantities of plastics waste from abroad. India has become a major dumping ground for the western world. The United States alone dumped 10 million tonnes of plastic waste during 1999-2000. As a result there is a boom in secondary recycling industry, which in turn feeds on the rising demand for import of plastic waste.

The trend of collection, separation and recycling of plastics in India presents an interesting picture both socially as well as technologically much in contrast with the developed countries in the west. In advanced countries the Government Departments, Plastic Industry and Municipalities are in the forefront of collection and separation schemes of plastic wastes. In India this part of waste disposal job is naturally west in a chain of self organised and enterprising rag pickers, Kabuliwalas and waste traders numbering over one million. Over 80 per cent of the plastic waste in India get collected through rag pickers and reached their proper destination.

5.8.2 Incinerator

Municipalities and industries are engaged in reducing waste generation through source reduction recycling. Nevertheless even under maximum use of reduction and recycling, a significant quantity of waste continues to be generated. At present, high temperature incineration is the preferred technology for managing plastic waste. Properly designed incinerators have the capability to destroy nearly 100 per cent of all type of solid waste.

Incinerator contains a combustion zone where the waste is stored at high temperature and burned in the presence of enough oxygen. Polymeric solids are degraded at high temperature. In the presence of oxygen, the carbon, the hydrogen and sulphur contents are oxidised to Carbon Dioxide, Water and Sulphur dioxide respectively. The rate of incineration increases rapidly with temperature. Most of the general-purpose incinerators operate between 760°C and 1100°C. Incineration produces energy in the form of combustible gases. This can be used like LPG at homes.

For successful conversion of plastic waste to energy by incineration, it is important that burning be complete as complete

as possible. The area of incineration of plastic waste with energy recovery is currently the subject of intensive research. Well-maintained and closely controlled incinerators can dispose the plastic waste effectively at the same time recovering the calorific value of the waste stream.

Ten per cent of US plastics waste is disposed by incineration while it is 26 per cent in Japan 34 per cent in Germany and 75 per cent in Switzerland.

5.8.3 Other Remedies

Even if we adopt the above said methods or incineration and recycling it could not be solve the problem if we continued the production and use of plastics in the present sense. There must be radical changes in these areas as mentioned below.

1. Eliminate toxic constituents:- Packaging designs should incorporate non – hazardous materials whenever possible.

2. Use reusable packages:- If a package can be reused in its original application it can be very effective in waste reduction, by eliminating the disposal requirements for several cycles. Secondary use of plastic packaging is also possible. The ability of a container to serve a

secondary function is important. This will prevent the user from throwing out it away after one use.

3. Use a single material whenever possible:- it will help in better recycling and give better products from recycling.

4. Use materials that are either easily separable or compatible if a simple material cannot be used.

5. Use recycled materials whenever possible.

5.8.4 New Generation Plastics

The New generation plastics offer a better future for plastic industry as well as society as they do not carry the usual blame of non – bio degradable. The plastic industry continues to evolve from rapidly expanding petroleum-based industry in the 20^{th} century into a complicated economic, regulatory and ecological phase.

With the increase in environmental consciousness among consumers and governments, the industry is now faced not only with manufacturing and marketing concerns, but with ecological and legislative issues as well. The trend is environmental conservation and the plastic manufacturer is increasingly responsible for the handling the pollution during production and the post consumer products' disposal.

The above said circumstances is forcing the industry to examine the lifecycle of plastics and determine solutions other than recycling can achieve disposal, of solid waste. The continuous and rapid research has succeeded in discovering decomposable or bio – degradable plastics during the last decades of 20th century. These plastics are produced from cellulose, starch, protein and sugar molasses and are degradable via micro organisms into water and carbon dioxide. Bio plastics made out of cornstarch-polyester blends are already being commercialised in U.S. and Japan. Research is going on to make these products more competitive.

The research has resulted in the discovery of soybean plastics recently in the U.S. The scientists at Michigan State University have developed a plastic film, produced using soybean protein and oil, in 1999. Petroleum is expensive and non-renewable resource whereas soybean is abundantly available. Biodegradable plastic film for use in applications like lawn and leaf bags, carry bags, trash bags and agricultural mulch offers a new market opportunity for soybeans also. These biodegradable plastics will open new avenues in the future to keep the environment cleaner and greener.

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SUMMARY, FINDINGS AND CONCLUSION

M.S.Suresh Kumar " Economics of plastic industry in India with special reference to Kerala " Thesis. Department of Economics , Dr.John Matthai Centre , University of Calicut, 2003

Chapter VI

SUMMARY, FINDINGS AND CONCLUSION

This chapter is the summary of the study and also gives the important findings of the study as well as the major conclusions derived from it.

In chapter I we have given a brief introduction to the topic, that is, the plastics industry. As all of us know plastics are now indispensable in our day-to-day life. Though the industry has been developed since four decades, its growth is significant. In India as well as in Kerala there was a steady and fast growth for the industry during the last two decades. So it is of great importance to study the economics of such a *Sunrise* industry.

The second chapter depicted the current status of plastics industry in India. It is observed that in India along with the world the plastics industry enjoys high growth and high revenue earning potential. It is the material for the masses. The Indian plastic industry has registered an exponential growth in the last decade. The growth of plastic industry is at a rate of 18.80 per cent, which is higher than the plastic industries worldwide. The plastic industry has outpaced all other industries in India in growth and served the needs of the common man at lowest cost with innumerable products to meet the daily life and convenience.

With the globalisation of Indian economy, the demand for better energy efficiency has meant greater need of plastics. The per capita consumption of plastics in India is 1.7 Kg. Though it is less in quantity than the world average of 13 Kg, plastics have become popular all over India. Even in the remotest village or town of India plastics have become the preferred choice, whether it is for fertiliser packaging in woven sacks, or the medicine tablets in blister packing or the water tank remoulded or installed in plastics in the hilly regions of Assam and Himachal Pradesh. The agriculturists in Himachal Pradesh and Kashmir insist on plastic crates for apples and pears, as they do not want their beautiful forests denuded to meet the demand for packaging boxes. The smallest farmer in Andhra or Gujarat insists on plastic pipes for irrigating their farms, whether it is groundnut or rice, cotton or sugarcane.

The third chapter analysed the financial performance of the plastic industries in Kerala. A sample of 60 units, 20 each from Kozhikkode, Thrissur and Alappuzha districts was selected for the study. The sample units are selected in such a way that all investment groups and product groups are included from each of

the three districts. The method of stratified random sampling was used for this purpose.

The study showed that around 90 per cent of the units have started within the period of 1986 to 1995 when there was a boom in the number of plastic industry units. Around 35 per cent of the units are in rural areas and the remaining in urban areas.

Around 50 percent of the entrepreneurs are in the age group of below 40 years. Most of the small industries are those started by youngsters after a long search for a gainful employment or due to the dissatisfaction in the previous employment. 42 per cent of them were unemployed when starting the unit while 22 per cent were employed as operators in similar units. 15 per cent of the entrepreneurs are retired government servants.

Almost 57 per cent of the entrepreneurs are well educated and half among them are technically qualified. 35 per cent of the entrepreneurs got entrepreneurial training before starting the unit. These training courses were conducted by agencies like Kerala Industrial and Technological Consultants Organisation

(KITCO), Small Industries Development Corporation (SIDCO), and Small Industry Service Institute (SISI).

The ratio of external capital to internal capital is comparatively high in large units than small units. The ratio is around 1.04 per cent, which means that above 50 percent of the capital is obtained through loans.

More than 54 per cent of the capital is invested in plant and machinery. This shows the capital intensity of the industry. Machines are important as far as plastics industry is concerned and with that even at home one can produce small size plastic products.

In the analysis of cost of production it has seen that 83 per cent of the total cost of production goes to the purchase of raw materials. Wages constitute only 7 per cent of the cost of production. This shows that the production system is an activity of processing the raw materials, in which major role is carried out by machines. Extra machinery activities are less. This again shows the high degree of capital intensity of the industry.

The monthly profit ranges from Rs.7000 to Rs.2 lakhs depending on the size of the firm. No unit has been found working in loss. The average monthly profit when all the units taken together is Rs. 88411.

The gross profit margin ranges from 12 per cent to 32 per cent with an average of 16.62 per cent. The gross profit as percentage of net sales first declines and lastly increases with the increase in net sales.

Operating Margin is found to be decreasing with increase in total expenses. The average is 19.93 for plastic industry. The firms could not run profitably of operating margin is below 10 per cent. It is a comparatively good ratio as compared to many other industries.

The rate of return on investment is declining with increasing investment. It ranges from 5 per cent to 24 per cent. The average rate of return on investment is only 10.05 per cent, which corresponds with the general rate of interest in the economy.

The core of any economic activity is to strive for the maximum possible efficiency. In chapter IV the productivity and

efficiency aspect of the industry is analysed. The capital output ratio ranges from 1.35 to 5.12. The average capital output ratio when all the units put together irrespective of size is 3. This shows that the capital required per unit of output is less than most of the other industries in small-scale sector. That is the reason for attraction of a number of new investors and entrepreneurs to plastic industry.

The output labour ratio, which is around Rs.40 per man-hour in class I with an investment less than Rs.1 lakh increases to around Rs.400 per man-hour in class VI with an investment greater than Rs.20 lakhs. The average output labour ratio is Rs.296 per man-hour. The increasing labour output ratio with increasing investment means that what make labour more productive is the machine or investment. Hence productivity of labour increases in more automated units.

The output per worker is calculated for a month. It ranges from Rs.9, 226 to Rs.1, 34,750 per month. The average ratio is Rs.42325 per month. The output per worker ratio is very high plastic industry compared to other industries. This means that even if fewer workers are employed plastics give more returns for that.

The labour output ratio, which measures the labour required to produce one unit of output, is very less in plastic industry. It ranges from 0.011 to 0.2. The average labour output ratio is 0.025. The highest labour output ratio is seen in units with less investment. These units generally use hand moulding and machines and semi mechanised production system.

The Total Factor Productivity is greater than unity in plastic industry. It is a good trend compared to many of the industries in India. The average Total Factor Productivity ranges from 0.28 to 0.99 if we take the Indian industry as a whole. The Total Factor Productivity in our sample units ranges from 1.13 to 1.48. No class have Total Factor Productivity less than unity. This again shows that the industry provides increasing returns to scale.

From the study it has been seen that more than 37.60 per cent of the workers are skilled labourers. They are possessing qualifications like ITI certificate of Diploma in different trades. Skilled workers contribute a major share in production because the machines are carefully operated. Most of the machines are advanced in nature and imported from abroad.

The capital labour ratio is less than 20 in units in class I with an investment less than Rs.1 lakh. This increases to around 120 in units in class VI with an investment greater than Rs. 20 lakhs. The average capital labour ratio is 77. The capital per worker ratio ranges from Rs.15,147 to Rs.1,84,375 with an average of Rs.1,20,286. This ratio reflects the capital required for generating a unit of employment. The higher level of capital per worker ratio indicates the capital abundance of the production system and industry. Again this ratio increases with increases in investment. Hence more investment could not generate level of employment proportionately.

The Cobb – Douglas Production Function has been fitted in the cross sectional data of plastics industries. The regression analysis is performed on the data from three districts each and separately. The regression results possess overall significance in general. The R^2 ranges from 0.892 to 0.943 indicating high overall significance of the regressions.

The coefficients of capital and labour are also significant in all the regressions. The elasticity of output with respect to capital ranges from 0.564 to 0.987. It is 0.756 when all the units are taken together. These high values of individual coefficients reflect the great influence of capital in output determination. All these coefficients are statistically significant.

The coefficient of labour is also significant in all the regressions. The elasticity of output with respect to the input labour ranges from 0.434 to 0.536. It is 0.446 when the regression is performed on combined data. All these coefficients are statistically significant.

The production function is also fitted on a model with three explanatory variables, say, capital, raw material and labour. The regression has become more statistically significant when the raw material included among the explanatory variables. The value of R^2 ranges from 0.985 to 0.996. The analysis showed that the raw material is the most determinant factor of production. The elasticity of output with respect to raw material ranges from 0.638 to 0.748 where as that of capital and labour are from 0.066 to 0.220 and from 0.075 to 0.777 respectively.

In chapter V the impact of plastics consumption on environment and related aspects were discussed. The study includes a survey on consumption and disposal of plastics in 100 households. The results showed that the per capita consumption of plastics in the study area is very much higher than the national average. The per capita consumption in Kerala is around 38.73 Kg while the national average is 1.76 Kg. Kerala's plastics consumption is approaching slowly to the developing countries' per capita rate of 60 Kg.

Major plastic items of consumption are footwear (24.20 per cent) and packaging (20.06 per cent). It has been found that the location of the household and family size is positively influencing consumption of plastics. The consumption rate is higher in urban areas compared to semi-urban and rural areas. Income is significant in rural areas while it is not significant in urban areas.

About 60 per cent of the respondents believed that the plastics pollution is a major problem faced by our society. More than 50 per cent of the people agreed to the opinion that plastics are inevitable in our life. Most of the respondents (52.50 per cent) are of the opinion that plastic is convenient than glass, paper or other materials. According to some of the respondents they also offer safety and purity. 30 per cent argued that it is the cheapness of plastics, which make them more preferable than any other material.

As far as the disposal of plastic waste is concerned the method adopted by most of the families (62.5 per cent) is to gather the plastic waste and later sell it or dispose it by other ways. About 22 per cent of the people are burning plastic waste in air, which is not a good habit as plastics are concerned. Around 16 per cent of the respondent agreed that they were

carelessly throwing up plastics waste to countryside. Which is again a bad habit, which makes huge mounds of plastic wastes across the roads.

Plastics have created severe waste management problem especially in urban areas. Even though the problem is not acute in India demands have been raised from different quarters for the ban on plastics. Many environmental organisations have approached Courts and directions have been issued to the Central and state governments. The state and central governments have issued a series of notification, which are bound to control the use of plastics for several purposes.

At the same time the goodness of plastics have been completely forgotten by many of those criticising the use of plastics. Plastics have been saved our forests to a great extent and now become the material of the masses especially the poor and medium income people. The plastics have provided a bit of cleanness and beauty at their homes and made their lives colourful. We could not obtain products ranging from combs to automobiles at a price they are available now if plastics have not been used.

The only problem is that the plastics are bio-degradable. Still they themselves do not produce any nasty smell or become hazardous

or cause any contagious diseases. What make problem from plastics is the man's utilisation of that. Controlled use of plastics along with systematic methods for collection and recycling of waste will very much reduce the problem of bio-degradability. Methods like incineration again solves the waste problem as well as making new energy sources.

The trend of collection, separation and recycling of plastics in India presents an interesting picture both socially as well as technologically much in contrast with the developed countries in the west. In advanced countries the Government Departments, Plastic Industry and Municipalities are in the forefront of collection and separation schemes of plastic wastes. In India this part of waste disposal job is naturally west in a chain of self organised and enterprising rag pickers, Kabuliwalas and waste traders numbering over one million. Over 80 per cent of the plastic waste in India get collected through rag pickers and reached their proper destination.

The continuous and rapid research has succeeded in discovering decomposable or bio – degradable plastics during the last decades of 20th century. These plastics are produced from cellulose, starch, protein and sugar molasses and are degradable

via microorganisms into water and carbon dioxide. Bio plastics made out of cornstarch-polyester blends are already being commercialised in U.S. and Japan.

The research has resulted in the discovery of soybean plastics recently in the U.S. Petroleum is expensive and non-renewable resource whereas soybean is abundantly available. Biodegradable plastic film for use in applications like lawn and leaf bags, carry bags, trash bags and agricultural mulch offers a new market opportunity for soybeans also. These biodegradable plastics will open new avenues in the future to keep the environment cleaner and greener.

Findings and Conclusions

Major findings and conclusions of the study can be briefly stated as follows.

1. Plastics industry worldwide has grown at a fast pace and has replaced materials like metals, wood, glass, paper etc. in numerous applications.

2. The major advantage of using plastics is low cost and adaptability to mass production methods.

3. Indian plastics industry registered a growth rate of 18.8 per cent per annum, which is among the highest ones in Indian industries.

4. The per capita consumption of plastics in India is 1.7 kg while world average is 13 Kg and 60 Kg on developed countries.

5. Plastics served the needs of the common man at lowest cost with innumerable products to meet the daily life and convenience.

6. In Kerala the though industry has emerged only two and half centuries back, it is growing fast especially in small-scale sector.

7. Almost all the units in Kerala are in small-scale sector and are operating under profitable conditions.

8. Around 60 per cent of plastics products used in Kerala especially large size products like furniture and automotive parts were brought to the state from other states.

9. The industry provides enormous opportunities for the new and young entrepreneurs.

10. The industry needs less investment compared to many of the modern industries.

11. The plastic industry is capital intensive in nature. More labour saving technologies and machines are being imported in our country.

12. Even though capital intensive, plastics industry provides numerous indirect employment opportunities in distribution of the products, collection, separation and recycling of used goods.

13. Plastics industry provides increasing return on investment.

14. Capital labour ratio is increasing with increase in investment. This means that additional investment hardly generates more employment.

15. Major plastic items of consumption are footwear (24.20 per cent) and packaging (20.06 per cent).

16. It has been found that the location of the household and family size is positively influencing consumption of plastics.

17. About 60 per cent of the respondents believed that the plastics pollution is a major problem faced by our society.

18. More than 50 per cent of the people agreed to the opinion that plastics are inevitable in our life.

19. Most of the respondents (52.50 per cent) are of the opinion that plastic is convenient than glass, paper or other materials.

20. According to some of the respondents plastics also offer safety and purity.

21. Almost 30 per cent argued that it is the cheapness of plastics, which make them more preferable than any other material.

22. As far as the disposal of plastic waste is concerned the method adopted by most of the families (62.5 per cent) is to gather the plastic waste and later sell it or dispose it by other ways.

23. About 22 per cent of the people are burning plastic waste in air, which is not a good habit as plastics are concerned.

24. Plastics have created severe waste management problem especially in urban areas.

25. Plastics themselves do not produce any nasty smell or become hazardous or cause any contagious diseases. The only problem is that they are bio-degradable.

26. Even though the problem is not acute in India demands have been raised from several quarters for the ban on plastics.

27. The state and central governments have issued a series of notification, which are bound to control the use of plastics for several purposes. But they are not executed properly due to the negligence of the respective authorities.

28. Controlled use of plastics along with systematic methods for collection and recycling or incineration of waste will very much reduce the problem of bio-degradability as well as making new energy sources.

29. Over 80 per cent of the plastic waste in India get collected through rag pickers and send for recycling.

30. The biodegradable plastics will open new avenues in the future to keep the environment cleaner and greener.

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APPENDIX - I

INTERVIEW SCHEDULE FOR THE SURVEY OF PLASTIC INDUSTRY UNITS IN KERALA.

1. GENERAL BACKGROUND

1.1 Name of the unit

1.2 Year of establishment

1.3 Initial investment

1.4 Locality

a. Place

b. Village

c. Taluk

1.5 Type of Ownership

a. Proprietorship

b. Partnership

c. Others (specify)

1.6 Type of products

1.7 Details about the entrepreneur

a. Name

b. Age

c. Religion and Caste

d. Educational qualifications

e. Previous experience if any

f. Training from ant institution

g. Occupation before starting the unit

2. PLANT AND MACHINARY

2.1 Land and Building: (own / rented)

2.2 Investment in land and building

2.3 Investment on machinery

2.4 Type of machinery

2.5 Whether imported?

2.6 Installed capacity

2.7 Utilised capacity

2.8 Working capital

3. SOURCES OF FINANCE

3.1 Finance from internal sources

3.2 Finance from external sources

3.3 Type of loan

3.4 Bank

3.5 Amount of loan

3.6 Period of loan

3.7 Rate of interest

3.8 Subsidies if any

3.9 whether the repayment is regular or not

3.10 if not what are the reasons

4. EMPLOYMENT DETAILS

4.1

Type of Employment	No. of Employees	Wage Rate		
		Daily	Weekly	Monthly
Managerial posts				
Sales personnel				
Skilled workers				
Unskilled workers				
Family members if any				
Total				

4.2 Whether the workers are getting any other benefits?

If yes, specify

5. DETAILS OF PRODUCTION

5.1 Revenue calculation

Items produced	Daily		Weekly		Monthly	
	Quantity	Value	Quantity	Value	Quantity	Value
1						
2						
3						
4						
5						
6						
Total						

5.2 Cost of production

Raw materials	Daily		Weekly		Monthly	
	Quantity	Value	Quantity	Value	Quantity	Value
1						
2						
3						
4						
5						
6						
Total						

5.3 Cost of labour (wages)

5.4 Establishment costs

a. Rent
b. Electricity
c. Water, Fuel, Oil
d. Taxes
e. Transportation costs
f. Interest on working capital
g. Others if any

6. PROBLEMS FACED BY THE ENTREPRENEURS

6.1 Whether you faced any problems in starting the firm?

If yes, give details

6.2 Whether you faced any difficulty in getting financial assistance?

If yes, give details

6.3 What are the methods of marketing? Is there exists any problems?

If yes, give details

6.4 Are you facing competition with imported products?

6.5 Are you facing any labour problems?

If yes, give details

6.6 Are you getting any technical assistance from government organizations?

If yes, give details

6.7 Whether the power failure/cut affects the working of the unit?

If yes, give details

6.8 What are the methods adopted for disposal of waste?

If yes, give details

6.9 Whether you have taken any measure to check pollution?

If yes, give details

6.10 Any other problems?

Specify

APPENDIX – II

QUESTIONNAIRE FOR THE HOUSEHOLD SURVEY ON PLASTICS CONSUMPTION, DISPOSAL AND ENVIRONMENT.

1. Name and address of the respondent

2. Locality (Corporation / Municipality / Pachayath)

3. Number of Members in the family: (a) Below 14 ☐

   (b) Above 14 ☐

4. Average Monthly Income: Rs.

5. In your opinion what is the reason for the excusive use of plastics in packaging?

   (a) Convenience (b) Low cost (c) Both (d) No comment

6. Do you agree to the argument that the use of plastics in unavoidable in current circumstances?

   (a) Strongly agree (b) Agree (c) Disagree (d) strongly disagree (e) No comment

7. Do you think that disposal of plastics in our days is a severe problem?

   (a) Yes (b) No (c) Do no know

8. No of plastic products purchased during current year

Item	No of Units
1. Foot wear	
2. Hand Bags	
3. Buckets (small size)	
4. Buckets (large size)	
5. Containers (small size)	
6. Containers (large size)	
7. Mugs	
8. Others (small size)	
9. Others (large size)	

9. Record of Plastic items of daily use

Type I : Carry bags

Type II : Small covers used for packing milk, bakery products, biscuits, vegetable oils, curry powders, washing powders, tea, coffee, etc.

Type III : Tubes of tooth paste, medicines, gum, shaving creams, beauty creams, etc.

Type IV : Small bottles of tea, coffee, jam, pickles, ice cream, oils, medicines, shampoo, beauty creams, etc.

Type V : Medium type bottles of vegetable oil, tea, coffee, milk powder, health drinks, etc.

Type VI : Sacks used for packing rice, cattle feed, fertilizer, cement, etc.

2001 September	Daily consumption in number of units					
Date	Type I	Type II	Type III	Type IV	Type V	Type VI
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						
25						
26						
27						
28						
29						
30						
Total						

10. Methods of disposal of plastics waste adopted by the household.

Usual methods of plastic waste disposal	
Type I	
Type II	
Type III	
Type IV	
Type V	
Type VI	
Foot wear	
Buckets / Mugs	
Disposal using (a) incinerator (b) Burning (c) store in a place and sell or dispose later (d) carelessly throw away	

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