

## **The role of innovative technologies in the use of alternative environmental materials for the production of interior and industrial design elements**

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### **Abstract:**

No one can deny the great role that technology has played in our lives, the solutions it has given us to many of our problems, the comfort and well-being in all areas of life that it has given us and were not available to previous generations, but on the other hand, technology has caused great damage to humans and to environment. It is therefore necessary for human being to reach a balance between benefits of technology and the damages it brings to it, so that in the end it can achieve the maximum benefit possible with the minimum amount of losses. Therefore, the role of the intellectual trends of the to work on achieving this balance and enables the designer to use all technological potentials with minimal damage to the environment. The idea of the research can be summarized in innovative means that use high technology to adapt alternative environmental materials to produce interior and industrial design elements. The problem of the research is that there is no clear mechanism for the use of high technology to adapt environmentally friendly alternative materials in the production of interior and industrial design elements. The research aimed to identify the modern intellectual trends in design that help to adapt high technology to serve the environment by focus on the role of technology in reviving the use of environmentally friendly materials for the production of internal and industrial design elements and to high light the effect of integrating the newly developed technology with the green design on the production of internal and industrial design elements. To achieve this objective, the research used the inductive methodology of means of Modern technology in the fields of interior and industrial design, and how to employ them to support environmental, alternative raw materials, and then the deductive approach to reach the methodology for the integration of the technological means and environment-friendly intellectual trends. The results of the research are the possibility of adapting the newly developed technology to serve environmental and ecological purposes, and that alternative environmentally friendly raw materials can compete strongly with other industrial raw materials to produce elements of interior and industrial design.

### **Keywords:**

Technology - Intellectual trends in design - alternative Interior and industrial design materials – ecology - green design.

**Introduction:**

Technology is a process used for accessing innovative ways to help human to accomplish tasks quickly and less costly, technology has affected human life with both positive and negative ways, and it was necessary for man to work on achieving a balance between the benefits provided by technology and the damages it causes. So the role of intellectual trends of design comes to work to achieve this balance and enable the designer to use all technological possibilities with the least damage to the environment such as green design and Sustainable design which aim to preserving the environment and minimizing the negative impacts on the environment through the use of environmentally friendly, non-toxic, recyclable materials that require little energy during the manufacturing process. One of the most important principles of Sustainable design is reuse or recycling, and the selection of materials from renewable sources (14) In addition to ecological efficiency (from cradle to cradle), it is based on the principle of the closed life cycle in the natural from and this is by focusing on the role of technology in revitalizing the use of environmentally friendly materials to produce elements of interior and industrial design where the material is the means of expression for artistic and functional production, which are indispensable to transform the idea of design into reality, and nature is the main source of raw materials and non-industrial raw materials. Hence the idea of the research, which summarized in accessing new means that use high technology to adapt environmental raw materials to produce elements of interior and industrial design through the process of recycling local materials to manufacture alternative materials which can be used in the implementation and finishing models of design ideas or re-use again and used in the design of other products taking into account not to harm the environment as a fundamental principle of sustainable design that takes into account the environmental dimension.

**Research problem:**

Lack of a clear mechanism for the use of high technology to adapt environmentally friendly alternative materials in the production of elements of interior and industrial design.

**Research importance:**

The importance of the research is to focus on the importance of the study of modern intellectual trends in design and access to modern means using high technology to adapt alternative environmental materials to produce elements of interior and industrial design

**Research aims:**

1. Identify modern intellectual trends in design that help to adapt high technology to serve the environment.
2. Focus on the role of technology in the revival of the use of environmentally friendly materials to produce elements of interior and industrial design.
3. Focus on the impact of the integration of new technology and intellectual trends in design on the production of elements of interior and industrial design.

**Research hypotheses:**

1. The developed technology can be adapted for environmental and ecological purposes.
2. Environmentally friendly alternative materials can compete with other industrial materials to produce interior and industrial design elements.

**Research Methodology:**

The inductive approach of modern technological means in the fields of interior and industrial design, and how to employ them to support alternative environmental raw materials, and then deductive approach to reach a methodology for the integration of technological means and friendly environment intellectual trends.

**Intellectual trends in design:**

Intellectual trends in design aim to preserve the environment such as; Green design, which is characterized by environmental considerations by reducing the negative effects on the environment during the product life cycle; Ecological design, which refers to products that take into account ecological factors and reduce the negative effects on human health and is concerned with the appropriate choice of environmentally friendly materials (4) and Sustainable design, which aims to preserve the environment and reduce the negative impacts on it through the use of environmentally friendly materials, non-toxic, can be recycled and require little energy during the manufacturing process, and the most important principles is reuse or recycling, the selection of materials from renewable sources 14. In addition to ecological efficiency (from cradle to cradle), it is based on the principle of a closed life cycle in nature, through that products should be designed not to end as wastes, they end up as food for other products (9).

**Alternative interior and industrial design materials****Triple Design (Material - Idea - Technology):**

The material is the first side of the design triangle, where the designer is based at the beginning of the development of his design idea to choose the right material for the design that serves his idea and get the design to the desired goal, the aim of this study is to achieve the integration of the three sides of the triangle so that the technology serves he design in its broad concept to use the material in the best of its features, taking into account not to damage the environment as a fundamental principle of sustainable design takes into account the environmental dimension and takes care of it. The research focuses on the intellectual trends that add an environmental dimension to the design product through the material, the following is a presentation: Some of these intellectual trends that can achieve this goal:

**First: Material:****1- Using the outputs of carpentry workshops:**

It is known that the woodworking workshops produce lots of wood residues and waste that unfortunately is wasted without the best use of them, where large factories are working to sell them to recycling plants, which chop them and inserted in some of the manufactured wood panels. In the small workshops, size of the output does not allow this step, unfortunately, these outputs are sold to incinerators and burners where they are burned and used as

alternative fuel, which represents a waste of raw materials and damage to the environment due to the exhaust that results from burning them. so designers must find a systematic work mechanism to benefit from these products and their re-operation to produce useful furniture or other products that help to provide environmental materials that are environmentally friendly and used in the implementation of design ideas models. These products are obtained through **various technological methods, including:**

• **Glue technology:**

Where the use of glue material with standard specifications and the use of lathes and mechanical planers to produce non-traditional furniture as shown in Figure (1) and (2 /a, b) Where some of the defective lathes were used, which did not come out according to the standard specifications required for the main product due to a technical error in the lathe machine, which makes the piece of wood unfit for the original product. The alternative solution was to use these pieces together with some glue to produce an unconventional table that could be sold as a useful product instead of chopping wood or using as it fuels, or producing different forms of chairs. Thus, the modern glue and mechanization technology used in the production of furniture helped a lot in the emergence of these patterns.



Figure (1) shows the use of some defective lath pieces in the production of an unconventional table

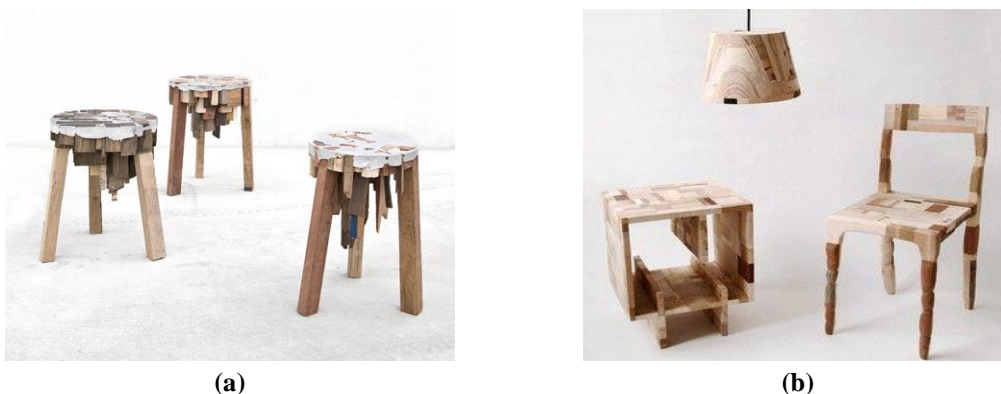


Figure (2 / a, b) shows the use of some defective lath pieces in the production of various furniture pieces

• **Chopping technology:**

Where the waste of factories and workshops of all types of wood is used and recycled again to make models and blocks of wooden foam-like as shown in Figure (3) can be used to form and implement design models through a production line that goes through several stages where the wood is sorted according to the classification of wood waste and then They are processed in the cutting machine where these huge wooden parts are cut into small homogeneous pieces and then comes the stage of separation of undesirable nails and metal parts, then cut these pieces into smaller pieces, then the stage of milling to obtain homogeneous granules, then the

stage of agglomeration and pressing to a Wooden blocks can then be used in the formation of design ideas or products used as components of models.



Figure (3) shows the recycling of wood waste to produce wooden blocks suitable for models of design ideas

## 2- Employing products previously used in the manufacture of household products:

The idea of reuse ensures that the product is given another chance to have a beneficial role before it is destroyed or recycled. This is one of the most important trends that serve **the environment for the following reasons:**

- Give a new opportunity to an existing product to be used.
- Reduce the production processes of a new product (which might be harmful to the environment).
- Postponing recycling operations to a later stage.

The technology used here is the technology of cutting and unloading products with digital control machines and 3D printing technology as shown in Figure (4 / a, b).



(a)



(b)

Figure (4 / a, b) shows the employment of other products in the production of chairs, tables and home storage units

Where plastic and metal containers are used for products and re-operating as benches, tables and home storage units, allowing these products to serve another purpose for a new period of time before thinking about recycling, which necessarily necessitates production processes that have an impact on the environment. These products are based on thermoplastic, and plastic cutting technology with 3D printing legs. Figure (5) shows the conversion of a shopping trolley after the end of its useful life to three useful household products (seat, lighting unit and storage unit with table) so that the metal parts of the cart were adapted to fit the dimensions of the required pieces of furniture using a metal plinth and a metal segment guided by a computer (1).



Figure (5) shows the conversion of a shopping cart useful life to three useful household products

### 3 - Use of paper products to form and produce products and design models:

#### • Formation of waste paper:

The paper material is characterized by high flexibility in recycling, formation and use, and it has the advantages of relatively cheap price, environmentally friendly material, light weight, multiple images that exist on it. Therefore, the operation of this material in the production of useful furniture is a good mean for environmental protection and a distinctive model of sustainable design. The technology used here is the CAD and CAM technology, where the formation of the configurations are spatially using a computer then cutting and slitting paper according to these designs and then assembled to give the required shape as shown in Figure (6 / a, b) where more than one of the forms of paper in Manufacture of furniture pieces are light weight, cheap and modern design. The operation of paper in this way gives the piece of furniture durability and ability to bear weights as a result of vertical assembly method used in the design.



(a)



(b)

Figure (6 / a, b) shows the use of paper in the manufacture of furniture pieces

Figure (7) also shows the use of cardboard in the manufacture of models of furniture pieces of various dimensions, purposes and colors, these pieces are very economical as the price is suitable for their useful life and they are very easy to recycle (11).





Figure (7) shows the use of cardboard in the manufacture of models of furniture pieces of various dimensions, purposes and colors

#### • Recycling of waste paper:

Some local raw materials can be recycled, such as waste paper and cardboard (magazines, newspapers, etc.) to manufacture cardboard paper, which is used in the work of design ideas, models are basic techniques in the presentation of design ideas. The techniques of design models vary from simple prototypes where simple materials such as paper, etc. can be used as shown in Figure (8) to rapid prototyping techniques.



Figure (8) shows examples of paper design ideas

Through the use of modern technological methods waste paper and cardboard (magazines, newspapers, etc.) can be recycled for the manufacture of cardboard paper as shown in Figure (9), which is used in the work of design ideas models as shown in Figure (10 / a, b, c) where The waste is collected from institutions, clubs, etc. The sorting process is considered the most important stage in the recycling of paper, to get a good quality of paper, then the stage of cutting into thin and homogeneous slices by cutting machine, and the paper is immersed in water basins and then mixed Paper cut by the mixing device to obtain the desired dough and the paper is formed in different ways Then the drying stage.



Figure (9) shows the cardboard boards

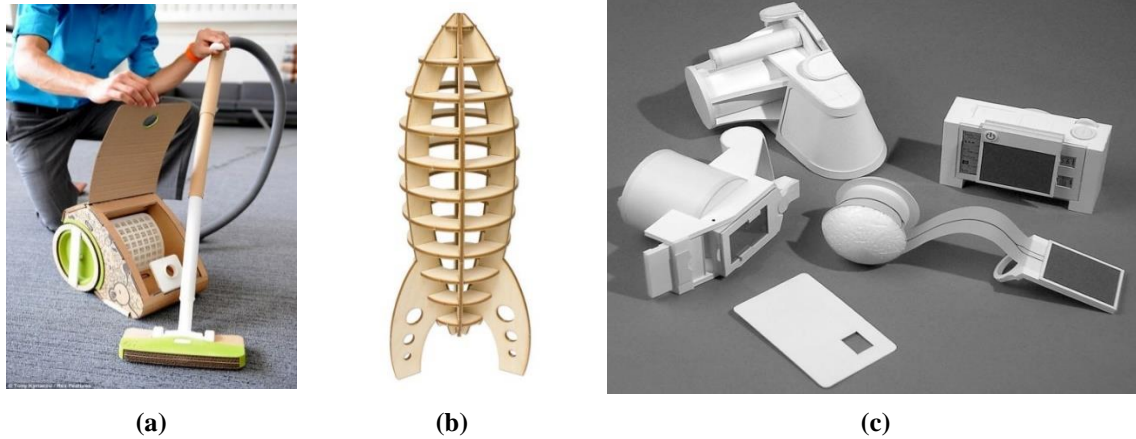


Figure (10 / a, b, c) show the design ideas of cardboard material (18,17)

- **Recycling of plastic products:**

Waste plastic products can be recycled such as plastic bottles to obtain a material that can be used as a construction material in 3D printing machines such as PET (polyethylene terephthalate) as shown in Figure (11).



Figure (11) shows the threads of polyethylene terephthalate (PET)

It is a material used to make plastic bottles, and polyethylene terephthalate yarns are colorless transparent crystals when heated or cooled, the degree of transparency changes and when these filaments are cooled slowly for use in 3d printing machines, they have a more crystalline structure. The advantage of this material is that they withstand shocks and are used in lightweight models. The design idea is transformed into a three-dimensional physical model of this technique by drawing the proposed design idea using one of the CAD programs, and then convert it to STL format (13) where the 3D printer receives commands that allow it to convert the digital file with its data. Three-dimensional layers, which will be formed using different materials, which may be in the form of liquid or solid or in the form of powder with very small granules or in the form of flakes or strips of very small thickness may reach less than 100 microns of metal or plastic or wax, glass or other synthetic materials. (19) However, it can print any stereoscopic provided that the stereo is not larger than the size of the printer. (6) (16) The most important raw materials used in the implementation of models using three-dimensional printing technology ceramic, plastic, wax and metals (8) as shown in Figure (12)



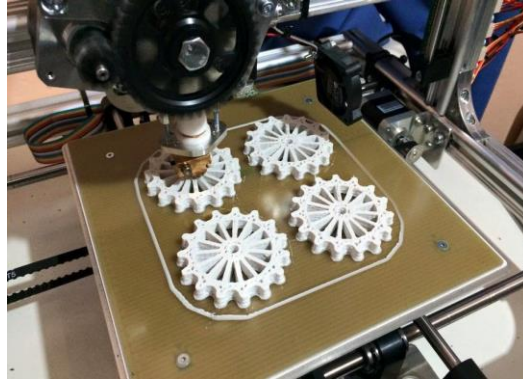


Figure (12) shows the implementation of models using three-dimensional technology (15)

Plastic waste can be collected from toys, utensils, etc., then grinded and converted into dough using resins and then reconstituted in the form of slabs or pieces of useful furniture as shown in Figure (13 / a / b). This method is considered one of the least polluting and the cheapest way to reuse plastic. The resulting furniture is lightweight, cheap and more suitable for light furniture style (1).



(a)



(b)

Figure (13 / a / b) shows models of furniture manufactured with the technique of grinding toys and reshaping the dough from them.

## Second: Production Methods:

### • Design based on one design unit:

The structural method of design depends mainly on one unit and fixed dimensions is a method of production in the provision of material as shown in Figure (14) where it shows the production of models of furniture based on a single design unit repeated in different shapes and structures to give infinite design alternatives and this method is a saving method for material and manufacturing. The quantitative production of a module is one of the methods of production provided in the material and in the manufacturing processes and accordingly this method is ideal for achieving economic and environmental feasibility of using the material, and the quantitative production mode depends largely on CNC-oriented mechanization. (7).



Figure (14 / A, B) shows models of furniture that depend on a single design unit repeated in different shapes and structures

#### • Inspired by Origami Design:

Origami's idea is basically to create space configurations using complex geometric relationships. The idea began with paper, and with the advent of CAD technology (computer drawing) it became easy to prepare these spatial configurations and then remodel on many materials to produce products inspired by the art of origami as shown in Figure (15) This trend is environmentally friendly because:

1. Helps to operate the material without waste in the panels.
2. They use CNC techniques in cutting, slitting, drawing and unloading which helps to provide assembly units.
3. Works on many environmentally friendly materials such as cardboard, wood and fiber.



(a)



(b)

Figure (15) shows models inspired by Origami art

#### • Assembly of product units without assembly units or glue:

The use of metal or plastic assembly units or industrial glue are all things that require additional manufacturing processes cause damage to the environment, the use of wood seams is the best choice for the preservation of the environment, the advent of advanced technology has helped to produce unconventional wood seams as follows:

- Digital control technology helped in cutting, shaping and drilling the material with the utmost precision, which leads to the suitability of the seams as shown in Figure (16).
- Stereoscopic printing technology allowed the printing of composite models of welds that are difficult to form in the materials through drilling (7) as shown in Figure (17).



Figure (16) shows the formation of wooden pieces using digital control technology, which ensures the accuracy of the installation



Figure (17) shows a leg formed in three-dimensional printing to enter a stable in place very accurately with ease of disassembly when needed

• Surface Furniture:

This type of furniture is ideal in terms of preserving the material and not wasting it and thus preserving the environment, the production line technology has contributed in the development of this trend and highlighted its importance in the production of a simple type of furniture which is cheap, easy to disassemble, easy installation, storage and transport (7) as shown in Figure (18 / a, b).



(a)



(b)

Figure (18 / a, b) Shows some models of Surface Furniture.

**Research results:**

**The by analyzing the previous studies, the following conclusions can be reached:**

1. There are new methods that harness high technology to adapt alternative environmental materials to produce elements of interior and industrial design.
2. The possibility of adapting the new technology to serve environmental and ecological purposes.
3. Environmentally friendly alternative materials can compete strongly with other industrial materials to produce interior and industrial design elements.
4. Modern technology can be used to operate natural materials in various ways and systematic production processes.
5. Some of the consumed local materials can be adapted and recycled to be used in the manufacture of materials that can be used to make design models again.
6. There is no limit to innovation in the production of composite materials that combine natural and synthetic materials in a single product.
7. Digital control technology has a great role in the operation of natural materials to produce modern products.
8. 3D printing contributes to the production of products combining natural and industrial materials.
9. Modern production methods can contribute to the non-waste of material and facilitate the process of manufacturing it.

**Recommendations:**

1. Establishing an entity affiliated to the Ministry of Commerce and Industry specialized in environmentally friendly raw materials to spread this culture among the masses of manufacturers and consumers.
2. Work on the establishment of an Egyptian code for environmentally friendly materials to be circulated to the employers of industries.
3. The need to legislate a law criminalizing the use of raw materials harmful to the environment and impose a ban on their use.

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