

# Pre-Feasibility Study

## INJECTION MOLDING PLASTIC PRODUCTS



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## **1 PROJECT PROFILE**

### **1.1 Purpose of the Documents**

This document is developed to provide the Investor with potential investment opportunity in setting up and operating an Injection Molding Plastic Good Plant manufacturing a variety of household items. This pre-feasibility gives insight into various aspects of an injection molding setup including both technical and general information. The document is designed to provide relevant details to facilitate the Investor in making the decision by providing various technological as well as business alternatives. The document also allows flexibility to change various project parameters to suit the needs of the Investor.

### **1.2 Project Brief**

Plastic is a common name for Polymers: materials made of long strings of carbon and other elements. Each unit in a string is called a monomer, and is a chemical usually derived from oil. There are many different types of plastic, depending on the starting monomer selected, the length of polymer chains, and the type of modifying compounds added. Each plastic is developed for a special purpose. However the varied use of plastic in our everyday life has made it an integral component in almost everything. Plastic is used in everyday items like ballpoint pen, buckets, cups, glasses, water pipes, plastic bags to items of engineering excellence like cars and airplanes. According to some experts, around 350 kilograms plastic is used in every car manufactured in Germany. With such a high ratio of usage in developed countries, plastic has become a cheap but an important commodity

### **1.3 Opportunity Rationale**

The manufacturing of household durables through the plastic injection and molding business is a viable business provided that it is operated with a good business acumen that involves having a thorough knowledge and experience of the product range, technical requirements, operational procedures and also managing the jobs with the right type of technical manpower. When these factors combine with good and effective business development skills, the business is expected to give considerable profits which are expected to grow over the years.

#### ***1.3.1 Properties of Plastics***

The numerous properties of plastics have made it possible to virtually make every product conceivable. Some properties of plastic that distinguishes them from other materials are:

- Attractive
- Hard
- Soft and rubbery

- Easy to clean
- Flexible
- Good insulators of heat or electricity
- Light weight
- Hygienic
- Easy to shape and color
- Economical

Apart from some of the properties of plastics mentioned above, one important feature of plastic is that it is a non-rusting material which makes it a very usable commodity especially in coastal areas where there is a lot of humidity.

As stated earlier, the use of plastics is increasing all the time as they replace materials such as metal, wood, paper, ceramics and glass in a wide variety of uses. More over the overall demand and local supply gap that prevails in the market remains largely unmet which also provides opportunities for entering in to this business.

The following table gives an overview of some of the applications of plastics

POLYMER	PROPERTIES	TYPICAL APPLICATIONS
<b>ABS</b>	Toughness, Electroplatable	Home appliances, TV and computer parts, etc
<b>POM</b>	Low friction, low wear. Little change in impact strength with temp. Resistance to fatigue, free from biological attack but susceptible to UV radiation.	Bearing applications, gears, digit wheels, sprocket, chain, cams, carburetor body, aerosol parts etc.
<b>PMMA</b>	Excellent clarity & mp; transparency Dimensionally rigid, Resistant to outdoor weathering.	Lamp covers, lenses, reflectors knobs, transparent panel knobs, covers.
<b>PPO</b>	Excellent electrical properties flame resistant, good toughness, dimensionally rigid, resistant to detergent.	Electrical parts, TV back covers, car dashboards, and washing machine parts.
<b>PA</b>	Wear resistant, tough, low friction, low fatigue, withstand temp. Electrical insulation property.	Bearings, gears, electrical socket plug, cooling fan, power tool housing, safety belt parts, bathroom fittings, etc.

<b>POLYMER</b>	<b>PROPERTIES</b>	<b>TYPICAL APPLICATIONS</b>
<b>PC</b>	High impact strength, excellent clarity, good dimensional stability good weathering resistant, low moisture absorption, high heat deflection temperature.	Replacement for glass, Transparent covers for instrument panel, lighting application, safety helmet, car lamp housing, goggles, lenses, food mixer parts, computer parts, connectors.
<b>PES</b>	Lower flammability, excellent electrical properties, excellent long term load bearing properties at elevated temperature, good toughness.	Aircraft parts, electrical parts, automobile parts, microwave, dishes, grills, dishwasher parts, hair drier parts, projector fan.
<b>PBT</b>	High rigidity, ultra-low water absorption, excellent electrical properties, withstands high temperature under load.	Electrical components, lamp housing, fuse cases, pump housing, toaster parts, and hairdryer parts.
<b>PPS</b>	Excellent electrical properties, arc resistant, withstand high temperature. good dimensional stability,	Connectors, terminal blocks, socket, coil former, relay parts, lamp holder, switches, carburetor parts, ignition plate.
<b>PETP</b>	High stiffness, excellent dimensional stability at elevated temperature, good electrical properties.	Rotary switches, contactors, circuit boards.
<b>PP- Co polymer</b>	High impact strength, Improved heat stability,	Luggage, housewares, toys, interior parts of car, washing m/c parts, bottle caps, disposable syringe, crates, battery boxes, bobbins, dyeing cones.
<b>PEEK</b>	Excellent long term bearing properties at high temperature of 200 degree C., strong, rigid, tough, excellent abrasion resistant.	Wire coating, parts for aerospace application.
<b>SAN</b>	Excellent optical properties, tough, no weather resistant,	Cup, picnic items, tray, cutlery, cassette storage racks, dials, cosmetics containers,
<b>TPU</b>	Flexible, durable, oil resistant.	Seal, washers, rollers, watch straps, shoes soles.

Some most common applications of commodity plastics in our everyday life are:

APPLICATION OF COMMODITY PLASTICS		
<b>HDPE</b>	High Density Polyethylene	Bottle crates, containers, house ware
<b>LDPE</b>	Low Density Polyethylene	Toys, bottle caps, lids, bowls, shopping bags
<b>PS</b>	Polystyrene	Toys, containers, tape cassettes, disposable cups, transistor cabinet, appliance housing
<b>CA</b>	Cellulose Acetate	Toys, pen, handles for tools
<b>RPVC</b>	Rigid Polyvinyl Chloride	Pipe fittings, guttering, plumbing items
<b>SPVC</b>	Soft Polyvinyl Chloride	Washers, soft tubes, soles, heels, footwear

## 1.4 Plastic Industry & Market Overview

The per capita consumption of plastic in Pakistan is 4.5 kilograms, while this is 9.7 kg in India and 45 kg in China. The highest per capita consumption of plastic is in United States and Germany, where per capita consumption is 120 kg per annum. Globally, the per capita plastic consumption works out to be around 24 kg per annum<sup>1</sup>. The consumption of plastic is less in Pakistan as the local industries are not developing as rapidly as they are growing in the other parts of the world.

### 1.4.1 Market Players

There are some 6,500+ plastic manufacturers in the country and 700,000 people are directly and indirectly engaged with this business. The plastic industry falls in cottage industry and there are some manufacturers, who are medium-sized industries.<sup>2</sup>

<sup>1</sup> <http://www.plasticsnews.com/article/20131204/NEWS/131209962/study-plastic-consumption-to-double-in-india-by-2016>

<sup>2</sup> <http://www.plastipacpakistan.com/overview.html>

### 1.4.2 Consumption & Imports

Pakistan imports 80-90 percent raw material for plastic making from different countries, and at present there is only one company producing raw material for the industry. Currently Pakistan top producing company is captured 85%<sup>3</sup> of market share among other companies 176 kg tons raw material produced last year.

Pakistan's economy achieved an impressive GDP growth rate during the last three decades. Pakistan's plastic industry is thriving at an average annual growth rate of 15% with a total estimated production capacity of 624,200 M/T per annum and raw material production is 543,000 Metric Tons per annum<sup>4</sup>. The country imports 70 percent raw material from UAE and Far Eastern countries. The special grade raw material is imported from China and USA, which is 20 percent of total raw material consumption. India is also a major producer of plastic's raw material. In 2015 the Pakistan imported 96,925 Kg<sup>5</sup> of plastic raw material from India which is most imported by any country. The total consumption of plastic raw material in India is two million tons annually.

Moreover, the recent penetration of cheap Chinese products into Pakistan has made the competitive situation in the local plastic industry very intense. Local manufacturers have to import raw material which is a substantive cost of their total produce while Chinese products offering a large variety at affordable rates have made survival difficult for the local industry.

However many plastic manufacturers still enjoy good business since they are able to anticipate and understand the market dynamics that helps them to relate to the demand supply gap quickly than the rest of the producers. Some critical success factors are discussed below that need to be considered for the successful operation / viability of the business.

### 1.5 Key Success Factors/Practical Tips for Success

The three main critical success factors that affect the decision to invest in the proposed business setup are:

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<sup>3</sup> [http://www.engropolymer.com/pdf/analyst/2016/Analyst\\_Briefing-1Q\\_2016.pdf](http://www.engropolymer.com/pdf/analyst/2016/Analyst_Briefing-1Q_2016.pdf)

<sup>4</sup> <http://www.plastipakistan.com/overview.html>

<sup>5</sup> <http://comtrade.un.org/data/>



**i) Related Experience**

The Investor must have considerable experience of the plastic industry wherein he / she should be able to identify the changing environment both at the demand and the supply side and react accordingly. Molds are very expensive; therefore the Investor needs to choose molds only for those products for which demand is expected to rise in the future.

Related industry experience is also required where purchase of raw material is being considered. Prices of HDPE / PP plastic resins are directly related to petroleum prices which are very dynamic.

**ii) Marketing Skill**

Another critical factor is that the Investor must have effective PR & marketing skills. These marketing skills will enable the Investor to carry out business development activities to target his potential customers and also to maintain his existing client base. Contacts with relevant distributors and major wholesale / retail outlets and markets play a crucial role in business development.

**iii) Toll Manufacturing / Contract Manufacturing**

Considering the price competition and the possibility of decreasing margins at retail level, many plastic good manufacturers have adhered to toll manufacturing where they are subcontracted by large companies to manufacture product parts like refrigerator parts, AC vents, grills etc. Although the margins received initially might not be significant but the volume of business is considerably large which makes up for the low margins. The margins tend to be very significant if the manufacturer possesses an expensive mold which is not available quite easily in the market. A strong referral base needs to be established in order to get such contracts.

**1.6 Proposed Business Legal Status**

Although the legal status of business tends to play an important role in any setup, the proposed plastic good manufacturing business is assumed to operate on a sole proprietorship basis which may extend to partnership in case of addition of new products that might add significant business to the existing setup.

## 1.7 Project Investment

This section will provide the total cost of the project.

<b>CAPITAL INVESTMENT</b>	<b>RS. IN ACTUALS</b>
Building/Infrastructure	2,500,000
Machinery & equipment	11,255,000
Furniture & fixtures	112,000
Office equipment	211,000
Pre-operating costs	222,000
<b>Total Capital Costs</b>	<b>14,300,000</b>
<b>WORKING CAPITAL</b>	<b>RS. IN ACTUALS</b>
Equipment spare part inventory	43,116
Raw material inventory	2,291,975
Upfront building rent	600,000
Upfront insurance payment	562,750
Cash	500,000
<b>Total Working Capital</b>	<b>3,997,841</b>
<b>Total Project Cost</b>	<b>18,297,841</b>

## 1.8 Proposed Product Mix

The proposed project is assumed to manufacture the following items using HDPE / Co - PP (Yuplene) plastic – Injection Grade:

- Water Buckets
- Buckets Handle
- Wash Tubs

According to this feasibility is assumed that these two products running in the production line, but initially the Investor, needs to be careful in choosing the product mix of the right type and size that has the greatest acceptability such that the sales volume generated is able to cover the mold costs required for each separate item.

Considering this factor, it is proposed that the Investor produces plastic goods for the above mentioned product categories with the following details:

ITEM	SIZE	COLOR VARIANT
Water Buckets	• 20 liters	• Blue & Red
	• 24 liters	• Blue & Red
Bucket Handles	• 16 liters	• Blue & Red
	• 20 liters	• Blue & Red
Wash Tubs	• 24 liters	• Blue & Red
	• 30 liters	• Blue & Red

It is proposed that water colors be used for blue and red shades which give a translucent look to the product and are the most preferred option for the consumers.

One important factor to consider here is that the Investor must have the requisite skills to decide on whether to introduce a new product or add a new size to the existing product both of which require the purchase of an additional mold. Hence the experience of the Investor will play an important role in determining the course of action.

### 1.9 Recommended Project Parameters

YEARLY CAPACITY	HUMAN RESOURCE	EQUIPMENT	LOCATION
70% Capacity Utilization	Management Staff (5) Techincial Staff (9)	Japan/USA	Industrial Area
Financial Summary			
Project Cost	IRR	NPV	Payback Period
18,297,841	31%	Rs. 5,022,198	3.85 Years

### 1.10 Proposed Location

The recommended area for the proposed business setup will be in an Industrial Area. The main reason for such a location is dependent on the availability of all provisions necessary for the production process.

## 2 MACHINERY & EQUIPMENT

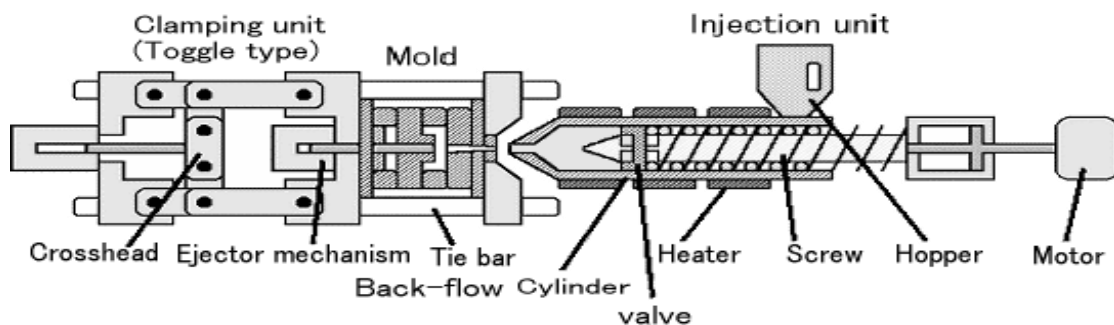
Injection molding is a method to obtain molded products by injecting plastic materials molten by heat into a mold, and then cooling and solidifying them. The method is suitable for the mass production of products with complicated shapes, and takes a large part in the area of plastic processing.

A typical injection molding machine is divided into 2 units i.e. a clamping unit and an injection unit.

- **Clamping Unit:** The functions of the clamping unit are opening and closing the die, and the ejection of products. There are 2 types of clamping methods, namely the toggle type shown in the figure below and the straight-hydraulic type in which a mold is directly opened and closed with a hydraulic cylinder.
- **Injection Unit:** The functions of the injection unit are to melt plastic by heat and then to inject molten plastic into a mold. The screw is rotated to melt plastic introduced from the hopper and to accumulate molten plastic in front of the screw (called metering). After the required amount of molten plastic is accumulated, injection process is started. While molten plastic is flowing in a mold, the machine controls the moving speed of the screw, or injection speed. On the other hand, it controls dwell pressure after molten plastic fills out cavities. The position of change from speed control to pressure control is set at the point where either screw position or injection pressure reaches a certain fixed value.

It is however important to note that all flow speeds, injection speed, shot lead time, screw rotation speed and other particulars need to be controlled by the machinery operator. The Investor may also appreciate that the time allowed for the plastic to cool down also has an effect on the end product properties which requires considerable know-how and skilled handling of production line processes.

The diagram on the following page gives a cross-sectional view of the injection molding machine (note: this is just a theoretical representative diagram for the injection molding machine, as machines may vary according to their makes, brands, products produced etc.).



## 2.1 Tips for Purchasing a Mold

The mold is the most expensive component requiring considerable investment which is sometimes higher than the cost of the machinery itself. Therefore as discussed earlier, the molds need to be carefully chosen based on product acceptance production ease. Some of the following points should be considered when selecting the mold:

- **Cavity Size** of the injection molding machine is the major factor when deciding on the mold. The larger the cavity capacity the greater the adjustability of large sized molds for large products. For example an injection mold machine with 75 ounce cavity capacity cannot accommodate a 100 ounce mold. It is preferred that the mold should be at least 10 ounce less than the cavity size.
- **Mold Area & Structure** is another important factor to consider since it is not necessary that the mold size fits in the cavity as the dimensions of the mold also need to be in congruence with the cavity dimensions. The length width and depth of the mold needs to be in line with the cavity dimensions.
- **Tie Bars** are the strongholds that firmly grip the mold such that it remains unmoved during the impact. The distance between the tie bars which holds the mold and their relative properties need to be considered in order to avoid mismatch and errors during the injection molding process.
- **Mold Opening Space** is the space required by the ejector mechanism to eject the product, in case the mold opening space is smaller than the mold, the ejector will not be able to eject the cooled product within the available space.

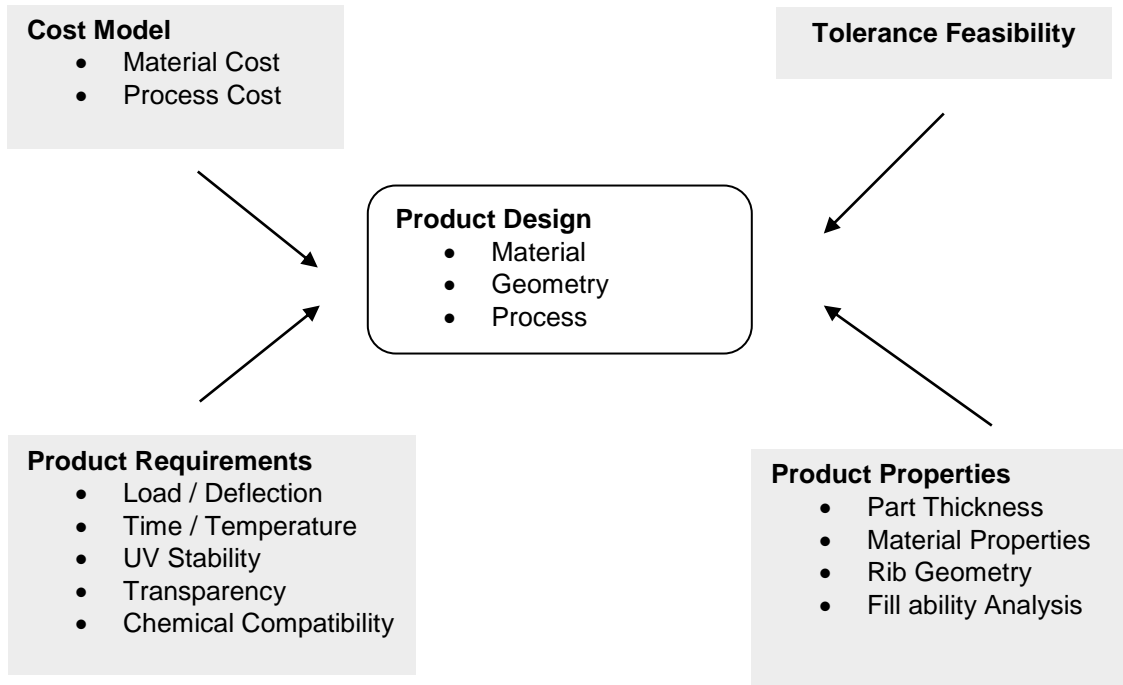
## 3 PROCESS FLOW

Injection molding is a powerful and comprehensive manufacturing process. However, it can also be a complicated and costly experience. The Investor and the product designer must not only consider part performance requirements, but process and material constraints as well as well as market accessibility. Effective management of these constraints in a time efficient manner can yield significant product cost savings and a quick time-to-market.

Much savings can be realized by making informed decisions early in the product design process. The product designer should have several tools and forms of knowledge at his disposal. In the early stages of design, and throughout much of the design process, the designer can employ qualitative knowledge in the form of personal experience and tabulated rules of thumb. Hence a brief overview of what things to consider while developing the product requires to be deliberated upon.

### 3.1 Product Design & Basics

Of critical importance to a good product design practice is the product under consideration which directly impacts on the raw material and the features of the molds to be used. The following schematic diagram depicts some of the basic requirements:



Based on the above product requirements the molds are to be carefully chosen since they are the most costly component of the Injection Molding Machine.

The geometric variable has the largest impact on mechanical performance of the product, of which wall thickness is the most critical. Since wall thickness is so strongly coupled with process ability, any design technique must also consider material and process constraints on wall thickness configuration. There are a number of factors that influence the choice of wall thickness, including:

- **Mechanical Requirements:** Nominal wall thickness must meet basic part requirements such as static, dynamic, and impact loading.
- **Material and Process:** Higher-flow materials will permit thinner wall designs, while thinner wall designs will in general require higher injection pressures.
- **Production rate:** Thicker parts will require longer cooling times and increase the cycle time.

- Part Geometry: Assembly and functional surface protrusions will require variations in the nominal wall. These may cause uneven cooling, part distortion, and residual stresses.
- Agency Requirements: Electrical and flammability considerations place certain restrictions on part thickness.

From a design perspective, the part mechanical performance will place certain (and very important) restrictions on wall thickness and part geometry. In many engineering applications, such mechanical performance concerns include strength & stiffness, impact strength, fatigue, and creep and stress relaxation. Good engineering practice suggests that the designer optimize the material, geometry, and process design to meet the mechanical, process, and production constraints to the extent possible. However, these parameters and technical details must be finalized and decided by the product designer (engineer) and machine operators. The use of computers in Computer Aided Designing (CAD) and Computer Aided manufacturing (CAM) has made it easy for the product designers to reach optimal and best suited solutions before starting the manufacturing process.

### 3.2 Production Process

The theory of injection molding can be reduced to four simple individual steps: Plasticizing, Injection, Chilling, and Ejection. Each of those steps is distinct from the others and correct control of each is essential to the success of the total process.

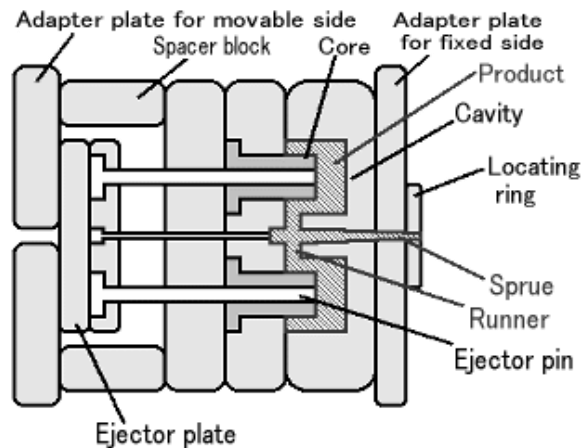
- i. Plasticizing - describes the conversion of the polymer material from its normal hard granular form at room temperatures, to the liquid consistency necessary for injection at its correct melt temperature.
- ii. Injection - is the stage during which this melt is introduced into a mold to completely fill a cavity or cavities.
- iii. Chilling - is the action of removing heat from the melt to convert it from a liquid consistency back to its original rigid state. As the material cools, it also shrinks.
- iv. Ejection - is the removal of the cooled, molded part from the mold cavity and from any cores or inserts.

### 3.3 Process Description

The solid polymers are added into the injection unit by way of the hopper, which are then crushed by a motor propelled screw in a heated cylinder, the molten polymer on reaching the desired temperature levels is introduced into the mold through a pressure valve (at the

desired pressure level). The molten plastic then fills the cavities inside the mold until the core is completely filled. Once completely filled, the plastic is allowed to cool down at the desired temperature for a certain time period (this also affects the plastic properties). After cooling, the plastic product is ejected out of the mold through ejection pins operating from an ejection plate placed behind the mold.

A mold is a hollow metal block into which molten plastic is injected to form a certain fixed shape. Although they are not illustrated in the figure shown above, actually there are many holes drilled in the block for temperature control by means of hot water, oil or heaters. Molten plastic flows into a mold through an aperture and fills cavities by way of runners and gates. Then, the mold is opened after cooling process and the ejector rod of the injection molding machine pushes the ejector plate of the mold to further eject moldings. The following diagram gives a common illustration of a mold:



### 3.4 Color Pigmentation

Attractive plastic products are key elements that appeal to the customer, since similar products vary nominally amongst various manufacturers. Usually the production manager decides on the color in consultation with the owner and then develops the pigment mix in terms of quantity and quality to meet the desired color schemes. The color pigments are then bought from the market and added to the plastic resins which are then churned in the coloring machine. Once the resins are colored according to the desired intensity, they are dried and cooled before being subsequently poured into the injection molding machine.

### 3.5 Raw Material Requirement

The raw materials required for the manufacturing of plastic goods are Injection Grade HDPE / PP Plastic resins. These plastic resins are usually bought as Co-Propylene Polymers (Yuplene). The main supplier of this plastic resin is SK CHEM., which has



considerable presence in the Pakistani Market and is easily available. Moreover the color pigments are also easily available from the local market according to the color mix as desired by the manufacturer. There are recycled plastic resins available in the market and one has to be careful to check the plastic resins to ensure that they are not recycled since they diminish product quality and outlook.

### 3.6 Production Capacity

The production capacity for each of the machines depends on two main things

- Cooling Cycle Time
- Raw Material Injection Weight

Based on the above two factors and keeping in view the products to be produced, the yearly production output (based on 70% capacity utilization) for the proposed project will be as follows:

ITEM	SIZE	UNITS
Water Buckets	20 Liters	9,360
	24 Liters	9,360
Buckets Handle	20 Liters	14,976
	24 Liters	14,976
Water Tub	24 Liters	9,360
	30 Liters	6,240

The production of the two types of water buckets is assumed to be based on a rotating cycle of six months. The cost of deploying a single machine for a single product becomes very high; therefore a single machine would be used to produce the two sizes of water buckets.

Apart from the above production schedule, it is suggested that at least two machines be deployed for toll manufacturing purposes on which the margins tend to be relatively higher. Such contract manufacturing orders can be easily secured for various commodities like AC grills, road posts, and plastic containers for various FMCG products, automobile parts etc. For costing purposes, it is assumed that the two machines would be producing products requiring a shot weight of 500 grams and 1,000 grams respectively. The size and shape of the mold would depend on the product. (Please see Revenue and Cost Sheet for details).

## 4 LAND & BUILDING REQUIREMENT

### 4.1 Land Requirement

The land requirement is around 5,000 sq. feet in an industrial area where all utilities and facilities are properly available. The Building will easily allow the accommodation of the recommended machines and also allow space for further expansion in future, if required. The Building will also allow ample spaces for the raw material and finished good warehouses and a proper office building.

### 4.2 Covered Area Requirement

The proposed setup is assumed to be totally covered with around 100% of the total area of the building to work. It is recommended that the office and warehouses be made on the production hall to allow maximum utilization of space. It is also suggested that minimum space be utilized for office to allow maximum space available for storage of raw materials and finished goods inventory. The allocation of space would be as follows:

DETAILS	SIZE (SQ. FEET)	TOTAL CONSTRUCTION COST (RS)
Production Hall	4,000	2,000,000
Warehouse	1,000	500,000
<b>Total</b>	<b>5,000</b>	<b>2,500,000</b>

### 4.3 Recommended Mode

The proposed premises will be acquired on rental with 06 months upfront deposit.

#### 4.4 Office Furniture & Equipment

A total of Rs. 211,000 is required for purchase of office furniture and related equipment. The following table gives an assumed breakup:

OFFICE FURNITURE		
ITEM	NUMBER	ESTIMATED COST (RS.)
Table & Chair Set (Owner)	01	12,000
Table & Chair Set (Office Staff)	03	30,000
Air Conditioner (Split Unit)	01	40,000
Waiting Chairs	05	15,000
Sofa Set for Customers	01	15,000
<b>Total</b>	<b>11</b>	<b>211,000</b>

The Office Furniture & Equipment will be depreciated at the rate of 10% per annum according to the diminishing balance method for the projected period.

#### 5 MACHINERY & EQUIPMENT

Based on the number and type of products to be produced by the proposed injection molding setup, the following machinery and molds will be required:

ITEM	MACHINE	PRICE RS.
<b>Water Buckets</b> Details : 150 Ton Origin USA Make: CINCINNATI	A	2,000,000
<b>Bucket Handles</b> Details: 120 Ton Origin Japan Make: KAWAGUCHI	B	2,000,000
<b>Wash Tubs</b> Details: 365 Ton Origin Japan Make: KAWAGUCHI	C	3,500,000

<b>MOLD</b>	<b>PRICE RS.</b>	<b>TOTAL RS.</b>
1) 20 Liters	250,000	520,000
2) 24 Liters	270,000	
3) Bucket handle	130,000	130,000
4) 24 Liters	275,000	600,000
5) 30 Liters	325,000	

The above tables gives the details of the machinery and molds required along with their cost for each commodity to be produced. These molds are locally available and can be customized according to the customer requirements. Apart from bucket handle, every other product requires a separate mold which corresponds with the size of the product; hence it has a direct impact on the cost of the machine and mold according to the product size.

### 5.1 Injection Molding Machine

The injection molding machine is available in Pakistan with local suppliers dealing in used / refurbished machinery. However since the life of this machinery is very long (15 to 17 years) many people prefer using used machinery which requires a greater maintenance but the capital investment is very much low than the new machines. These machines usually come in two technological formats

- Computerized
- Analog

The most common brands for injection molding machinery are Jet Master, Super Jet, Mitsubishi, BM Biraghi, Engel, Horizon, Sintesi etc. The machines proposed for this setup are computerized machines of Japanese / American origin. Although Chinese machines are also available but locally the former (Japanese / American) machines are preferred.

### 5.2 Injection Mold

The molds are very costly and need to be carefully picked. Some molds are locally made but people usually prefer Chinese molds that are usually robust and refined. Used molds

are also available in the market, which are proposed for this setup since they are cheap and efficient in delivering the desired products.

### 5.3 Coloring Machine

The coloring machine is a round shaped mixer which is similar to the common cement mixing machines mostly found near construction sites. The coloring machine is easily available from the local market.

## 6 HUMAN RESOURCE REQUIREMENT

The human resource requirement for the general and management staff are as follows:

<b>GENERAL MANAGEMENT</b>		
<b>DESIGNATION / TYPE</b>	<b>NUMBER</b>	<b>MONTHLY SALARY (RS.)</b>
Accountant	01	20,000
Purchaser	01	16,000
Office Assistant	01	14,000
Store / Warehouse Keeper	01	16,000
Guard (24 Hour)	01	14,000
<b>Total</b>	<b>05</b>	<b>80,000</b>

Considering the size of the proposed establishment it is assumed that the owner would be managing the overall affairs of the plastic molding setup. An accountant is required to process and check bills, invoices, receivables management, maintain accounts, etc. for external and internal reporting. The accountant is required to update records and ensure safe custody of store keys.

The purchaser would be primarily responsible for making daily purchases; raw material purchases and other purchases as and when required. The purchaser would also assist the accountant in the safe custody of all inventories in the storeroom. The office assistant would be responsible for handling customers & complaints, following-up on bills and managing all day to day activities. One security guards would be required for ensuring security for the overall premises.

The following table gives the details for the proposed technical labor that forms the integral part of the total employee payroll:

<b>TECHNICAL MANPOWER</b>		
<b>DESIGNATION / TYPE</b>	<b>NUMBER</b>	<b>MONTHLY SALARY (RS.)</b>
Production Manager	01	20,000
Production Assistant	01	16,000
Shift Supervisor	01	16,000
Hydraulic Technician	01	14,000
Machine Operators	03	48,000
Helpers	02	28,000
<b>Total</b>	<b>09</b>	<b>142,000</b>

The Production Manager and Production Assistant should have considerable knowledge about polymer technology and properties preferably with diploma in plastic technology with 5 to 7 years' experience for the former and 2 to 3 years for the latter. The machine operators should also have relevant experience of handling and operating injection molding machines and plastic processing.

## **7 FINANCIAL ANALYSIS & KEY ASSUMPTIONS**

The project cost estimates for the proposed Injection Molding Setup have been formulated on the basis of discussions with relevant stakeholders and experts. The cost projections cover the cost of land, building, inventory, equipment including office furniture etc. The specific assumptions relating to individual cost components are given as under:

### **7.1 Revenue & Cost Projections**

The Sales are expected to increase by 7.5% every year while the cost of raw materials is assumed to increase by 5%. The 8% annual increase in revenue is expected to result from a part increase in capacity utilization and part increase in product price. However the price of the plastic resins (Co-PP) is usually linked with the petrochemical prices, therefore the Investor is required to carefully negotiate the purchase price and manage the inventory level in coordination with the production personnel.

The prices used to calculate the gross revenue earned are based on the selling rate at which the Investor will charge the distributor. These basic prices do not include the selling and

distribution margins and the since these would depend on the negotiation with the distributor. The prices are also exclusive of the General Sales Tax.

## 7.2 Rent Cost

The rent for the assumed premises will be Rs. 50000/- per month. It is assumed that Rs. 600,000 will be given in advance before possession of premises. This will include 3 months deposit and 3 month advance rent. The rent would be payable on a monthly basis and is expected to increase at the rate of 10% per annum for the projected period.

## 7.3 Utilities Requirement

The following table presents the assumed breakup of utilities on a monthly basis:

UTILITY	MONTHLY CHARGES (RS.)
Electricity	546,480
Telephone	5,600
<b>Total</b>	<b>552,080</b>

As depicted above the machines require considerable power during the injection molding process. The preheating procedure of the machine before commencement of production consumes a lot of time and electricity. Therefore it is advisable that the machines are kept on continuously for 24 hours and only shut down when the mold needs to be changed. It is assumed that utilities expenses will increase by 10% every year.

## 7.4 Depreciation on Building & Equipment

Depreciation on Building is 05%, Machinery and Office Furniture & Fixtures is assumed to be at the rate of 10% per annum based on the diminishing balance method for the projected period.

## 7.5 Machine Maintenance

The Injection Molding Machines and molds have a long life however the maintenance cost of the machines are usually very high since they need to be oiled and cleaned regularly specially before installing a new mold or starting a fresh production process. The yearly maintenance cost has been taken to be Rs 02 per production quantity produced. Quantity increase with 05% increase in price

## 7.6 Working Capital & Pre Operating Costs

It is estimated that an additional amount of approximately Rs. 3,997,841 will be required as cash in hand to meet the working capital requirements / contingency cash for the initial stages. The requirement is based on the rent, utilities and salaries expenses for at least four months and four months raw material inventory. The following table gives the break up.

<b>WORKING CAPITAL</b>	<b>RS. IN ACTUALS</b>
Equipment spare part inventory	43,116
Raw material inventory	2,291,975
Upfront building rent	600,000
Upfront insurance payment	562,750
Cash	500,000
<b>Total Working Capital</b>	<b>3,997,841</b>

## 7.7 Account Receivables

A collection period of 45 days is assumed for sales. Further provision for bad debts has been assumed equivalent to 1.5% of Gross Sales.

## 7.8 Traveling & Miscellaneous Office Expenses

A monthly figure of Rs. 6,400 is assumed to be incurred for traveling expenses and office purchases which are expected to increase at the rate of 8% per annum for the projected period.

## 7.9 Taxation

The tax rate applicable to sole proprietorship is the same as that of the salaried individual. Therefore, we are assuming that the tax rate would be the same for the proposed injection molding setup.

## 7.10 Owner's Withdrawal

It is assumed that the owner will withdraw from the business once the desired profitability is reached from the start of operations. The amount would depend on business sustainability and availability of funds for future growth.



**Key Assumptions**

ITEM	ASSUMPTION(S)
Sales Increase Growth Rate	7.5 % per year
Increase in Cost of Raw Materials	05 % per year
Increase in Staff Salaries	10 % per year
Increase in Utilities (Electricity / Water / Gas)	10 % per year
Increase in Rent	10 % per year
Increase in Office Expenses	10 % per year
Debt / Equity Ratio	0 : 100
Depreciation	
o Plant Building	05 % per annum (Diminishing Balance)
o Machinery & Molds	10 % per annum (Diminishing Balance)
o Office Furniture & Equipment	10 % per annum (Diminishing Balance)
Machine Annual Maintenance Cost	Rs. 02 per production quantity produced
Receivables	45 Days
Bad Debts	1.5% of Gross Sales
Finished Goods Inventory	15 Days
Raw Materials Inventory	30 Days
Tax Rate	Income Tax on Salaried Individuals

## 8 PROJECTED FINANCIAL STATEMENTS

Calculations										SMEDA
Income Statement										
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Revenue	46,489,428	49,976,135	53,724,345	57,753,671	62,085,196	66,741,586	71,747,205	77,128,245	82,912,863	89,131,328
<i>Cost of sales</i>										
Cost of goods sold 1	27,503,698	28,878,883	30,322,827	31,838,969	33,430,917	35,102,463	36,857,586	38,700,466	40,635,489	42,667,263
Operation costs (direct labor)	1,704,000	1,869,904	2,051,960	2,251,742	2,470,975	2,711,552	2,975,553	3,265,257	3,583,167	3,932,029
Operating costs (machinery maintenance)	517,390	577,744	618,764	662,696	709,748	760,140	814,110	871,912	933,817	1,000,118
Operating costs (direct electricity)	6,557,760	7,213,536	7,934,890	8,728,379	9,601,216	10,561,338	11,617,472	12,779,219	14,057,141	15,462,855
Operating costs (genset)	5,616,000	6,177,600	6,795,360	7,474,896	8,222,386	9,044,624	9,949,087	10,943,995	12,038,395	13,242,234
Total cost of sales	36,282,848	38,540,067	40,928,441	43,481,786	46,212,856	49,135,493	52,264,721	55,616,853	59,209,614	63,062,266
Gross Profit	10,206,580	11,436,067	12,795,903	14,271,885	15,872,340	17,606,092	19,482,484	21,511,392	23,703,249	26,069,062
	22%	23%	24%	25%	26%	26%	27%	28%	29%	29%
<i>General administration &amp; selling expenses</i>										
Administration expense	960,000	1,053,467	1,156,034	1,268,587	1,392,099	1,527,635	1,676,368	1,839,581	2,018,686	2,215,228
Building rental expense	600,000	660,000	726,000	798,600	878,460	966,306	1,062,937	1,169,230	1,286,153	1,414,769
Travelling expense	76,800	84,277	92,483	101,487	111,368	122,211	134,109	147,167	161,495	177,218
Communications expense (phone, fax, mail, internet, etc.)	67,200	73,743	80,922	88,801	97,447	106,934	117,346	128,771	141,308	155,066
Office expenses (stationary, entertainment, janitorial services, etc.)	57,600	63,208	69,362	76,115	83,526	91,658	100,582	110,375	121,121	132,914
Promotional expense	464,894	499,761	537,243	577,537	620,852	667,416	717,472	771,282	829,129	891,313
Insurance expense	562,750	506,475	450,200	393,925	337,650	281,375	225,100	168,825	112,550	56,275
Professional fees (legal, audit, consultants, etc.)	232,447	249,881	268,622	288,768	310,426	333,708	358,736	385,641	414,564	445,657
Depreciation expense	1,282,800	1,282,800	1,282,800	1,282,800	1,282,800	1,282,800	1,282,800	1,282,800	1,282,800	1,282,800
Amortization of pre-operating costs	44,400	44,400	44,400	44,400	44,400	-	-	-	-	-
Bad debt expense	697,341	749,642	805,865	866,305	931,278	1,001,124	1,076,208	1,156,924	1,243,693	1,336,970
Subtotal	5,046,233	5,267,654	5,513,931	5,787,326	6,090,305	6,381,167	6,751,658	7,160,596	7,611,499	8,108,209
Operating Income	5,160,347	6,168,413	7,281,972	8,484,559	9,782,035	11,224,925	12,730,826	14,350,796	16,091,750	17,960,853
Earnings Before Interest & Taxes	5,160,347	6,168,413	7,281,972	8,484,559	9,782,035	11,224,925	12,730,826	14,350,796	16,091,750	17,960,853
Earnings Before Tax	5,160,347	6,168,413	7,281,972	8,484,559	9,782,035	11,224,925	12,730,826	14,350,796	16,091,750	17,960,853
Tax	1,070,604	1,381,445	1,771,190	2,192,096	2,646,212	3,151,224	3,678,289	4,245,278	4,854,613	5,508,799
<b>NET PROFIT/(LOSS) AFTER TAX</b>	<b>4,089,743</b>	<b>4,786,969</b>	<b>5,510,782</b>	<b>6,292,464</b>	<b>7,135,823</b>	<b>8,073,701</b>	<b>9,052,537</b>	<b>10,105,517</b>	<b>11,237,138</b>	<b>12,452,054</b>
	9%	10%	10%	11%	11%	12%	13%	13%	14%	14%
Balance brought forward		4,089,743	4,438,356	4,974,569	5,633,516	6,384,669	7,229,185	8,140,861	9,123,189	10,180,163
Total profit available for appropriation	4,089,743	8,876,712	9,949,138	11,267,032	12,769,339	14,458,371	16,281,722	18,246,378	20,360,327	22,632,218
Dividend	-	4,438,356	4,974,569	5,633,516	6,384,669	7,229,185	8,140,861	9,123,189	10,180,163	11,316,109
Balance carried forward	4,089,743	4,438,356	4,974,569	5,633,516	6,384,669	7,229,185	8,140,861	9,123,189	10,180,163	11,316,109



Calculations											SMEDA
Balance Sheet											
	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
<b>Assets</b>											
<i>Current assets</i>											
Cash & Bank	1,050,000	1,481,714	2,838,225	4,059,746	5,341,568	6,647,521	7,928,202	9,195,080	10,444,304	11,671,841	18,717,843
Accounts receivable		5,731,573	5,946,507	6,392,495	6,871,932	7,387,327	7,941,377	8,536,980	9,177,254	9,865,548	10,605,464
Finished goods inventory		1,577,515	1,607,149	1,706,746	1,813,222	1,927,110	2,048,986	2,179,477	2,319,264	2,469,084	2,629,743
Equipment spare part inventory	43,116	50,553	56,849	63,929	71,892	80,846	90,915	102,239	114,973	129,293	-
Raw material inventory	2,291,975	2,526,902	2,785,910	3,071,466	3,386,291	3,733,386	4,116,058	4,537,953	5,003,094	5,515,911	-
Pre-paid building rent	50,000	55,000	60,500	66,550	73,205	80,526	88,578	97,436	107,179	117,897	-
Pre-paid insurance	562,750	506,475	450,200	393,925	337,650	281,375	225,100	168,825	112,550	56,275	-
<b>Total Current Assets</b>	<b>3,997,841</b>	<b>11,929,732</b>	<b>13,745,341</b>	<b>15,754,858</b>	<b>17,895,761</b>	<b>20,138,091</b>	<b>22,439,216</b>	<b>24,817,991</b>	<b>27,278,617</b>	<b>29,825,849</b>	<b>31,953,049</b>
<i>Fixed assets</i>											
Building/Infrastructure	2,500,000	2,375,000	2,250,000	2,125,000	2,000,000	1,875,000	1,750,000	1,625,000	1,500,000	1,375,000	1,250,000
Machinery & equipment	11,255,000	10,129,500	9,004,000	7,878,500	6,753,000	5,627,500	4,502,000	3,376,500	2,251,000	1,125,500	-
Furniture & fixtures	112,000	100,800	89,600	78,400	67,200	56,000	44,800	33,600	22,400	11,200	-
Office equipment	211,000	189,900	168,800	147,700	126,600	105,500	84,400	63,300	42,200	21,100	-
<b>Total Fixed Assets</b>	<b>14,078,000</b>	<b>12,795,200</b>	<b>11,512,400</b>	<b>10,229,600</b>	<b>8,946,800</b>	<b>7,664,000</b>	<b>6,381,200</b>	<b>5,098,400</b>	<b>3,815,600</b>	<b>2,532,800</b>	<b>1,250,000</b>
<i>Intangible assets</i>											
Pre-operation costs	222,000	177,600	133,200	88,800	44,400	-	-	-	-	-	-
<b>Total Intangible Assets</b>	<b>222,000</b>	<b>177,600</b>	<b>133,200</b>	<b>88,800</b>	<b>44,400</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>
<b>TOTAL ASSETS</b>	<b>18,297,841</b>	<b>24,902,532</b>	<b>25,390,941</b>	<b>26,073,258</b>	<b>26,886,961</b>	<b>27,802,091</b>	<b>28,820,416</b>	<b>29,916,391</b>	<b>31,094,217</b>	<b>32,358,649</b>	<b>33,203,049</b>
<b>Liabilities &amp; Shareholders' Equity</b>											
<i>Current liabilities</i>											
Accounts payable		2,514,949	2,654,744	2,800,848	2,955,604	3,119,581	3,293,390	3,477,689	3,673,187	3,880,645	3,589,100
<b>Total Current Liabilities</b>	<b>-</b>	<b>2,514,949</b>	<b>2,654,744</b>	<b>2,800,848</b>	<b>2,955,604</b>	<b>3,119,581</b>	<b>3,293,390</b>	<b>3,477,689</b>	<b>3,673,187</b>	<b>3,880,645</b>	<b>3,589,100</b>
<b>Total Long Term Liabilities</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>
<i>Shareholders' equity</i>											
Paid-up capital	18,297,841	18,297,841	18,297,841	18,297,841	18,297,841	18,297,841	18,297,841	18,297,841	18,297,841	18,297,841	18,297,841
Retained earnings		4,089,743	4,438,356	4,974,569	5,633,516	6,384,669	7,229,185	8,140,861	9,123,189	10,180,163	11,316,109
<b>Total Equity</b>	<b>18,297,841</b>	<b>22,387,584</b>	<b>22,736,196</b>	<b>23,272,409</b>	<b>23,931,357</b>	<b>24,682,510</b>	<b>25,527,026</b>	<b>26,438,702</b>	<b>27,421,030</b>	<b>28,478,004</b>	<b>29,613,950</b>
<b>TOTAL CAPITAL AND LIABILITIES</b>	<b>18,297,841</b>	<b>24,902,532</b>	<b>25,390,941</b>	<b>26,073,258</b>	<b>26,886,961</b>	<b>27,802,091</b>	<b>28,820,416</b>	<b>29,916,391</b>	<b>31,094,217</b>	<b>32,358,649</b>	<b>33,203,049</b>

Calculations											SMEDA
Cash Flow Statement											
	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
<i>Operating activities</i>											
Net profit		4,089,743	4,786,969	5,510,782	6,292,464	7,135,823	8,073,701	9,052,537	10,105,517	11,237,138	12,452,054
Add: depreciation expense		1,282,800	1,282,800	1,282,800	1,282,800	1,282,800	1,282,800	1,282,800	1,282,800	1,282,800	1,282,800
amortization of pre-operating costs		44,400	44,400	44,400	44,400	44,400	-	-	-	-	-
Accounts receivable		(5,731,573)	(214,934)	(445,988)	(479,437)	(515,395)	(554,050)	(595,603)	(640,274)	(688,294)	(739,916)
Finished goods inventory		(1,577,515)	(29,634)	(99,597)	(106,476)	(113,888)	(121,876)	(130,491)	(139,786)	(149,821)	(160,658)
Equipment inventory	(43,116)	(7,437)	(6,296)	(7,081)	(7,962)	(8,954)	(10,069)	(11,324)	(12,734)	(14,320)	129,293
Raw material inventory	(2,291,975)	(234,927)	(259,007)	(285,556)	(314,825)	(347,095)	(382,672)	(421,896)	(465,140)	(512,817)	5,515,911
Pre-paid building rent	(50,000)	(5,000)	(5,500)	(6,050)	(6,655)	(7,321)	(8,053)	(8,858)	(9,744)	(10,718)	117,897
Advance insurance premium	(562,750)	56,275	56,275	56,275	56,275	56,275	56,275	56,275	56,275	56,275	56,275
Accounts payable		2,514,949	139,795	146,104	154,756	163,977	173,809	184,300	195,498	207,457	(291,545)
Cash provided by operations	(2,947,841)	431,714	5,794,867	6,196,090	6,915,338	7,690,622	8,509,866	9,407,740	10,372,412	11,407,700	18,362,111
<i>Financing activities</i>											
Issuance of shares	18,297,841	-	-	-	-	-	-	-	-	-	-
Cash provided by / (used for) financing activities	18,297,841	-	-	-	-	-	-	-	-	-	-
<i>Investing activities</i>											
Capital expenditure	(14,300,000)	-	-	-	-	-	-	-	-	-	-
Cash (used for) / provided by investing activities	(14,300,000)	-	-	-	-	-	-	-	-	-	-
<b>NET CASH</b>	<b>1,050,000</b>	<b>431,714</b>	<b>5,794,867</b>	<b>6,196,090</b>	<b>6,915,338</b>	<b>7,690,622</b>	<b>8,509,866</b>	<b>9,407,740</b>	<b>10,372,412</b>	<b>11,407,700</b>	<b>18,362,111</b>
Cash balance brought forward		1,050,000	1,481,714	2,838,225	4,059,746	5,341,568	6,647,521	7,928,202	9,195,080	10,444,304	11,671,841
Cash available for appropriation	1,050,000	1,481,714	7,276,581	9,034,315	10,975,084	13,032,190	15,157,387	17,335,941	19,567,493	21,852,004	30,033,952
Dividend		-	4,438,356	4,974,569	5,633,516	6,384,669	7,229,185	8,140,861	9,123,189	10,180,163	11,316,109
Cash balance	1,050,000	1,481,714	2,838,225	4,059,746	5,341,568	6,647,521	7,928,202	9,195,080	10,444,304	11,671,841	18,717,843
Cash carried forward	1,050,000	1,481,714	2,838,225	4,059,746	5,341,568	6,647,521	7,928,202	9,195,080	10,444,304	11,671,841	18,717,843