JOURNAL OF DESIGN FOR RESILIENCE
IN ARCHITECTURE & PLANNING

Research Article
Online: www.drarch.org
Volume 4, Issue 2, (232-243), 2023
DOI: 10.47818/DRArch.2023.v4i2095

An approach for the material selection and use in industrial-energy facilities

Ürün Biçer*
Rana Ayça Derviş**

Abstract

The place and characteristics of architectural structures in the developing production, industry and energy fields are important at the point of architecture being a versatile and interdisciplinary practice. Industrial-energy facilities are buildings that are mostly established in areas outside the city and designed to be protected against environmental factors, where energy and industrial activities are carried out. Since it is a production-oriented system, it includes many different operational processes. These buildings are used for a wide range of purposes such as manufacturing, storage, and distribution. The design of an industrial building plays an important role in determining the productivity, efficiency and safety of the facility. In this view, material selection has been evaluated as a critical factor in architectural design of industrial-energy facilities. It affects the environmental sustainability, structural performance, and aesthetic appeal of the built environment. The materials used in the construction of an industrial building should also be carefully selected. These buildings experience heavy wear and tear, and therefore need to be durable and long-lasting. Steel and concrete are popular materials because of their strength and durability, while also being flexible in accommodating the changing needs of the business. This paper presents a scientific approach to material selection that considers sustainability, performance, and aesthetics criteria. Studies on the structure and other characteristics of industrial-energy facilities, which constitute the main problematic of the study, has been examined, and it has been aimed to reveal the theory and knowledge at the point of the experience of the authors. In this context, the aim of the study is to reveal the architectural features, commonly used materials and material selection criteria of industrial-energy facilities by determining them through theoretical knowledge, analysis, observation and professional experience.

Keywords: building construction & materials, criteria of industrial facilities, design of industrial facilities, industrial & energy buildings, selection of materials for industrial facilities.

1. Introduction

The 20th century corresponds to a process in which radical changes and innovations take place in terms of cultural, economic and social aspects. the emergence of mechanical production facilities with water and steam energy at the end of the 18th century, the introduction of mass production based on division of labor and electrical energy in the 20th century, and the beginning of automation in the 1970s and the use of electronic and information technologies in manufacturing took a different path. Today, it is known that technology is essential and smart building and automation systems are used in industrial buildings and non-industrial buildings. Accordingly, when

*(Corresponding Author), Assist. Prof. Dr., İstanbul Beykent University, Türkiye, urunbicer@beykent.edu.tr
**M. Sc. Architect, Independent Researcher, Türkiye, aycadervis@gmail.com
Article history: Received 25 April 2023, Accepted 14 June 2023, Published 30 August 2023,

industrial buildings are considered in terms of their relationship with architectural features, it develops together with both the systems and requirements brought by technology and the specifications of the facilities.

Industrial buildings which should be designed with a major focus on efficiency, functionality and safety to also contribute in productivity and performance, play a crucial role in the manufacturing, storage, and distribution of goods. In this sense, the design of industrial building is a complex process that requires a multidisciplinary approach in which the design team must primarily consider various factors, including the nature of the industry, the workflow, the equipment, and the materials used. Various studies have revealed the need of workflow, layout, and equipment placement for optimal production persistency. Safety is also an essential consideration, as there are risks associated with equipment operation and the storage of raw materials and finished goods. Material selection, fire suppression systems, and ventilation have also been studied for improved safety in industrial buildings. Previous research has shown that appropriate industrial building design is critical for cost efficiency and profitability. In this framework, this paper presents a scientific approach to industrial building design that considers workflow, safety, materials, and occupants' needs.

In this context, a scientific approach has been taken to industrial building design. The authors have collaborated with the industry experts, analyzed the workflow, and identified the critical areas of the facility. The authors have also considered the pros and cons of different materials and equipment configurations for optimal performance and safety. Depending on their theoretical knowledge and the experience in the field, the authors have been proposed a scientific approach on the material selection and use in industrial-energy facilities.

Qualitative data collection methods have been used in the study. In qualitative research, three types of information are generally collected. Environmental information, process-related information and perceptions are related to the social, psychological, cultural and physical characteristics of the research (Yıldırım, 1999). In the study, the architectural structures in the industrial area and energy facilities will be revealed and determined with a broad approach, together with the holistic exterior, interior building features and usage areas, digital resources, and applied sample production images. The study will progress architectural building designs in energy facilities within the qualitative data collection method analysis. Data collection was prepared in the light of the information obtained in the document review. Within the scope of literature research, documents and documents related to the problem area, city and university libraries, document scanning, article, thesis, etc. written sources were used. All the data obtained in the document scanning process are described in the appropriate order. Based on existing documents and observations, it has been tried to clarify what the structures of architectural buildings are and which materials are preferred in energy facilities, along with the reasons.

To summarize, the aim of the study is to create and conduct a research of a wide range of information about the building structures and properties, material types in the energy facilities as a part of industrial buildings and the main concern of the study is to form a theory on the use of materials in industrial-energy facilities.

2. Industrial Facilities

Industrial facilities are called as enterprises where production is made as a whole, and there are activities in many areas depending on the regional-environmental-use. Industrial facility areas; transformer maintenance centers, chemistry, process pipelines, energy, agriculture, iron-steel, mining, machinery and parts are the areas where production takes place. Köksal (2005) defines industrial buildings as “factories that manufacture with machinery, structures built from materials produced by industrial production, and side settlements (workers' residences, warehouses, shops) that support industrial production”.

Industrial Spaces features designs derived from the need of various industries to provide efficient, safe and workable spaces for both operations and administration, while at the same time complying with rigorous industry standards and incorporating the latest technology. The setting of the industry itself also influences such space, whether it be on an industrial estate, on the city fringe, in a rural precinct, or an inner urban area (Images Publishing Group, 2006).

One of the most important factors to consider while designing an industrial building is the workflow. The placement of equipment and machinery within the facility should create a seamless flow that is easy to navigate. This is achieved through careful planning and collaboration between the different departments involved. The layout of an industrial building should be such that it can accommodate large machines and equipment. The building should have a column-free space, high ceilings, and open floor plans to allow maximum flexibility in operations, movement and storage. Additionally, the building should be designed to accommodate natural light and proper ventilation to promote a healthy work environment. Another critical aspect of industrial building design is safety. The structure, as well as the equipment and machinery, should be sturdy enough to withstand the weight and force of heavy loads. The building should also have sufficient ventilation and fire suppression systems to minimize risk and prevent catastrophic events. Proper lighting and signage are also essential to ensure employee safety within the facility.

Energy facilities (Figure 1) operating in the field of energy, which is among the most critical problems and needs of Turkey, along with the increasing amount of use, the establishment of facilities and the search for systematic and new solutions in this context have started to gain importance. In this context, it is necessary to correctly determine the criteria during the installation phase of industry-energy facilities. Proper design qualities considering different facility characteristics such as crane dimensions inside the buildings, machinery parks, administrative management buildings etc., clarification of the areas of need with the selection of right team and the right planning process, evaluation of costs, dimensions and types of structures and fire and explosion resistance characteristics are crucial for the establishment of industrial-energy facilities. The criteria and issues during the installation phase are shaped and differentiated according to the country, geography and local procedures where the building will be implemented.

Figure 1 Monterrey Power Plant, Mexico (https://www.sodemsen.org.tr/)

2.1. Types of Industrial-Energy Facilities

The most important criterion to be considered in architectural structures in industry-energy facilities is to prepare and implement the construction design and application of reinforced concrete and steel works, taking into account the country codes. The main structures described as energy facilities and their features are given below. Energy facilities are generally divided into two as Industrial Buildings and Non-Industrial Buildings.

Industrial buildings are designed for the sectors such as furniture, food, clothing, power plants, electricity in general and turbine buildings, transformer buildings, water tanks, chemical buildings, workshops, shelters, etc. can be defined as *industrial buildings*. These buildings usually consist of steel structures. *Non-industrial buildings* are primarily administrative buildings, maintenance buildings, warehouses, security buildings, laboratory and auxiliary buildings and generally consist of reinforced concrete structures. Apart from these structures, perimeter walls, environmental lighting, landscaping works, walking and vehicle roads are also added in the facility. While preparing the cost method, it should be calculated correctly in accordance with the local procedures (license, project approvals etc.) in the country where the project will take place.

In the design of industrial energy facilities, the important points and the main factors to be taken into account are the foundation loads. Constant load, foundations, floors, roofs, ceilings, partitions, stairs, railings, pavements, etc. It is defined as the weight of all permanent structures including the own weight of structures and superstructures. The weight of equipment and piping is permanently related to HVAC ducts, machinery load, crane load, instrumentation, switchgear, air ducts, electrical duct/armatures, cables, insulation, fire resistance and structural components. When calculating the constant load, the product load of the equipment and pipes is considered as empty. The gravity weight of the ground cover is considered as dead load. The installation dead load is the weight of the equipment plus the weight of the foundation at the time of installation. Foundation weight is the combined weight of foundation, plinth and overburden soil.

2.2. Installation Stages of Industrial-Energy Facilities

The establishment of industry-energy facilities (Figure 2) starts with the preparation of technical specifications and documents in line with the construction methods and employer demands. Time, quality standards, planning, accurate cost analysis, equipment purchasing processes, process and piping line studies, infrastructure requirements and finally plant commissioning and operating processes and specific methods are determined. In addition to this scope, factors such as capital, raw materials, labor and transportation should be considered.

While creating the preparation phase methods of the building, the analysis of the facility and the process of supporting the correct planning, cost method and specification requirements play an important role. Technical specification for site rating; Technical specification for architectural and main construction works and selection of materials; Architectural finish works technical specification; Technical specification for structural steel; Technical specification for precast boundary walls and doors; Technical specification for roads; Technical specification for underground piping and surface drainage; Technical specification for landscape works are among the criteria for the installation stage of the industrial-energy facilities.

Figure 2 An Example of an Energy Facility (https://proente.com)

3. Materials Preferred in Industrial-Energy Facilities

Industrial-energy facilities are divided into industrial buildings and auxiliary buildings. Industrial buildings are made of steel structures and auxiliary buildings are generally made of reinforced concrete. In this context, first of all, the calculations of the ground surveys should be made, and then the roof, facade, flooring and finishing materials of the buildings should be determined.

In general, according to Maleque and Salit (2013), the materials selection plays an important role in the manufacturing process of product especially for the new product. It will not just involve with the selection of suitable materials because the design of the product should also satisfy the technical, safety and legal requirements. In the design, materials and process selection steps, materials and/or relevant engineer should aware of the effects of the materials used and the process involved in the environment. It is not advisable and acceptable that raw materials are simply consumed in making engineering materials which are then used and discarded. In response to these demands, it is highly recommended to use materials those are recyclable and biodegradable in order to make sure that they will help to minimize the production of waste (Maleque & Salit, 2013).

Considering the region where the projects are located, technical specifications and procedures change depending on the conditions of the country. For example, if the facility is located in a region by the sea, the material to be selected is expected to be resistant to corrosion, and the selections should proceed according to the performance expected from the material, based on wind load, standardization, heat resistance, acoustic calculation values and other calculations. Determining the selections on a project basis, rather than advancing with a single right in material selection, brings out the right results.

Industrial buildings where production takes place continuously; They are complex facilities where electricity, flame sources and machinery and equipment that may cause fire due to overload are actively used (Kızılboğa, 2022). In this sense, material selection has a critical role in design and construction of industrial-energy facilities. Building materials are updated at the point of technological developments depending on the process required by today. The architects and engineers of the project should analyze all these situations and turn to the selection of appropriate and correct materials.

The parameters which should be reviewed while making material selections in industrial facilities are, Physical characteristics of the project; Concept determination with 3D visuals during the design phase; Geographical conditions in the region where the project is located; The relationship of the project with the structures in the region and the environment; Technical specifications requested by the employer; Cost; Supply Process; Technical Evaluation Processes of Material Companies; Logistics; Lifetime and Coordination processes with all disciplines.

As Whittleton and Wood (2003) mentioned, the majority of industrial building superstructures are framed in structural steel, although a small percentage are in precast concrete. Steel is used primarily for its large strength-to-weight ratio, enabling it to span large distances economically. Steelwork is easily modified, which provides for a degree of adaptability not always available from concrete structures. Ground slab and foundations are invariably reinforced concrete, though some ground bearing slabs are constructed with no reinforcement. Industrial buildings for containment of toxic of other processes may require construction primarily from reinforced concrete (Whittleton & Wood, 2003). The most preferred construction building material in Industrial-Energy facilities is steel construction. It is among the most important materials of the construction industry. The reasons for the preference of steel construction in these facilities are summarized below.

- It is long lasting.
- As it provides flexibility, it is resistant to wind and earthquake in natural disasters. At the same time, thanks to flexibility, steels can be placed according to the desired design.

- They are light structures. It consists of small foundations. It has half the weight of the reinforced concrete structure.
- Since the calculations and design are prepared in computer programs before assembly, the margin of error in production and steel connection points is minimized.
- It is easy to install and saves man-hours.
- Although the steel raw material is expensive, it is more cost-effective than the reinforced concrete structure, considering the assembly and service life of the structure.
- It provides sustainability. It is a material that supports 100% recycling. The steel material, which is scrap after completing its life, is evaluated for use in remanufactured structures.

3.1. The Role of "Floor" and the Selection of Materials

The flooring materials to be selected in industry-energy facilities must be specially produced, comply with quality standards, have been tested according to the type of material, and have certificates. The floors in these facilities must be resistant to impacts, heavy vehicles and crashes. It must have long-term resistance performance, adapt to weather conditions and expansion depending on humidity, and must be resistant to acid and water. It is desired that materials with harmful properties such as acid do not damage the floor coverings.

In this context, *anti-acid tile floor coverings* are used as an alternative (Figure 3). In the technical specifications of industrial plant projects, it is stated that floor coverings should be hygienic, antibacterial, acid-resistant and non-slip. Non-slip, anti-acid tile ceramic floor coverings do not require maintenance and accordingly effects the reasons for preference. The most important features of the anti-acid tile material are; Its surface is matte, it is not affected by chemical acids, it has high resistance to heavy equipment materials, it is antibacterial and easy to clean, it does not change in color tones depending on time. It provides resistance to high heat transfer differences.

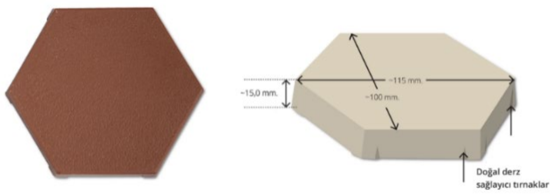

Figure 3 Sample Anti Acid Tile Floor Covering (https://vibroser.com/tr).

Epoxy flooring (Figure 4, Figure 5, Figure 6) is at the beginning of chemical floor coatings. Smooth surface, glossy surface, orange peel surface, parting sandy surface can be obtained. It is very resistant to physical impacts. It is applied on reinforced concrete surfaces. A homogeneous and continuous surface is obtained. In the application of epoxy flooring coatings, floor preparation is very important for a smooth surface. Structural defects, cracks and pits in the reinforced concrete floor are corrected using repair mortars. The most important features of epoxy flooring coatings are listed as; Resistant to acids, chemicals and water; It is resistant to impact and friction; It is hygienic. It prevents the formation of bacteria; It is long lasting; Allows decorative use, supports this with color transitions.

Figure 4 Sample Floor Epoxy Application (Author Archive).

Figure 5 Example Wall and Floor Epoxy Application (Author Archive).

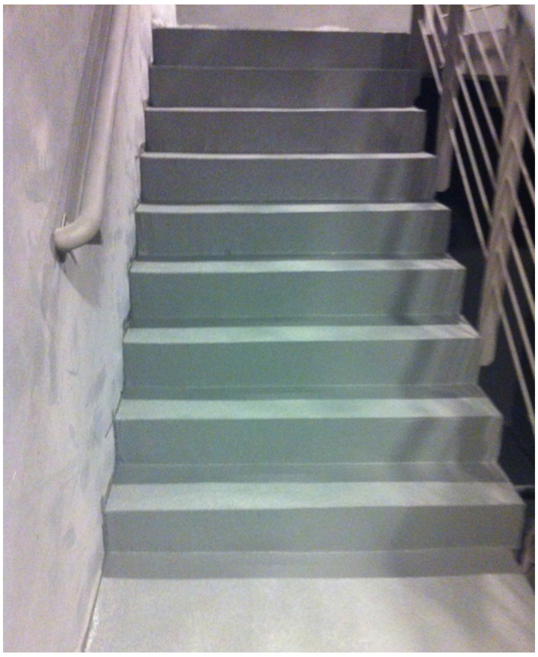

Figure 6 Example Fire Stair and Landing Epoxy Application (Parting sand surface epoxy) (Author Archive).

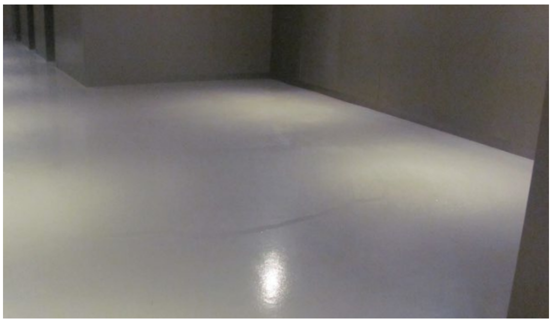

Figure 7 Sample Epoxy Application (Parting sand surface epoxy) (Author Archive).

Depending on the limestone contained in the concrete itself, the concrete causes dusting with the emergence of the materials from the concrete cavities, pores, capillary cracks, and vomiting. *Dust-free paint* (Figure 8, Figure 9) does not contain solvents and is two-component. It is a liquid, colorless primer paint application that protects reinforced concrete against moisture. It prevents the leak of oil, water, acid etc. to the concrete. One of the important reasons for preference of this material, which is applied on reinforced concrete wall and floor surfaces, is that it is economical. After the dust-free paint application of the reinforced concrete, it takes on a bright, polished appearance. It creates an antibacterial field. Due to the low material thickness, corrugations on the reinforced concrete surface indicate roughness.

Figure 8 Sample Dust-Free Paint on Reinforced Concrete Flooring (http://www.epoksizeminkaplamalari.com).

Figure 9 Sample Dust-Free Paint on Reinforced Concrete Flooring (https://www.tozumazzemin.net).

3.2. The Role of "Façade" and the Selection of Materials

In the construction of industrial-energy facilities, buildings are divided into steel structures and reinforced concrete structures. In reinforced concrete structures, the external wall material is usually pumice, brick or gas concrete, and plaster and paint are applied on it. In some cases, composite facade cladding on reinforced concrete structure is also used in administrative buildings where the facility has visual importance. In steel structures, it is progressed with sandwich panel coating application. An example of the industrial facility project, which was manufactured with all these facade cladding, is given below (Figure 10).

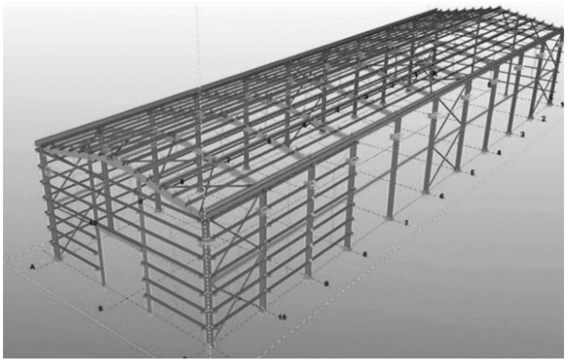

Figure 10 Sample 3D Modeled Steel Structure Project (http://www.mtfprokon.com/contents/hizmetlerimiz/250)

The designs of steel construction structures are made with the case design method in accordance with the region to be applied. They are generally light but robust, long-lasting, wide-opening structures that provide assembly and de-assembly at varying heights. Load calculations and force values are specially designed according to the project. In steel construction structures, the maximum deflection values under constant load and live load are determined for crane bridges or any element or material exposed to working load and do not exceed the determined values. Structural steel for major structural frames, including building frames, crane beams, stair towers and pipe racks, must be manufactured in accordance with recognized approved standards, according to material quality code and grade. It is important that other applications, including platforms, walkways and various complementary steel framing, are produced in accordance with quality codes and standards.

Sandwich panels (Figure 11) are preferred for the facade and roof coverings of steel construction structures. Sandwich panels consist of inner and outer metal sheet, and their contents are separated as rockwool and plastic foam (PUR-Poliüretan and PIR-Poliizosiyanurat). It is important to know the material in the sandwich panels very clearly and to proceed with the right material during the ordering phase. It is designed and produced for sound, heat, water and fire insulation. The rapidity of production and assembly has expanded its usage areas. Before the sandwich panel production, application projects must be prepared and the details of trapezoidal ridge, gutter skirts, wall-roof junction, drip, outer corner, inner corner, facade panel, window and coping must be shown in the project.

Figure 11 Sample Rockwool Filled Sandwich Panel (https://www.panelsan.com/tr/)

In reinforced concrete structures, *paint and plaster application* is preferred on the facades. Thickness and application method are used in accordance with the technical specifications of the facility. Due to the components in the plaster, it has fast adhesion to the surface and is resistant to moisture and mold. Spray plaster application method is generally preferred in large facilities.

After the plaster production on the exterior is set, paint production is started. Depending on the weather conditions of the region where the paint is manufactured, the most suitable paint option should be evaluated. Exterior paints are distinguished as smooth and grainy. Flat exterior paints; It is divided into two as silicone-based and acrylic-based.

It can be preferred as plain or grainy exterior paints. Flat exterior paints are divided into silicone-based and acrylic-based. Silicone-based exterior paints are resistant to mold and moisture thanks to their smooth, matte and permeable nature. Due to the strong components of acrylic exterior paints, they have a very high resistance to weather conditions, especially to sunlight. Thickness and application method should be used in accordance with the technical specifications of the facility.

3.3. The Role of “Exterior Doors and Windows” and the Selection of Materials

There are generally three types of door models on the facades of industrial buildings. These include steel doors with a fire resistance of at least 2 hours used by pedestrians, spiral doors used by large vehicles or cranes, and fence doors for transformer or equipment protection.

- *Rolling Doors;*

Folding shutter doors, also known as rolling shutters, are fire resistant and work manually for security purposes, with automatic closing at desired locations. Rolling shutters are often complemented by insulated door curtains and constructed from coil-formed galvanized steel laths that interlock where other access is required and to withstand specified wind pressure.

Wide access exterior doors come in vertical lift, insulated, weather sealed and wind locked, with components manufactured from galvanized steel and factory primed and field painted. Doors in high-traffic areas are motor-operated, with manual access capabilities and controls adjacent to the doors both inside and out. Models should be selected in accordance with the project, their color should be determined, and accessories should be clarified. In production projects, all information should be described completely and production should be started after the approval of the project architect.

- *Steel Doors;*

Figure 12 Fire Escape Door Installation Stage (Author Archive).

Fire resistant doors (Figure 12) are made of galvanized steel conforming to the fire resistance test methods and criteria of building construction elements or approved equivalent standards. High quality accessories (hinge locks, striker, handles, door stops, door leaf materials, ral code, panic bar set, door closers, under-door guillotine, wick, bolt latch, slide bar etc.) should be used on all doors, accessories including emergency escape facilities, should be complete, and stainless steel material is chosen for the hinges used.

- *Fence Doors;*

Fence gates are generally used as gates for equipment that should be outside the building structure, but also important to protect.

- *Ribbon Windows*

One of the reasons why the band window application on the façade is preferred is the fact that the industrial buildings are mostly made of steel structures due to the high building height. The details become clear in the application examples whose projects and implementations have been completed. Glass properties, thicknesses, profile properties should be defined in the production projects, and after the approval of the architect, production and assembly should be started.

4. Conclusion

Industrial building design is a critical factor in the success of the manufacturing, storage, and distribution of goods. A systematic methodology for design can enhance productivity, safety, and profitability. The design of an industrial building is a complex process that requires careful consideration of different factors. Besides, the design of the industrial building should take into account the needs of the occupants. Proper amenities such as restrooms, conference rooms, offices, and break areas must be included. The building should also be accessible to disabled persons, have a loading dock or a loading ramp for easy and safe loading and unloading of goods. The goal is to create a facility that is functional, efficient, and safe for its occupants. The building must be able to accommodate the changing needs of the business and be a place where employees can work efficiently and effectively.

From this point of view, material selection is a crucial aspect of architectural design that requires careful consideration of various sustainability, performance, and aesthetic criteria while considering the material's cost and availability. Material selection is a complex process that involves consideration of various factors, such as environmental and social sustainability, structural performance, and aesthetic appeal. Architects and designers must make careful decisions regarding the materials used in their designs to meet these criteria and ensure the safe and efficient performance of the built environment.

In this context, this scientific approach to material selection, will aid architects and designers in striking the right balance between these criteria, leading to high-performance, aesthetically pleasing, and sustainably built environments. A scientific approach to material selection aids architects and designers to identify and prioritize essential material properties to ensure that the selected material can meet sustainability, performance, and aesthetic criteria. Further, it also helps evaluate the environmental and social impacts of the materials, ultimately guiding environmentally friendly material selection decisions. Future research should continue to explore ways to improve industrial building design for optimal efficiency and safety, also, to explore alternative materials that meet these criteria for a better and more sustainable built environment.

This study demonstrates the importance of a scientific approach to industrial building design. The industry's unique needs must be considered, identify the critical areas, and optimize the workflow. Optimal material selection and equipment placement are also essential for safe and efficient building design.

Finally, it must be said that the presence of comfortable buildings that will allow the staff working in these facilities to stay at the facility whenever they want, increases both the efficiency of the facility and the motivation of the employees. The completeness of the specified substances throughout the entire time from the project stage to the operation process of industrial-energy facilities will ensure the production, workforce and success of the facility.

References

Images Publishing Group. (2006). *Industrial spaces: A Pictorial Review*, Volume 1. ISBN-13: 978-1876907631. Australia: Images Publishing Group.

Kızılboğa, G. (2022). *Endüstriyel Yapılarda Risk Analizi. Şantiye*, 392, 70-71. ISSN: 2717-8145. İstanbul: Ekosistem Medya.

Köksal, T. G. (2005). *İstanbul'daki Endüstri Mirası İçin Koruma ve Yeniden Kullanım Önerileri* (PhD thesis). İstanbul Teknik Üniversitesi, İstanbul.

Maleque, M.A. & Salit, M. S. (2013). *Materials Selection and Design. Singapore*: Springer. ISBN 978-981-4560-37-5.

Whittleton, D. & Wood, M.A. (2003). *Industrial Buildings*. D. A. Snow (Ed.). Plant Engineer's Reference Book. 2nd Edition, (s.3-25). ISBN: 978-0-7506-4452-5. UK: Butterworth-Heinemann.

Yıldırım, A. (1999). *Nitel Araştırma Yöntemlerinin Temel Özellikleri ve Eğitim Araştırmalarındaki Yeri ve Önemi*, Eğitim ve Bilim Dergisi, 23 (112), 7-17. ISSN: 1300-1337. Access Address (12.12.2019): http://eb.ted.org.tr/index.php/EB/article/view/5326/1485.

Resume

Ürün Biçer was born in 1979 in Adana. After graduating from Yıldız Technical University, Department of Architecture in 2001, she completed her master's and doctoral studies in the Department of Architecture of the same university. Between 2001-2011 she worked as a Research Assistant at Yıldız Technical University, Department of Architecture, Department of Building Elements and Materials. Ürün Biçer, who has undertaken administrative duties besides her academic studies since 2001, has many publications in different fields of the discipline of architecture such as building elements and materials, design, education and studio experiences. Ürün Biçer, who served as a member of the Board of Directors of the Chamber of Architects of TMMOB between 2012-2020, has been working as an Assistant Professor at the Department of Interior Architecture (TR) at Istanbul Beykent University since 2012 and continues to serve as the Vice Dean of the Faculty of Engineering and Architecture.

Rana Ayça Derviş recieved her bachelor degree in faculty of engineering and architecture from Beykent University (2004) and she received master of science degree (2023) about Architectural Materials of Industrial Buildings in the same university. In her 19 year of professional life, she worked in several companies and be part in building design and construction management side. Projects are mostly related in industrial and mixed used projects (office, residence and shopping malls). Currently Derviş is work at industrial building design company. As a principal architect her role is controlling detail engineering & design project and support architectural procurement packages. This is her first article.