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Study of Non-Biodegradable Waste Problem, and Suggesting easy ReUse Solutions with Economical Consideration.

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Abstract*: *This project is not all about waste problrm rather on its solution. We are lining in the age of industrialization change in climate is aarming, resources are decreasing rapidly mass consumption is a problem, and at last height and area of waste dumpyard is increasing day by day. We the Engineers have to find practical solution. Traditional Recycling is not enough the Reuse method offers better implementation and also don't need special machinery, processing and energy. There are two major negative sides of plastic first, they are made from petroleum and second, after use they beome litter for the earth and environment. It may take 450-500 years to decompose naturally which is a huge problem. If present trends continue by 2050 our oceans will have more plastic than fish, as said by UN chief Antonio Guterres.

Here in this project work suggested by respected Dr. Himanshu Agrawal sir, we will try to find out some solution of bio non degradable waste. Whenever we discuss non biodegradable waste first thing comes in our mind is synthetic polymer which is plastic. People often use and throw these things after use they directly goes to dust bin then bigger dump box of area and then to the land fills or dumpyard. If it is not taken from there it may go and stuck to severages which will block them completely and water from severage stops flowing and comes out from it which creates peoblem for municipal bodies.

In the present era of year 2018 we have to make balance between 1.Sustainable Development, 2.Environment, 3.Industrialization, 4.Cleanliness (generally termed as Swachhata), 5.Economical solution to pollution and, 6.Jobs. in this project work we are suggesting some sort of Reusable ideas with engineering tips which can provide economical and easy solution to plastic waste. Aslo it can help to generate money and revenue from the zero cost waste. It's the duty of engineers to help society to the current problem by using all the technical knowledge which we absorb from our books.

Keywords*: *Plastic, PET, Stool, SSI, Table, Waste, Municial, Society, Revenue, Job Creation.

I. INTRODUCTION

"Engineers like to solve problems. If there are no problems handily available, they will create their own problems." -Scott Adams[1]
"Never try to solve all the problems at once — make them line up for you one-by-one. -Richard Sloma[2]

Plastic was first invented in 1907. Bakelite was the first fully synthetic thermoset made by chemist Leo Baekeland using phenol and formaldehyde. Later on during World War 1 (WW1) and WW2 demand of plastic fiber, products increased dramatically. Polystyrene (PS) was produced in 1930, Poly Vinyl Chloride (PVC) was produced in late 1920, Polyethylene was produced in 1933.[3] After era of world war industrialization started in whole world then demand of plastic increased naturally. Plastic was required in every sector ike packaging, bottling, furniture industry, home appliances, toys, carry bags, daily life stuffs etc. Further study attracted focus of world about the decomposition of plastic. Each and every day tones of plastic waste starts generating municipal corporations were severely affected by this. They started dumping these in the water resources like sea and river and the realized plastic donot gets immersed. Then further studies told that it may take 450-500 years to decompose. In last year 2018 during Summit on Worlf Environment Day this year's theme was "beat plastic pollution". This meet was held in New Delhi India, UN chief Antonio Guterres said "Our world is swamped by harmful plastic waste from remote islands to the Arctic, nowhere is unaffected. If present trends continue by 2050 our oceans will have more plastic than fish."He also invited countries to work on "Plstic Pact" which will be magnacarta for future. By the use of technology and Engineering this problem is created and now its our duty to solve this problem. We will try to Reuse, Reduce, Recycle the plastic and also try to find alternative. In this project we will discuss how major plastic waste which can be Reused in other forms at domestic level. Also further testing will be done on these products to calculate their expected life cycle, economics of our work which will justify the product to be usable or not. This project also offers economical suggestion to job creation at tiny level or we can say Small Scale Industry (SSI). Ehich is unorganized sector of india. They can generate revenue by

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making these Reusable products which will help them to earn money. Now it's the duty of Government and municipal corporations to provide them waste material in a organized manner, also help them to sell them, educate them and make market environment in the society. An educated society will always appreciate these kind of work which will make environment pleasant, safe and better. It can also be added to the syllabus of schools, kids will learn the things from school level, environment projects, seminar, competition will facilitate the speed of the propagation of awareness at smallest possible level.

II. POSSIBLE SOLUTIONS

Today's global economy depends on trade, including the import and export of scrap materials for recycling. When carried out in a responsible manner, this activity makes significant contributions toward achieving the goals of sustainable development. In recent years,but the quest for answers continues. It will take time to establisha national recycling infrastructure. In the meantime, we're committed to working with intitutions throughout the plastics and electronics supply chains to advance the responsible and cost-effective management of plastics. After studying many journals and going through websites author is suggesting some of the solutions for plastic waste problem and they are as follows

A. Recycle Reuse Of Tetra Pak

The layers that make up an aseptic carton – paper fibres, polymers and aluminium – can all be recycled using relatively simple techniques, and turned into new products, cutting the amount of waste sent to landfill and reducing demand for resources. We divide recycling solutions into three categories, depending on the materials to be recycled:

1) Fibre Recycling – the paper in our packages is used to produce pulp as material for new paper products;
2) Polyal Recycling – the polymer and aluminium in our packages are used, either together or separately, as material for new products; and
3) Full Carton Recycling – without separating the paper, plastic and aluminium, the whole package is used to produce material for new products.

B. Effective Swm System

C. It should include activities associated with generation, storage, collection transfer & transport, processing and disposal of solid waste, but in Indian context this six stage solid waste management systems are mostly reduced to three stages namely collection, transport and disposal. A variety of reasons from lack of infrastructure to available finance can be reasons for this cut short system of municipal solid waste management

D. Conversion To Fuel

Results of comparative analysis of waste to energy conversion chains using combustion, pyro-combustion and pyro-gasification applied to three different categories of heterogeneous solid waste. Experimental results from pyrolysis and gasification processing of waste were used in the assessment. The research focused on products physical-chemical properties quantification by experimental approach: primary analysis and elemental analysis.

Low temperature pyrolysis conducted at 400 ºC to 550 ºC and high temperature steam gasification at 900 ºC to 1100 ºC were used. The pyrolysis experiments revealed that minimum treatment period required for complete carbonization of waste is between 35 and 40 minutes. Based on experimental results and industrial operation units characteristics the electric power generation was estimated together with implementing solutions for energy recovery.

For products with water content over 40% but also high calorific value (dry basis) the first option could be the pyro-vapor-gasification combined with Diesel-gas engines. If product water content does not exceed 45% the direct combustion still remains the best solution. The pyro-combustion can present an alternative solution if waste generation is discontinuous.

For the heterogeneous solid waste with high energy content (22 to 25 MJ/kg) and low water content (under 45 %) the best energy efficient solution is the direct combustion.

The waste source particularities together with product thermal-physical-chemical properties, risk pollutants content and investment cost can shift the economic efficiency of the solution. These process may be dangerous also due to lack of knowledge of working procedure and may lead to severe level of pollution if special take care is not given to the system. Gujrat government has shut down some of the plastic pyrolysis plants due to pollution problem. So following government guidelines and controlling pollution is must whenever some one is installing this plant.

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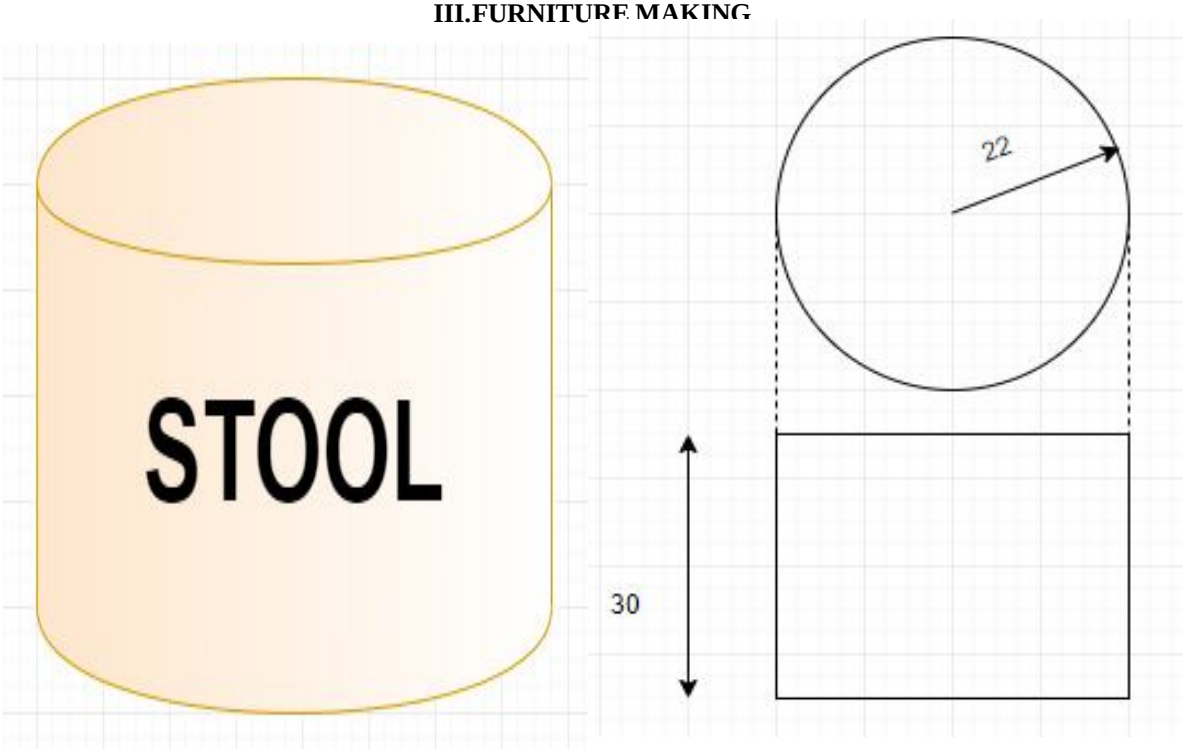
E. Furniture Making

It is possible to make some sort of Furnitures from wadte PET bottles.Detailed methodology and the analysis is shown in next chapter.

III.FURNITURE MAKING



A. Stool

1) Requirement: 19-20 PET waste bottles, Glue, Tape, Plywood sheet, Thermocol or cloth strips or cotton to make cushion, and printed cover for making outer portion.

2) Cost analysis of fabrication

Table 1 Cost Of Making Stool From Waste Bottle

S NO.	PART	QUANTITY	COST PER UNIT IN ₹	TOTAL COST IN ₹
1	PET waste Bottles	19 piece	1	19
2	Plywood	1520 cm^2	0.03027347 per cm^2	46
3	Glue(HEXON-800)Synthetic Rubber solution	200 ml	0.25 per ml	50
4	Tape	20 meters	0.50 per meter	10
5	Thermocol	5664 cm^2	0.00897021	50
6	Outer finishing	5664 cm^2	N/A	50 (depends upon personal choice)
TOTAL COST				225

3) Steps Of Making Stool From Waste Bottles:

STEP1- Collect as much bottles as you can and clean them, because they are used by many people for various purpose. Clean from outside and inside remove the rest liquid from inside portion, remove dust, wash them and then give proper time to get dry.

STEP2- Make proper choice with sizes.It is adviced that,Select same size bottle for one purpose.Arrange them as per design of product.

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STEP3- Connect all with help of “Brown Tape” starting from below till the middle of the bottle. Maintain proper tightness in this step.Too much tension may deteriorate the circular shape as well as the bottom leveling of bottles.Bottles located at coener may be lifted by excessive amount of tension.Too loose taping will also effect the trength of stool.
STEP4-Cut the plywood of the circular or the shape of lower portion of the bottle taped body.It is advised to use plywood sheet of thickness more than 10mm.For better strength reliability and results.
STEP5-Apply glue or the binding solution to the lower side of the bottle.And fix the plywood sheet.Put some weight upon it and give 48 hours to get dry properly.
fSTEP6-take measurement of top and side surface area of stool (geometrically cylinder). To apply thermocol sheet or foam to give a proper shape.It also offers “CUSHION” effect to the top surface.We can use variety of the Foam,cotton strips of cloath,wool to make cushion.So one can use anything depending upon availability and the budget.
STEP7-apply glue to the top surface as well as side surface and then wrap the thermocol or the foam. Then use tape to wrap thermocol or foam agin.it will help to fix with glue and strengthen the shape.Give atleast 24-36 hour again to fix this.
STEP8-Apply the colourfull 3D plastic cover,cloth cover etc to this as per choice.And the stool is fully ready to use.
(Steps are demonstrated in pictures below)
Its important to tell that, cost PET of bottles was considered 1 rupee. Becasuse restaurant owners and hotel management often sell their waste plastic to waste collectors by weight. This roughly gives us 1 rupee per bottle cost. Generally water bottle of 1 liter is sold at 15-20 rupee. After use the person can easily sell this back that bottle at 1 rupee. Cold drink bottles will offer much better strength to the product which we are making. The other costs of thermocol and plywood was calculated by dividing their cost of one full sheet to the area of that sheet. And the price of glue solution per milliliter was calculated by dividing cost to the 1000, because one retail box was containing 1000 ml of solutions. These calculations and rates may differ place by place and as per retailer. These prices may decrease 15-20% or more whenever mass production will be done.

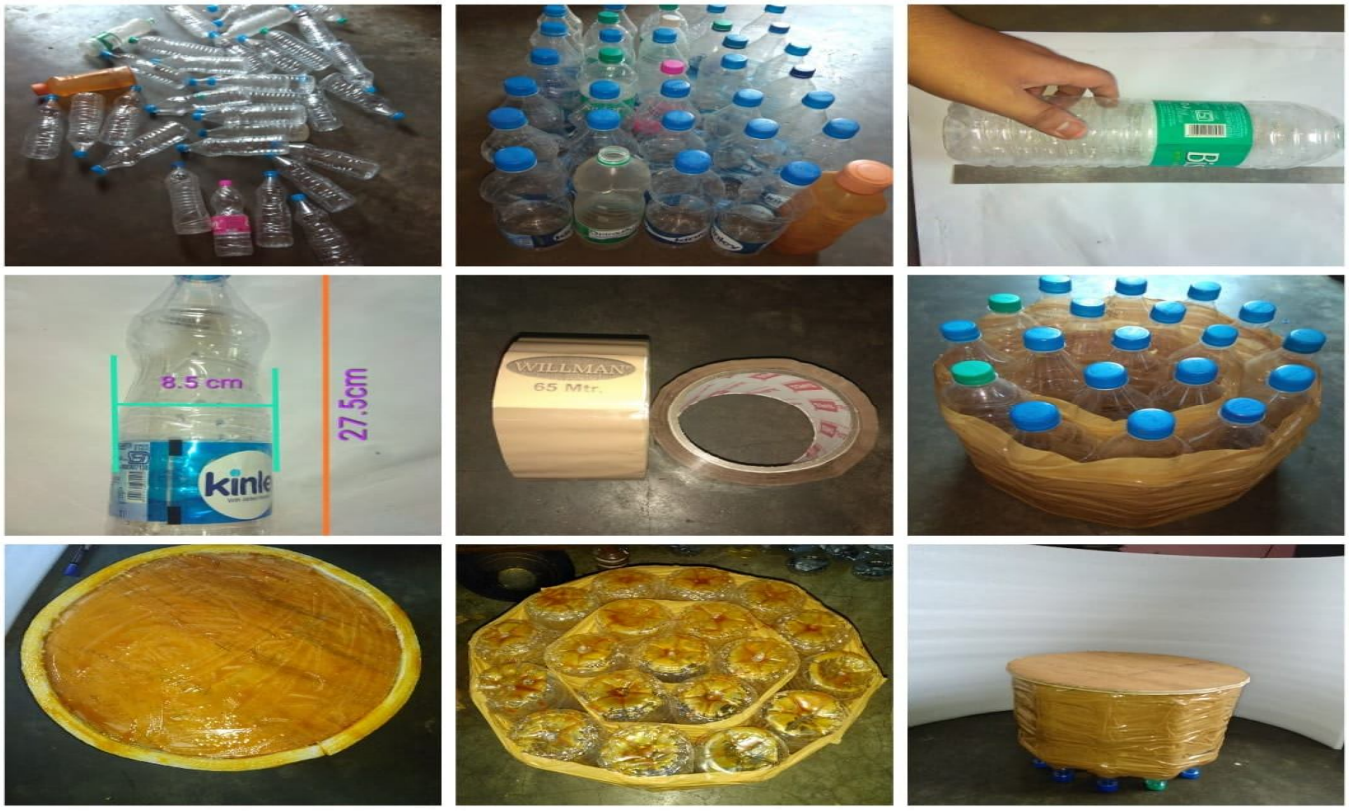

Fig. 1: Starting steps from collectiong bottles, arranging them, selectiong same type for one purpose, tapping, adding plywood circular head on the top portion with help of synthetic rubber solution HEXON-800 Glue.

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Fig. 2: Adding thermocol to side surface of stool which will provide strength and exact shape to the body, adding tape so that glue may work properly, and in final step covering with cloth or other plastic painting as per availability.

IV. TABLE

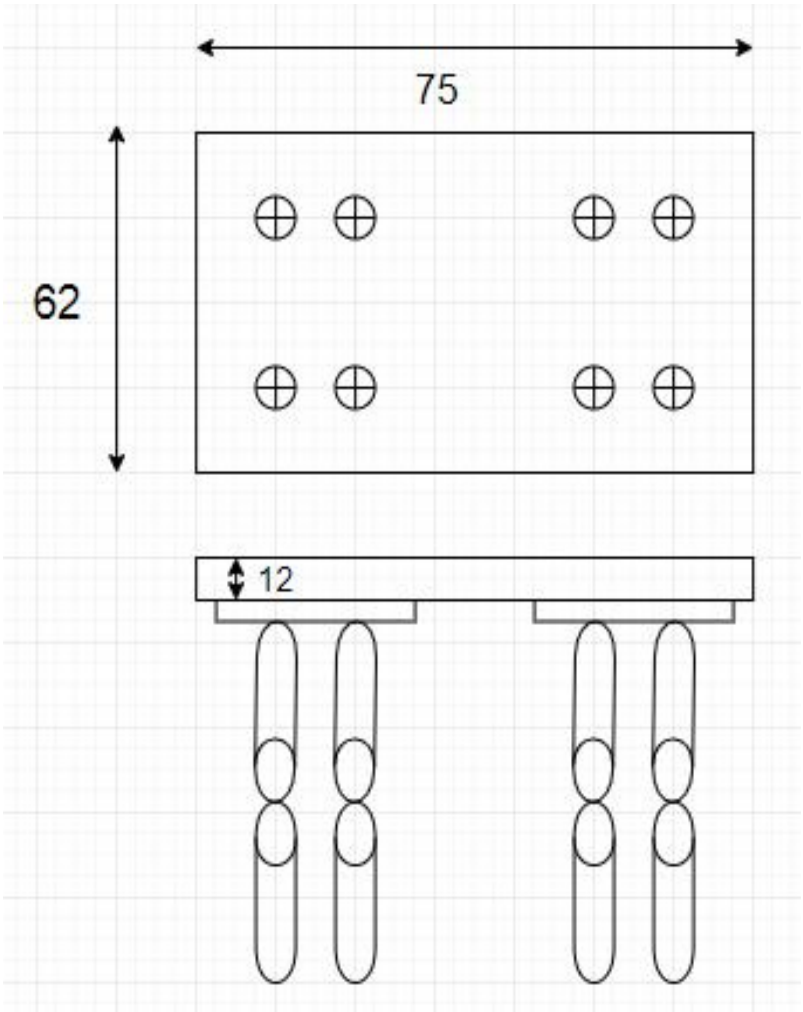

Fig. 3: Layout of Table made from waste PET bottles. All dimensions in mm

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A. Requirement: 32 PET waste bottles,Glue,Tape,Plywood sheet, Sunmica

B. Cost Of Making

Table 2 Cost Of Making Table From Waste Bottle

S NO.	PART	QUANTITY	COST PER UNIT IN ₹	TOTAL COST IN ₹
1	PET waste Bottles	32 piece	1	32
2	Plywood(Top+4 Plates)	(4650+3456)=8106 cm^2	0.03027347 per cm^2	245
3	Glue(HEXON-800)Synthetic Rubber solution	400 ml	0.25 per ml	100
4	Tape	40 meters	0.50 per meter	20
5	Plastic table cover	4650 cm^2	0.011039964 ₹ per cm^2	52
6	Thermocol top cover(Non Flexible Cheaper one used)	4650 cm^2	40 per sheet	40 (depends upon personal choice)
7	Pipe to connect Bottles	160 cm	0.1 per cm	16
8	Nuts,Bolts and Washer	350 gm(8 set)	0.1 per gm	35
TOTAL COST				540

C. Steps Of Making Stool From Waste Bottles

STEP1- Collect as much bottles as you can and clean them, because they are used by many people for various purpose. Clean from outside and inside remove the rest liquid from inside portion, remove dust, wash them and then give proper time to get dry.

STEP2- Make proper choice with sizes.It is adviced that,Select same size bottle for one purpose.Arrange them as per design of product.

STEP3: Connect two bottles with the help of PVC pipe and glue. For this purpose we have to reomove cap of the bottle and properly apply glue at inside portion of bottle at top also apply glue on pipe (approx. 10 cm length) and gently insert its half portion in both bottles. And let it rest for 48 hours. After this time interval they will be fixed.

STEP4: Make upper top portion of table as desired length and width, now make 4 plates of size roughly 24x36 cm. This size is calculated on the basis of 4 bottles putting in a square shape of 2x2. And extra ortion to drill and margin in all direction.

STEP5: Drill on plates and the upper portion of the table. 2 drills on each plate and same on top. We will need to fasten these 4 plates with top portion with help of the nut bolt and washer assembly. Here we used 8 sets.

STEP6: Now connect 2x2 sqauare bottle sets to each plate with help of glue and let it free for 72 hours. More time is required because this portion is going to face maximum amount of the load under working conditions.

STEP7: Now connect all 4 Plate-Bottle assembly to the top portion of table.using nuts and bolts.

STEP8: For finishing purpose we will apply one layer of non flexible Thermocol (generally available at stationary stores) on the top of table withglue or fevicol to smooth surface from “nut heads’. And apply one plastic cover on the top. Let the glue to work and let it on rest for 6-8 hour. Now the work is complete and table is ready.

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Fig. 4: Step by step making of Table from waste bottle.

V. ECONOMICAL ANALYSIS OF THIS PROJECT IDEA

There is a great demand for handicraft goods in foreign countries.Our project can help SSI for sure. As shown in flow chart below instead of going direct to dumpyard the plastic waste generates money, uses manpower and work at each value added step. This can generate big SSI opportunity in metro cities like DELHI, MUMBAI, KOLKATA, BANGLORE etc. where daily output of plastic waste is too high and constant. SSI can be setup there. Which will run on daily basis. Input raw material flow will be constant and the finishing designing will be great. Which will help unemployed, unskilled people to earn money, betterment of their life. And will effect working of Municipal corporations too. Environmental impacts are not required to mention again.[4]

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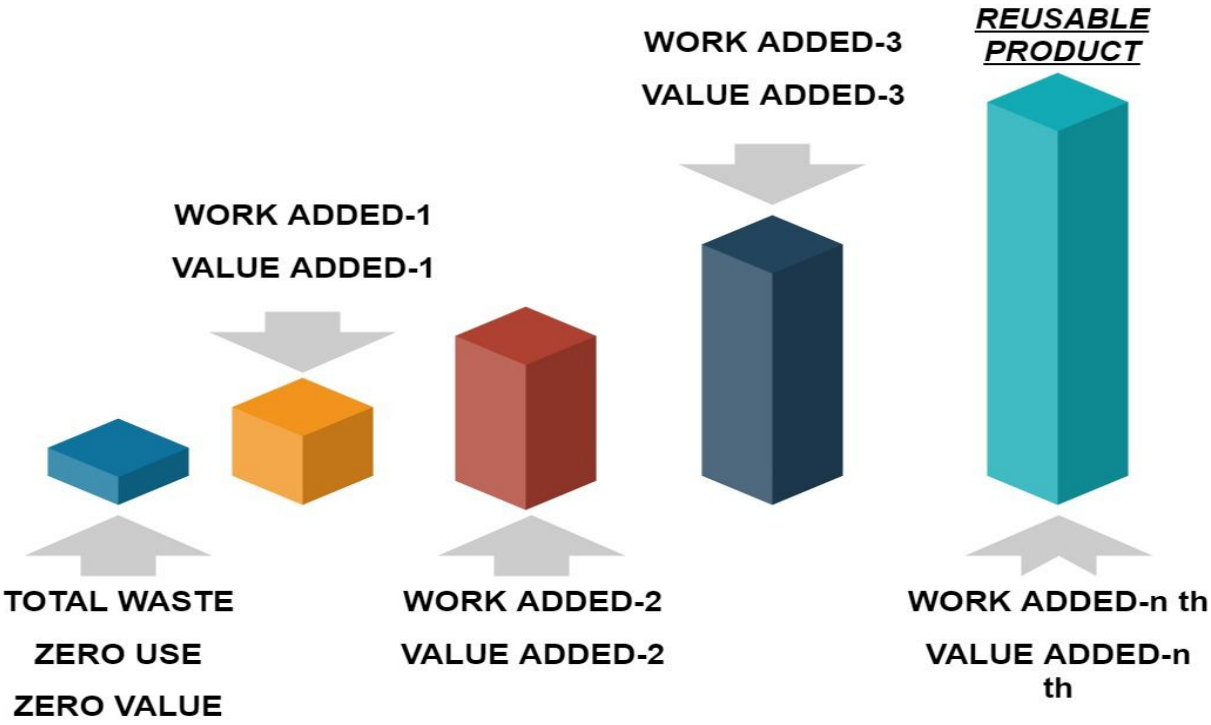

Fig. 5: Showing value and work adding in each step from complete waste till usable product.

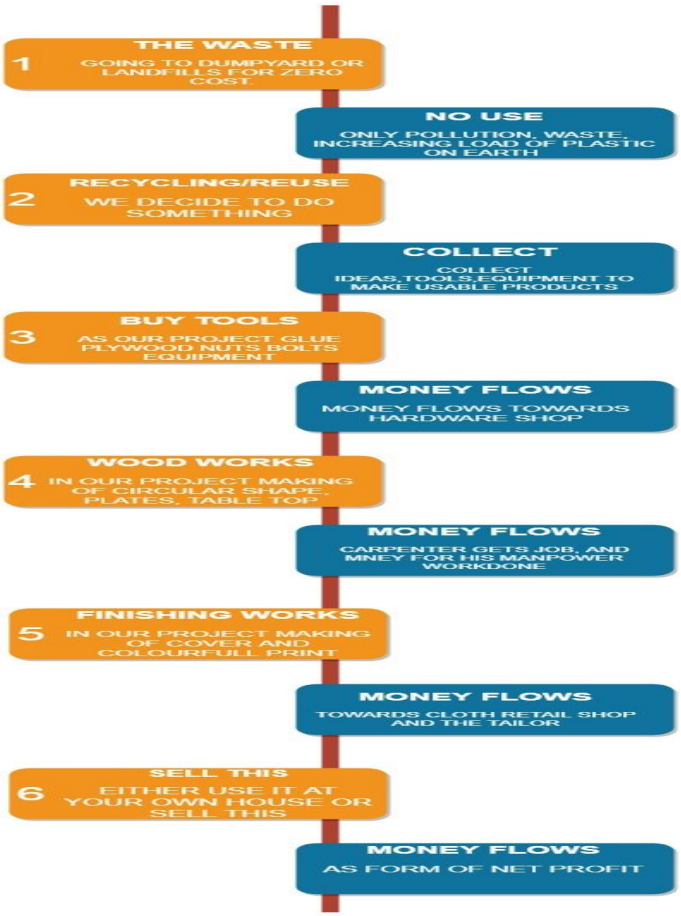

Fig. 7: Step (Orange Colour) and Money generation (Blue Colour) analysis; From zero value waste to usable product.

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VI. CONCLUSIONS

This needs further research, testing, and better designing to improve stability strength and material used. When mass production will take place cost will decrease by 15-20% approximately. Still we made Stool-1 from 19 waste bottles, an other Stool-2 from 14 waste oil bottles and Table from 32 waste bottles (Fig. 6). From total of 65 bottles. Means we saved 32 bottles from going to severage or Land-Fills. If these products will give us 1.5 to 2 year of working life it simply means we are stopping huge amount of plastic going towards Landfills, or oceans, which will provide some time to our scientists and international research organizations to find better Recycle methodology as well as our Government to setup mechanism and awareness environment for this work. This is also going to create a opportunity to start a Small Scall Industry (SSI) with very minimal investment and skills to make these types of usable products from waste, which will generate revenue also from the waste having zero cost at dustbin standing at corner of the road. With lots of possibilities around and ahed I am submitting this project with a new sort of idea and creativity to sustainable development of our society.

Fig. 6: 2 Stools and Table.

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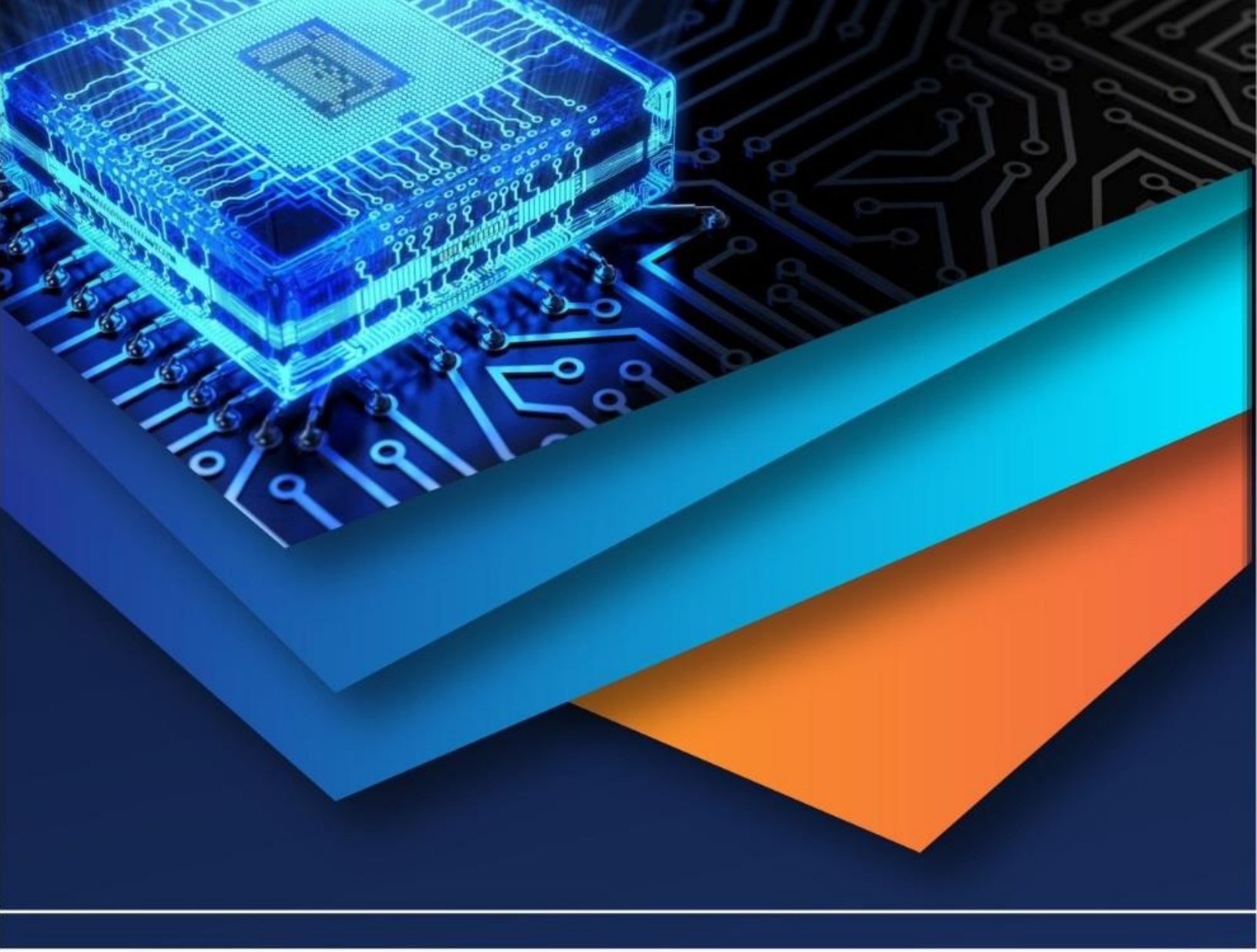

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