

Achieving Sustainability Standards in Designing Products and Interior Design Supplements according to Artistic Movements Principles

Haitham Ibrahim El-Hadidy

Assistant Professor and Head of Industrial Design Dep. – Faculty of Applied Arts-Damietta University, dr.haithamelhadidy@gmail.com.

Sara Osama

Demonstrator at Industrial Design Department, Faculty of Applied Arts, Damietta University, Egypt, saraosama839@du.edu.eg.

Sara Fathy

Professor at Interior Design and Furniture Department, Faculty of Applied Arts, Damietta University, sarahfathyfahmy@du.edu.eg

Ahmed M. Zayed

Associate Professor at Industrial Design Department, Faculty of Applied Arts, Damietta University, Egypt, ahmedzayed@du.edu.eg

Abstract:

Sustainability is one of the most important prerequisites for product designers to achieve when designing industrial products to minimize the negative impact on the environment and technical schools vary in their respective criteria, which means that each school's achievement of the principles of sustainability varies. The problem is that some designers focus on achieving some of the technical school's criteria without the rest that can serve as sustainability factors followed by that school, this results in a design that achieves some of the school's principles and does not conform to the current requirements of product design. The importance of research is to describe the types of technical schools and how they apply the principles of sustainability, thus contributing to the achievement of sustainability standards in the design of products designed according to the technical school approach. The research aims to identify the most important sustainability principles that lie in technical school standards, helping product designers to choose technical schools according to their degree of application of sustainability principle. The research examined the types of technical schools, their characteristics, the definition of sustainability, their importance, and the most important sustainability criteria achieved in technical school products. The research identified the principles of sustainability inherent in the different trends of technical schools, and one of the modern products was developed according to the sustainability criteria derived from the school's technical thinking.

Keywords:

Sustainability, Sustainability Principles, Product Design, Technical Movement.

Paper received May 02, 2024, Accepted July 06, 2024, Published on line September 1, 2024

Introduction:

The relationship between human beings and the environment is interchangeable, always influenced and influenced by it. And everything that man does affects it both negatively and positively. and given that the product designer is the fundamental pillar for innovation and increased convenience and utility, it had to take the environment into account when designing the product, starting from developing the design idea through the selection of materials, manufacturing processes, etc. For the end-of-life of a product, sustainability is one of the most important considerations a designer must follow when designing its products. In addition to its interest in creativity in shaping the appearance of the product, where the consumer is first influenced by the aesthetic appearance of the product, the need has arisen to see and study technical schools, to expand his perception and the

circle of his artistic culture. When looking at the criteria of some technical schools, we note that many of them have embraced the thought of sustainability in designing their products, making it easier for the designer when following the foundations of a school to design sustainable aesthetic products.

Problem Statement:

Some designers focus on achieving some technical school standards without the rest that can serve as sustainability factors followed by that school, resulting in a design that achieves some of the school's principles and is not in conformity with the current requirements of sustainable product design. The research problem is to answer a question: how can modern, sophisticated, and sustainable products be designed according to the concepts of different technical schools?

Aims and objectives:

The research aims to:

- 1- Identify the most important principles of sustainability that lie in the standards of technical schools, helping product designers to choose technical schools according to their degree of application of sustainability principles.
- 2- Study the concept of sustainable design, and sustainability strategies in industrial product design.

Research Importance:

- 1- Explaining the types of technical schools and how they apply the principles of sustainability, thus contributing to the achievement of sustainability standards in the design of their products.
- 2- Raising awareness of the intellectual aspect of industrial designers of the existence of the idea of sustainability in the foundations and standards of technical schools.

Hypothesis and Methodologies:

- 1- If it is possible to identify the standards and principles of sustainability that were followed during some technical schools, this will help the product designer to create modern, advanced products that bear the hallmarks of the technical school and achieve the principles of sustainability.
- 2- The study has adopted the Descriptive analytical method for studying the problem and achieving research hypotheses.

Research Limits:

A study of some technical schools that adopt the idea of sustainability in their standards.

2. Paper Structure:**1- First: Sustainability:****2- Definition of sustainability:**

The concept of sustainability emerged in the international development literature in the mid-1980s under the influence of new concerns for environmental conservation and because of concerns raised by the famous studies and reports of the Rome Club in the 1970s about the need to conserve depleted natural resources, the environment, and fundamental balances in ecosystems (Eco system). An international organization that brings together scientists, businessmen, and politicians, the organization's main objective is to define and develop the vital

issues facing humanity and to identify measures that can help achieve global balance.

The use of the concept has been widespread due to the recurrence of environmentally harmful events and high global pollution. (Hasson 2015). The concept of sustainability was first introduced in the field of ecology to describe "the ability of the environment to maintain a continuous flow of any part of the system that needs healthy practice". (Madge,1997) Sustainability as defined by UNEP is to meet people's daily needs, without destroying the resources required by them in the future, by adopting long-term planning. The phrase "sustainable development" means a pattern of development that does not overinvest or subvert the natural sources of wealth on which such development is based.

Sustainability in terms of human development or sustainable development is "a concept that recognizes that human civilization is an integral part of the natural world, and that nature must be preserved and sustained if human society is to survive". Policymakers have begun to expect that the current industrial system may not be sustainable if combined with unlimited growth in unlimited waste production, resource dependence, and energy use, leading to the establishment of the World Commission on Environment and Development by the United Nations in 1983. (Colby 2011 Thus, the concept of sustainable development does not have a single meaning or definition, and it was agreed that the state of sustainable development:

- 1- The benefit is not contradicted over time.
- 2- Consumption is not contradictory over time.
- 3- In which resources are managed to preserve production opportunities for the future.
- 4- Natural capital storage is not contradicted over time.
- 5- Resources are managed to maintain sustainable production of resource services.
- 6- The minimum conditions for the ecosystem's stability and regression are satisfied or achieved.

According to the United Nations Educational, Scientific and Cultural Organization (UNESCO), sustainable development lies in each generation's enjoyment of natural resources and leaves them as pure and unpolluted as they came to Earth. (Hasson 2015).

3- Sustainable development goals:

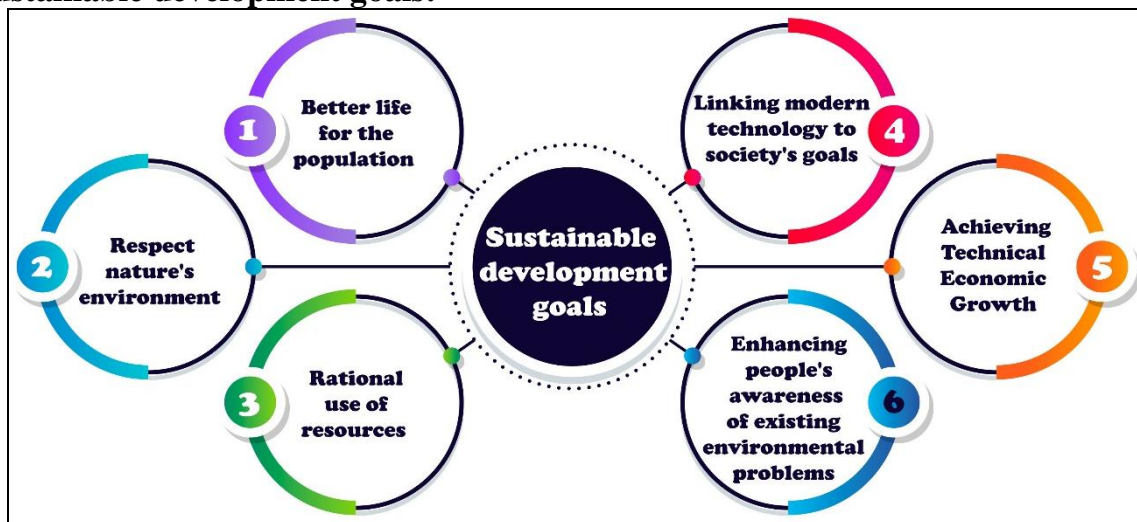


Fig 1, "Sustainable development goals"

4- Principles of sustainability:

Main Principles of Sustainable Development The statements that came to be known as the major principles of sustainable development were made at the 1992 Rio de Janeiro Declaration on the Environment and Development. These principles were reproduced by Mindjov (1999:196) as follows: (Jibril 2011)

- 1- Everyone has the right to a healthy and productive life in harmony with nature.
- 2- Present and future generations are equally entitled to this right.
- 3- Environmental protection must be seen as an integral part of any developmental process.
- 4- Each country has the right to utilize its own resources, without affecting the environment beyond its borders.
- 5- The polluter must compensate the damage caused to the environment – “polluter pays” principle.
- 6- Economic activities are combined with the principle of acquiring preventive measures for environmental protection.
- 7- States must cooperate for environmental protection.
- 8- The alleviation of poverty and living standards, inequity in the different parts of the world is an integral part of sustainable development.
- 9- States must limit and extinguish the unsustainable modes of production and consumption and enhance the appropriate demographic policy.
- 10- The most efficient way of solving environmental problems is the involvement of all interested parties.
- 11- States must develop and encourage the informed participation of the population in the

decision-making process (participatory democracy).

- 12- States must develop and implement effective legislation for environmental protection.

5- Elements (pillars) of sustainability

Three main pillars of sustainable development are disruptive to one's main objectives of development or sustainability. These are the environment, society, and the economy. They identify trends in which the idea of sustainability or communication moves towards its main goal of meeting needs and preserving the environment as it stands.

5-1- Social sustainability

Social sustainability includes environmental justice, human health, resource security, and education, and efforts to promote social sustainability are aimed at enhancing economic and environmental benefits. Efforts to generate social sustainability in companies include focusing the company's efforts on employee retention rather than economic priorities. (Morais 2018). Social sustainability is also aimed to control demographic growth as it puts severe strain on resources and Governments' capacity to provide various services. The distribution of population in a balanced manner between different regions as current trends seek to expand urban areas because the development of large cities has serious environmental consequences, while sustainable development aims to promote village development to help slow the movement of migration to cities. (Hasson 2015).

5-2- Environmental sustainability:

Environmental sustainability focuses on environmental well-being. They include water quality and air quality and reducing environmental pressures, such as greenhouse gas emissions. Human health depends heavily on the quality of a person's environment, which inextricably links human health to the state of the environment.

Therefore, efforts to preserve and restore the environment also benefit people. (Vandyck 2018) Environmental sustainability is the preservation of agricultural land, groundwater, and surface, protecting the climate from global warming.

5-3- Economic sustainability

Economic sustainability includes job creation, profitability, and correct accounting of ecosystem services for optimal cost-benefit analyses. Research shows that high employment rates benefit the economy and the people's social well-being by providing employment opportunities for resource security. (Gray, 2014).



Figure 2, Elements (pillars) of sustainability (ondokuz80, Grifa, 2022)

Second: Sustainable Environmental Design

Sustainable environmental design is a design philosophy that seeks to optimize the quality of the built environment and minimize damage to the natural environment.

1- Definition of Design

Design is a virtual structure based on a range of constructive relationships and governed by a system of exchange between elements, foundations, and conveyor media, to achieve an experimental act within the circle of the senses of constructive consciousness and performance experience and the design governs a set of rules, foundations and equations so that the assumption is complementary, it shifts from an assumption based on elucidation to one present by test verification. The design has the goal of using many influences and artistic thrills to employ in innovative works with an updated vision, "As design is linked to the production and use process, it is the design's responsibility to maintain the environment. Most products and services deplete natural resources, most of which are

characterized by inability to recycle and replenish. (AWD, 2002).

Since many products have an impact on the environment, it has therefore been necessary to design environmentally friendly products that can be recycled and reused, as sustainable industrial products strengthen the link between the environment and the economy, where products are designed, implemented, and operated with advanced methods that reduce the negative impact on the environment.

2- Environmental Design:

Environmental design is defined as "any form of design that limits the destructive effects of the environment by integrating them into life processes." Clive Dilnot defines this type of design as a means of organization in our world, not just for the formation of products". An approach used to address environmental standards, programs and products, environmental design includes areas such as arts, applied sciences, engineering, interior design, industrial products such as environmentally friendly electric cars and wind generators.

3- Sustainable Design:

Sustainable design is a term for environmentally conscious design techniques through design in a manner that respects the environment and its components, and conscious design reflects the proportionality of the work with its outcome through research to find the best performance by balancing effort and achievement. (Ghanam, 2020). The policies of States, agencies and companies are geared towards preserving the environment. Sustainable design is at the top of the design trends that preserve the environment. It is therefore the future direction for designing industrial products that achieve sustainable development: "Human development based on improved health care, education and social welfare. The report of the World Commission on Development and the Environment "Brundtland" noted that "sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their needs". (Gowda, 2011). It is a new design trend that initially emerged as "Green Design" and seeks to integrate and continuously align with the environment.

4- Sustainable design strategies:

Sustainable design strategies indicate how to integrate sustainability principles into design practices, bring about changes in consumption habits and increase overall well-being. Sustainable design focuses on functional and aesthetic aspects as integrated elements of the design process. It was therefore important to integrate sustainable design concepts at an early stage in the product design

process where more economical and sustainable results could be achieved.

4-1- Design for deconstruction

Design term for disassembly refers to a design approach that supports the use of parts use of parts, components, or materials from end-of-life products to be reused again with new products or the reuse of sound parts of them if the product cannot be easily constructed or can be obtained at a high cost as well as a design to facilitate the change of future design and the final deconstruction of products to restore systems and components, which is practical in order to maximize economic value and minimize environmental impact. (Al-Hadidy, Fahmy 2020). This method increases economic value and reduces environmental impacts through reuse and recycling. This approach is taken in the product design process using reverse engineering.

4-2- Cradle to cradle:

This method depends on each product at the end of its life cycle being the entry point for another system that does not end up as waste, as the process must take place in the form of the life cycle of an object, this being and a way to feed another object. In the same vein, the product at the end of its life is not a waste, but a means of initiating another product's new life cycle. (Ezzeldin, 2023).

4-3- Design to reduce waste:

The term "waste reduction design" refers to the design of sustainable waste management to reduce, reuse and recycle materials, a principle that reduces waste and improves resource management reduces demand for landfills, and saves cost. Reducing waste can be considered one of the most effective sustainable strategies for the management of chemical weapons. This indicates that waste must be reduced before it is produced. (Olanrewaju, Ogunmakinde 2020).

4-4- Design for well-being:

Design for Well-being (DfW) redirects the focus of product development from technology-based development to participatory product development. It aims to enable persons with disabilities to influence their daily living conditions by actively participating in the design of the assistive devices they use daily, thus using the concept of "well-being design" to broaden the scope and base of potential users to develop consumer products. DfW focuses on three main objectives: (Larsson, John 2005).

- 1- Design innovative products to increase luxury.
- 2- Shaping the future of globally distributed cooperation.
- 3- Educate tomorrow's product innovators.

4-5- Designing end-of-life strategies:

The need to define an end-of-life strategy occurs when the product is considered a "waste". The end-of-life strategy of the product aims to:

- 1- Reuse or return the ingredients of a product to its original use.
- 2- Repair an unusable product to its usable condition.
- 3- Reconfiguration (renewal) is the return of the used product to a consumer's satisfactory use status.
- 4- Remanufacturing by returning the used product to its original performance.
- 5- Reuse some components of the product in a function other than its factory.
- 6- Recycling by waste treatment.
- 7- Restore power by burning waste to generate power.
- 8- Dump the waste by dumping the waste by burying it.

"ISO proposes a classification of end-of-life strategies through standard 14062, which is classified according to potential environmental gains: (a) prevention, (b) reuse, (c) recycling, (d) energy recovery, and (e) disposal.

(Bauer, Brissaud, Zwolinski 2017).

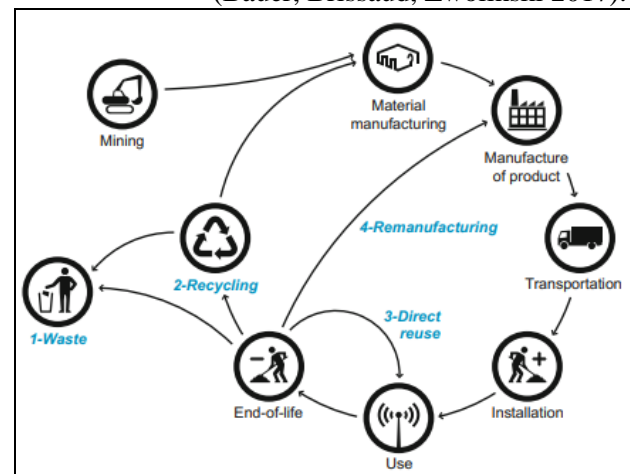


Fig3, Designing end-of-life strategies.

(Zhang 2014)

5- Sustainable Design Principles:

• Maximum Range Principle:

It includes that the environment meets the present and future needs of the human being, defined by the extent of technological development and the social system, and encompasses not only all existing boundaries, such as limited sources but also all factors leading to a reduction in the amount and efficiency or quality of resources. (Ghanam 2020)

• The principle of needs:

The principle of needs includes the provision of basic requirements for human life and includes basic needs such as food, clothing, housing, and individual needs that are only necessary to raise the standard of living. (Ghanam 2020)

Human needs are graded from basic needs such as food, drink, and clothing to sub-needs according to Maslow's division. (Fig4).



Fig4, Maslow's hierarchy of need

5-1- Principles of Sustainable Design on Industrial Product: (Deniz, 2002)

Governments, communities, and industry are all working to prevent pollution and overconsumption from ruining the planet and the natural resources we all rely on. To support this, there is an urgent need to make all industrial products and processes 'sustainable'. Small numbers of new products are becoming available that have a 'total beauty' about them. So, their total life, from the cradle of raw materials production to their end of life has been designed to minimize environmental and social impact. For every sustainable product there are thousands of products that have no environmental improvement. Most manufacturers eventually comply with the few laws that cover the environment, taking the lead out of paint or make their packaging more recyclable. But this is only a little part of what needs to be done. The goal of sustainable design is to make all products 100% cyclic, safe, and renewable. So, the design of Sustainable Products is not conceptually difficult. These are some of the principles that refer to "sustainable product design":

- **Cyclic:** The product becomes more cyclic using recycled paper, metal, glass, or plastic, by becoming more recyclable, or both, and then by taking advantage of cultivated materials such as wood, leather, and wool.
- **Alternative Energy in Use:** The product becomes more solar by using renewable energy in use, sometimes by using solar-generated electricity.
- **Alternative Energy in Manufacture:** The product becomes more solar by using a renewable energy source for its manufacturing process.

- **Substitute Materials:** The product becomes safer as a result of toxic materials or components being substituted for safer ones.
- **Utility:** The product becomes more efficient by providing greater utility for the user, such as multifunction products or rented products.
- **Durability:** The product becomes more efficient when using materials that last longer.
- **Efficiency:** The product becomes more efficient in its use of energy, water, and materials, both in manufacture and use.
- **Bio-everything:** The product becomes more cyclic, safe, and renewable because of using living organisms or biomimicry techniques.
- **Communication:** The product communicates information that leads to better environmental performance, usually by changing the behavior of users.

6-Sustainable design philosophy: (Ghanam 2020)

According to Jason F. MacLennan the philosophy of sustainable design "is based on a range of elements:

6-1- Understanding the principles of integration in natural cycles, including the following:

- Recycling is where in nature everything is recycled.
- The shape fits the function.
- Cooperation and sharing of the elements of the environment stop everything that leads to transgression within the ecosystem.
- Dependence of environmental elements on the surrounding local content, diversity is a key feature of environmental elements.

6-2- Preservation Principle:

It is concerned with respecting and preserving energy and natural resources and their efficiency in the applied framework of design outcomes and thus supporting the use of renewable energies.

6-3-The principle of vitality:

It is respectfully concerned with the human environment from the social, psychological, and cultural aspects.

6-4- Respect for the place Principle:

It means identifying and describing the characteristics of the product's biosphere (location) and respecting the balance in exchanges between its components.

6-5- Respect for the future Principle:

It's about conserving natural energy and wealth.

6-6- Holistic principle:

Design must consider the overall thinking of the pre-production, production, life cycle, and post-removal and disposal phases.

Third: Technical Movement:

The exterior of the product affects the user's acceptance of it, before entering the following stages of use, The importance of this lies in the need for the designer to focus on achieving users' desires and trends sustainability in general and product sustainability has become one of the most important global and individual requirements for users that a designer must follow when designing its products, In addition to his interest in creativity in shaping the appearance of the product, the need has arisen to see and study technical schools, to expand his perception and the circle of his art culture. When looking at the criteria of some technical schools, we note that many of them have embraced the idea of sustainability in designing their products, making it easier for the designer when following the foundations of a school to design sustainable aesthetic products. Below is an analysis of how some technical schools adopt the

concept of sustainability in their art products and works.

1- Arts and Crafts Movement (1860-1920):

The nineteenth century affected the industrial revolution, with aspects such as work, production, daily life, and art affected by technical changes in that period. Despite the evolution that has emerged in many aspects of life, the classics of craftsmen or users have limited their perception of this evolution as a deterioration in the design and manufacturing process. Hence the Arts and Crafts movement, whose representatives promoted handicrafts rather than mass production. (Graf,2022). This movement has focused on attention to the quality of everyday things, and how workers can be treated better. As well as how to create everyday objects in beautiful images that suit all layers of society. **The main pioneers of this movement are:** (William Morris - August Bogen - John Ruskin - Charles R Ashby - Gustav Steckley - Charles B Lember - William Lithaby).

The following table (1) sets out the fundamental principles of the arts and crafts movement and its most important principles associated with the idea and objectives of sustainability:

Arts and Crafts Movement	
Principles and foundations associated with sustainability ideas and goals	Basic Principles and Foundations of Movement
Focus on creativity and consumption ethics.	The Arts and Crafts movement called for the importance of decorations and aesthetics.
The importance of nature conservation has been called the "first nature of the design".	Estimate craftsmanship and manual quality on quantity and profits.
Manufacture products from non-traditional nature-inspired materials such as (glass, wood, bricks, etc.).	criticism of machines and revive handicrafts in the Middle Ages to revive the relationship between "production, craftsmanship, and creativity".
The movement's representatives demanded, "those things be useful, and the form follow the function."	Unity "Overcome the lack of unity and focus on creating a harmonious design"
The basic concepts of the movement were "functional competence and honesty."	
The design does not have unnecessary features. The purpose of the decoration must be "to enrich the basic construction."	

According to the preceding principles and foundations, some models of the arts and crafts

movement that have embraced the idea of sustainability can be analyzed:

1-1- Armchair by "Earnest William



Figure 5, Armchair by "Earnest William Jameson (the collector: Graf, 2022)

In the chair designed by Earnest William, we find a combination of distinctive decoration and simplicity besides efficiently achieving the function. The beaded-shaped round features of the product were inspired by the rollers used in weaving the fabric, an ore of nature (wood) was used. as well as simplicity in design and manufacturing processes, which entitles the principles of sustainability.

1-2- Voysey Cabinet by "Charles FA Voysey":



Figure 6, Charles FA Voysey cabinet (artarchivear)

The artist Voysey's cabinet is simple in design, ending with circular platforms intended to carry candles as an additional function in the product. The cabinet is made of natural material (oak wood and copper).

1-3- The Red House by "William Morris":



Figure 7, The Red House by "William Morris": (the collector: Graf 2022)

William Morris inspired the details of the decorations from nature during the Red House design and was influenced by the Gothic revival style. It relies on the use of natural materials, by relying on three natural materials (wood, glass, and red brick). The principle of simplicity in design was also maintained and no excess decorations were added, and natural materials used were maintained as they were. Simple decorations have been employed for constructive purposes such as brackets above windows to protect against sun and snow. Sustainability in this home has been achieved through decorative elements, simplicity, and functional performance.

2- The direction of deconstruction and reconstruction:

Deconstruction is a modern trend and began as a major cultural manifestation in 1890 as a trend in psychology by Sigmund Freud, as did the French philosopher "Jacques Deride". Study and analyze Freud's work using the deconstructive method. (Tahoun, 2015), says the French philosopher Jacques Derrida, deconstruction is both a structural and anti-structure movement. We deconstruct the building to highlight its structure, rib, and structure. deconstruction in all researchers was associated with the French thinker (Jacques Derrida) and the term deconstruction was associated with it (the fragmentation of the elements of the shape into its smaller parts, the understanding of the composition of the product, the concept of difference from the old in design strategies). (Nasser, 2018).

The definition of deconstruction in design: It is to show the difference within the design structure by returning it to its constituent elements and units to know its structure and to monitor its function and the scattering and multiplicity that this indicates.

The main pioneers of this movement are (Zaha Hadid, Rim Koolhaas, Frank Jerry, Peter Eisenman, and Bernard Chomey) (Ali and Salah 2018).

The following table (2) sets out the fundamental principles of the Deconstruction and reconstruction and its most important principles associated with the idea and objectives of sustainability:

Table (2): Principles and foundations for "Deconstruction and reconstruction":

Deconstruction and reconstruction	
Principles and foundations associated with the idea and goals of sustainability	The basic principles and foundations of the movement
Product design through derivation of other items that are stripped, codes, or thought.	Difference from old, traditional, and familiar
Design by using certain natural forms or parts of them or explicitly taking inspiration from nature.	Relying on the theory of doubt that calls for doubting the basic structure of the product and not taking preceding rules as a given.
Make the design fun and festive by forming an idea by deconstruction and reconfiguring.	Creating complexity: Detecting shapes, possibilities, and methods of deconstruction and making clashes and new dimensions of form and vacuum resulting in complex shapes.
Use the product or parts of it for more than one functional purpose.	Separation of form and function.

According to the preceding principles and foundations, some models of deconstruction and

reconstruction products that have embraced sustainability can be analyzed:

Zaha Hadid Design Office Shelves "Deconstruction Model":

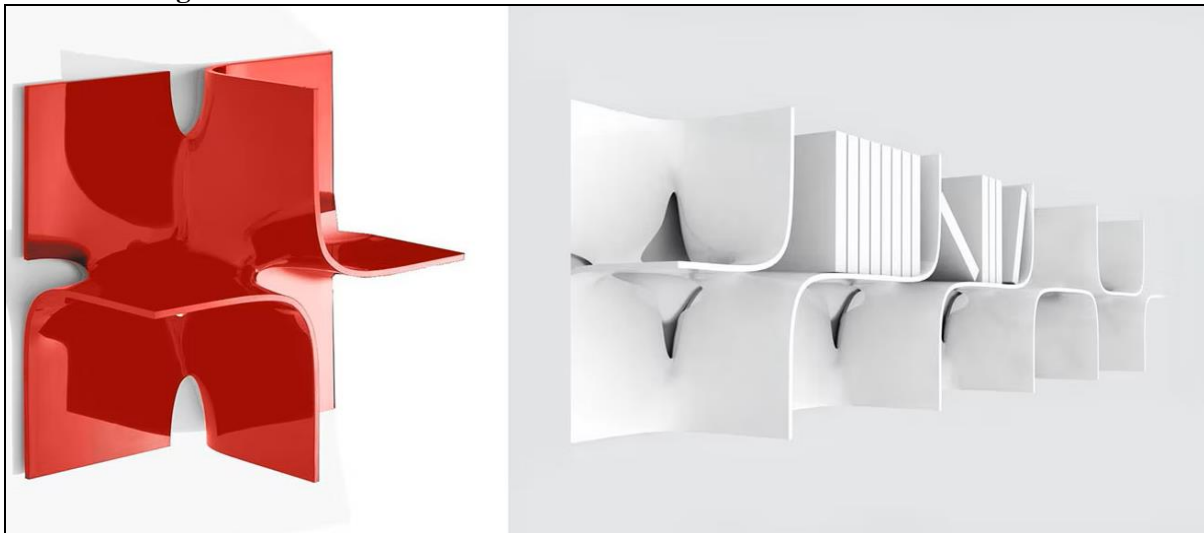


Figure 8, Design Office Shelves by Zaha Hadid
(Architizer: Sheila Kim, 2018)

Product Analysis:

- The shelves are designed according to the design principle of deconstruction to take maximum advantage of the shelves and give an aesthetic appearance and reuse them for another purpose "seat".
- Shelves are open for easy falling light and distributed in an ideal way (the shelves depend on a natural lighting source).
- The use of plastic material, which is distinguished by its soft texture, gives comfort to the user.
- Use white color to give pure and vital character.
- Multiplicity of product functions (library shelves to store books, bottom shelves to go up to put and take books, seat for sitting).
- The shelves are wide to accommodate most books and easy to take and retrieve books.
- Non-compliance with the foundations and rules and departure of the model movement from the accepted, as it does not have a fixed form.
- It is possible to create an infinite number of designs (which are similar and not similar repeated shelves).
- The principle of deletion and addition of the core element "shelf", helps to make the product aesthetic.
- Use strong plastic material for easy cleaning, heat resistance, and endurance.

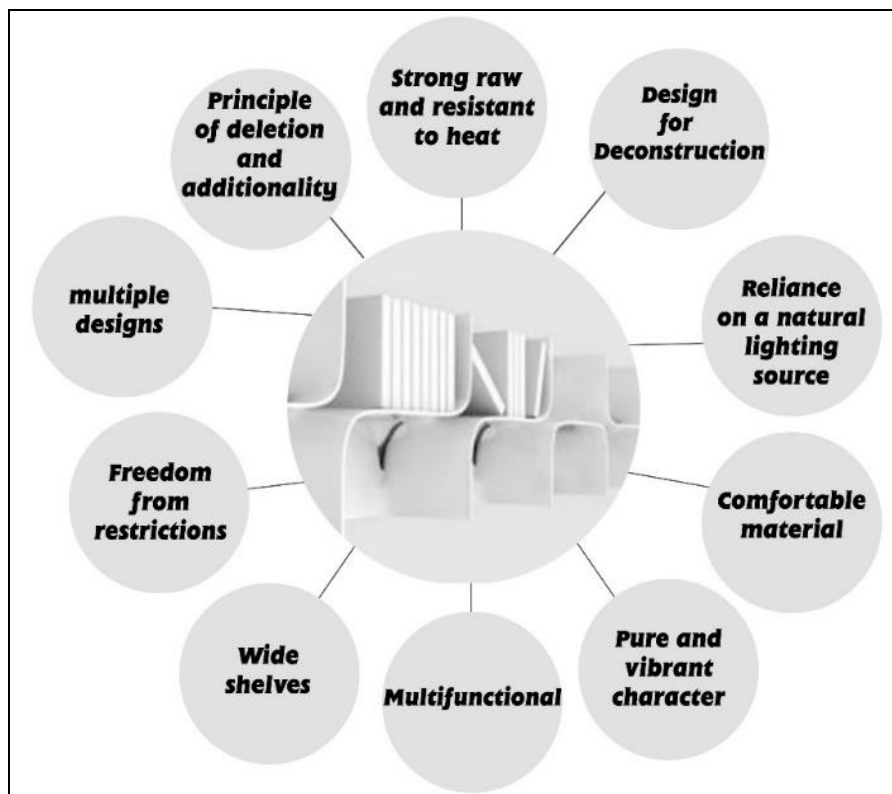


Figure9, Analysis of office shelves for (designed by Zaha Hadid).

Zaha Hadid relied on the foundations of deconstruction in her design of this product, this was demonstrated by a lack of adherence to the rules and freedom from design constraints, and Zaha Hadid highlighted the formation of forms and varieties of design in the product, which affected its aesthetic aspect, unlike traditional shelves. The principle of sustainability in this model has been achieved through the formation of an infinite number of designs through deletion and addition, the fit of the model to the environment by performing the required function, achieving aesthetic aspects and keeping pace with modernity, and the use of a modern material (plastics) characterized by its durability, ease of cleaning and heat resistance, model dependence on the natural light source, product use for more than the functional purpose (top shelves for book storage, bottom shelves for easy ascent for top shelves, use separate shelf as chair for sitting). This is where one sustainable design strategy (design for deconstruction) was achieved "as discussed in sustainable design strategies", which depends on Using parts of the product and reusing them in a new product or changing parts of the product to be

used in a new function. This method works to raise the economic value and reduce the harmful effects on the environment, thereby achieving the principles of sustainability in general and the sustainability of resources.

3- Bauhaus School:

Founded by the architect (Walter Gropius) at the beginning of the twentieth century in the city of Weimar, Germany, the Bauhaus is the most influential modern art school of the twentieth century in engineering and design, combining industrial design, architecture, sculpture, and painting. (Martinique, 2016). The Bauhaus combines Cubist School in Art and Expressive Architecture as well as being influenced by the hypotheses of the functional stream and the Construction Architecture School. The main pioneers of this movement are: (Paul Klee, Wassily Kandinsky, Marcel Breuer, Josef Hartwig, Josef Albers, Marianne Brandt, Wilhelm Wagenfeld, Peter Keler, Mies van der Rohe and Lilly Reich).

The following table (3) sets out the fundamental principles of the Bauhaus School and its most important principles associated with the idea and objectives of sustainability:

Table (3): Principles and foundations for " Bauhaus School ":

Bauhaus School	
Principles and foundations associated with the idea and goals of sustainability	The basic principles and foundations of the movement
Simplifying the creative process while improving their products through clean, simple designs.	Integrate fine and applied arts and remove the boundaries between them.
Social integration between the artist and the craftsman and eliminating the differences between them	Combining visual arts and architecture.
Focus on geometric shapes and basic colors.	Stay away from the central position of the images.
Develop innovative designs commensurate with modern technologies to address industry defects.	Art is a method of individual expression, using materials in a rough way and emphasizing fine details.
Simplicity in design and emphasis on straight lines and explicit arcs as a response to formal exaggeration.	Integrate fine and applied arts and remove the boundaries between them.
Avoid excessive decorations and do not exaggerate.	Good design should follow the principle of equality and harmony.
Linking art, technology, craftsmanship, industry, and attention to the principle of Truth to materials. "Use of materials in their natural state and simply and without complexity".	
Achieving the functional aspect of the product while retaining the aesthetic aspects.	
Form follows function (it should be functional, not decorative).	

According to the preceding principles and foundations, some models of Bauhaus School products that have embraced sustainability can be analyzed:

3-1-Barcelona Chair (Mies Vander, Lilly Reich):



Figure 10 Barcelona Chair (Mies Vander, Lilly Reich): (Cate st hill, 2019)

The chair was designed for the German pavilion at the 1929 International Exhibition in Barcelona. The chair consisted of 3 parts: a light metal frame made of stainless steel and two rectangular cushions of leather. It was initially manufactured from parts installed together but was developed in 1950 to become a single metal piece welded together which

facilitated the production process as well as reduced the assembly and installation phase. The sustainability principle in the chair is achieved through transparency, flexibility, simplicity in shape, and a design with an angle of inclination to achieve physical comfort for the consumer.

3-2- Overlapping tables for (Josef Albers):



Figure 11 Overlapping tables for (Josef Albers): (DÉCOR, Elisa Zagaria, 2018)

This product is five overlapping tables of different sizes manufactured from oak and acrylic glass. The beginnings of sustainable development have

emerged in this product through the simplicity of design and manufacturing and the use of natural materials in its manufacture, and it is free from decorations, non-overuse, and excessive use of materials. This product is still in production to this day, and this means that the design is in keeping with modern manufacturing methods and materials that are not harmful to the environment.

3-3- Tea Infuser for (Marianne Brandt):



Figure 12 Tea Infuser for (Marianne Brandt):
(DÉCOR, Elisa Zagaria, 2018)

The tea infuser was characterized by combining geometric shapes to form a simple shape, stripping off any decoration, simplicity, and light weight. The infuser body is shaped as a silver hemisphere, the D-shaped handle is made of ebony wood for heat insulation, and the handle is also placed on top of the infuser body for easy pouring to ensure the user's comfort and safety during use. This achieves the principles of sustainability.

3-4- MT lamp by William Wagenfeld:



Figure 13 MT lamp by William Wagenfeld:
(DÉCOR, Elisa Zagaria, 2018)

The lamp has been designed according to the principle of "shape follows function", an economic lamp only two materials were used to manufacture it (glass and metal). One of the first products to appear in the Bauhaus that is based on technology in manufacturing, with a simple geometric form, is the absence of any decorations where it provided the most used materials, which are still being manufactured to this day.

3-5- The Wassily Chair (Marcel Breuer):



Figure 14 The Wassily Chair (Marcel Breuer):
(Cate st hill, 2019)

Inspired by the frame of his bicycle, artist Marcel designed the chair, bending steel tubes without the use of welding. The chair is composed of a steel base frame and fabric parts. The beginnings of sustainable development were achieved in this product using new materials to create the best physical stamina and user comfort, simplicity in design, not overusing materials, easy to move, light in weight, produced in large quantities and still being manufactured until now.

Fourth: Results:

- 1- The possibility of designing sustainable aesthetic products using the principles and standards of artistic movements that have embraced the thinking of sustainability in designing their own products and artworks (Bauhaus School, Arts and Crafts Movement, Dismantling and Reconstruction Direction).
- 2- The Bauhaus school, the Arts and Crafts movement, the deconstruction and reconstruction movement are among the most important schools and artistic trends that adopted the thought of sustainability in designing their products.

References:

- 1- Abo Ganema, W. E. E. Z. A., El-Saadany, N. O. E.-S. A. El, & Mustafa, S. N. E.-D. M. M. (2023). Sustainability in Product Design and using it for designing organic food containers.

- مجلة العلوم والفنون والعمارة 8(38), 605–623. <https://aaciaegypt.com/wp-content/uploads/2023/05/Sustainability-in-Product-Design-and-using-it-for-designing-organic-food-containers.pdf>
- 2- Bauer, T., Brissaud, D., & Zwolinski, P. (2017). Design for high added-value end-of-life strategies. *Sustainable Manufacturing: Challenges, Solutions and Implementation Perspectives*, 113–128. <https://library.oapen.org/bitstream/handle/20.500.12657/27791/1/1002214.pdf>
 - 3- Colby, C. (2011). The relationship between product design and business models in the context of sustainability.
 - 4- Deniz, D. (2002). Sustainability and environmental issues in industrial product design. Izmir Institute of Technology (Turkey). <https://www.proquest.com/docview/2579042351?pq-origsite=gscholar&fromopenview=true&source=type=Dissertations%20&%20Theses>
 - 5- Gray, M., Hunter, B., & Biddle, N. (2014). The economic and social benefits of increasing Indigenous employment. <https://core.ac.uk/download/pdf/30673505.pdf>
 - 6- Ibrahim Elhadidy, H., & Fahmy, S. (2020). Sustainable Architecture as a Concept of Rationalizing Consumption and Improving the Environment. *مجلة العلوم والفنون و العمارة*, 5(Conference Issue (1)), 41–59. https://mjaf.journals.ekb.eg/article_117374.html?lang=en
 - 7- Jelena Martinović. (2016, May 23). Timeless Examples of Bauhaus Design Still Relevant and Popular. <https://www.widewalls.ch/magazine/bauhaus-design>
 - 8- Jibril, A. (2011). The Concept and Principles of Sustainable Development. Can Be Accessed at https://www.researchgate.net/publication/332593288_THE_CONCEPT_AND_PRINCIPLES_OF_SUSTAINABLE_DEVELOPMENT
 - 9- Larsson, A., Larsson, T., Leifer, L., Van der Loos, M., & Feland, J. (2005). Design for wellbeing. Proceedings of the 15th International Conference on Engineering Design, ICED'05.://www.diva-portal.org/smash/get/diva2:889501/FULLTEXT01.pdf
 - 10- Madge, P. (2023a). Ecological Design: A New Critique [1997]. In *The Design Culture Reader* (pp. 50–60).
 - 11- Morais, D. O. C., & Silvestre, B. S. (2018). Advancing social sustainability in supply chain management: Lessons from multiple case studies in an emerging economy. *Journal of Cleaner Production*, 199, 222–235.
 - 12- Morsy, M. M., Abd Elrahman, E. S., & ElghannamAhmed Saied Gharieb. (2020). A proposed methodology for design integration as one of the sustainable design goals for light metal construction.
 - 13- Nawal Mohsen Ali, & Hanan Ghazi Saleh. (2022). Design thought in the industrial product between constructivism and deconstruction. *Journal of the College of Basic Education*, 24(100), 477–506.
 - 14- Nidhal Naser Diwan. (2020). Deconstruction Mechanism in Postmodernism Arts and its Role in Teaching the Artistic Tasting for the Learner. *Al-Academy*, 95, 161–178. <https://jcofarts.uobaghdad.edu.iq/index.php/jcofarts/article/view/255>
 - 15- Olanrewaju, S. D., & Ogunmakinde, O. E. (2020). Waste minimisation strategies at the design phase: Architects' response. *Waste Management*, 118, 323–330.
 - 16- Stefanie Graf. (2022, February 14). An Introduction to the Arts and Crafts Movement. <https://www.thecollector.com/introduction-arts-and-crafts-movement/>
 - 17- Vandyck, T., Keramidas, K., Kitous, A., Spadaro, J. V, Van Dingenen, R., Holland, M., & Saveyn, B. (2018). Air quality co-benefits for human health and agriculture counterbalance costs to meet Paris Agreement pledges. *Nature Communications*, 9(1), 4939. <https://www.nature.com/articles/s41467-018-06885-9>
 - 18- اسراء عبدالرحمن خضير, عبد الله حسون محمد & مهدي صالح دواي. (2022). التنمية المستدامة المفهوم والعناصر والإبعاد. *Diyala Journal of Human Research*, 1(67), 338–356. <https://djhr.uodiyala.edu.iq/index.php/DJHR2022/article/view/1997/1872>
 - 19- عوض, ا. (2002). دراسات بيئية. دار المعرفة. https://books.google.com.eg/books?id=8RxYr_gEACAAJ
 - 20- هيبه, إ. م. ا, ابو قمر, أ. م. إ & , طاحون, أ. س. ح. (2015). تفكيكية ما بعد الحداثة كمدخل لإثراء التصميم الزخرفي. *المجلة العلمية لكلية التربية النوعية - جامعة المنوفية*, 2(العدد الرابع يونية 2015 الجزء الاول), 285–304. <https://doi.org/10.21608/molag.2015.1630>