

## Article

# Urban Sustainability through Public Architecture

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**Abstract:** As the sustainability of contemporary cities has gained emphasis, interest in architecture has increased, due to its social and public responsibility. Since sustainability is linked to public values, research on sustainable public spaces is an important way to secure sustainability in cities. Based on this, we analyzed the sustainability of European cities by examining the design methods of public architecture according to the region. The aim of the study is to derive architectural methodology corresponding to local characteristics, and to suggest issues to consider in public architecture design to promote urban sustainability based on this. First, regarding the environmental aspect, it can be observed that there is an effort to secure sustainability. Second, in terms of social sustainability, historical value remains as a trace of architectural place, so that it continues in people's memory. In addition, public architecture provides public places where citizens can gather and enjoy programs, while the architectural methods showed differences influenced by cultural conditions. Third, in economic sustainability, it was shown that energy saving was achieved through cost reduction through recycling of materials, facilities, or environmental factors. In conclusion, the issues to be considered in public architectural design are the voiding of urban space through architectural devices in the construction method. In other words, the intention is to form "ground" that attempts to be part of the city, and thereby create better places. Since skin and material have a deep relationship with the environment, they should have the durability and an outer skin that are suitable for the regional environment. Finally, sustainability is to be utilized through the influx of programs that meet local and environmental characteristics. Design research into public architecture that is oriented towards urban sustainability will be a task to be carried out by the present generation for the millennial generation.

**Keywords:** elements of sustainable public space; environmental sustainability; social sustainability; economic sustainability; northern region; middle region; southern region; method of voiding the ground; durable skin with the materials; flexible use of the program

## 1. Introduction

### 1.1. The Background and Purpose of the Study

Recently, many rerearches have been attempting to provide a sustainable society in various fields, such as society, economy, and the environment. As sustainability is emphasized, architecture that is publicly and socially responsible has been gaining much interest. In turn, this has caused the role of public architecture to be greater than ever, due to its existence being tied to the public [1]. This is because sustainability is linked to public values. Therefore, research into sustainable public space can be an important way to secure the sustainability of the cities. For a city to endure, it is most important to meet geographical and environmental conditions. In an attempt to supplement the definition of the city as entity, some environmental researchers have adopted the term "urban ecosystem" to identify the qualities of urban areas [2]. That is why vernacular architecture, a style in which contemporary

architecture seeks to find a new source of design from traditional and indigenous architecture, is becoming more and more important.

Thus, it can be hypothesized that public spaces need to reflect distinct environments such as northern, middle, and southern regions of Europe while they also have to consider other various features because they are different countries with their own socio-cultural context. Based on these hypotheses, we tried to compare the sustainability of European cities—where inter-country exchanges were the most active, and many countries were border-crossing and have built high-level architecture—by examining the design methods of public architecture according to region. The aim of the study is to derive architectural methodology corresponding to local characteristics and to suggest issues to consider in public architecture design to promote urban sustainability based on this. This can be an effective approach among the various ways for cities to become sustainable.

### 1.2. The Method and Contents of the Study

For this purpose, in Section 2 we discussed the characteristics of urban design towards sustainability. First, we described the meaning of public space in urban design and presented requirements and components for sustainable public space in an urban context. In particular, the study suggested that urban social sustainability could be influenced by economic, environmental, and socio-cultural factors. Therefore, we proposed the whole methodology by explaining the potential of each scope and how to interpret it.

In response to this, in Section 3 we comparably analyzed various kinds of public architecture. The cases were selected because they were popularly utilized as a public design among those constructed throughout Europe since 2000 and considered to be oriented toward urban sustainability. There were 15 cases in the northern region, 28 cases in the middle region, and 22 cases in the southern region. The northern, middle, and southern regions were determined by the latitude being above, between, and below 44 and 54 degrees north respectively.

European countries share a similar cultural and ethnic background, but also show prominent regional differences. Because there was a vast amount of cases of public architecture, we went through the process of establishing the hypothesis based on a sample survey, and then doing an in-depth analysis on recent cases which were frequently referred toward urban sustainability. Finally, in Section 4, we tried to derive the issues to consider public architecture design toward urban sustainability (Figure 1).

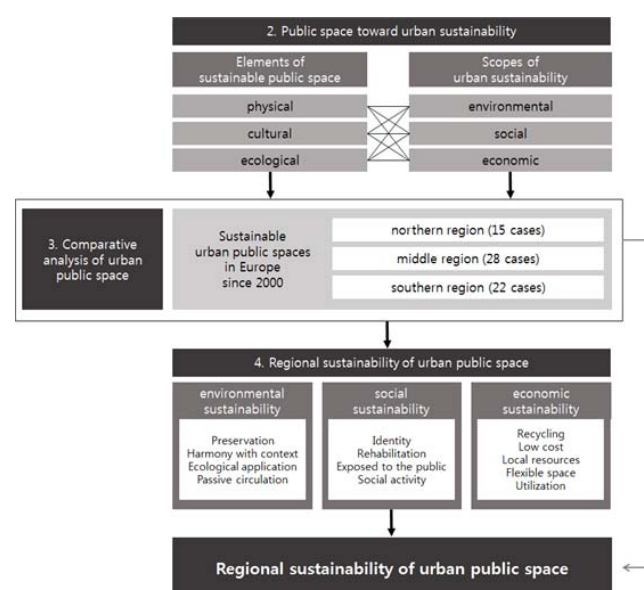


Figure 1. Logical connections between chapters.

## 2. Public Space towards Urban Sustainability

### 2.1. Urban Design and Public Space

Urban design provides probably the most important tool in the creation of a sustainable society [3]. In an international context, the theories and ideals that dominate today's urban design discourse have been defined and categorized in various ways, resulting in differing categorizations and definitions, such as "territories of urban design", "images of perfection", "urban design force fields", "integrated paradigms in urbanism", "urbanist cultures and approaches to city-making", "new directions in planning theory", "models of good design", and "typologies of urban design". However, the three dominant ideals that stand out are new urbanism, post urbanism, and sustainable urbanism (Haas, 2008, 2012), with other important categories—such as everyday urbanism, ecological urbanism, and landscape urbanism—qualifying as runners-up. In the end, all share a concern with shaping and composing public spaces; and creating livable and healthy places of variation, interest, familiarity, interaction, and contrast. However, they were different in approach. Some work in the traditional way, of advocating public squares and perimeter blocks as integral to the shaping and composition of cities, based on historical and proven principles (new urbanism and sustainable urbanism); while others turned to vanguard approaches, referring to globalization, mediatization—meaning a theory that argued that the media shapes and frames the processes and discourse of political communication, as well as the society in which that communication takes place—and contemporary architectural transformation (post urbanism, city marketing, and place branding schemes). Some looked for narratives and hidden dimensions in the micro-sphere of the public realm (everyday urbanism), and still others turned to solutions connected to urban ecological design and systemic landscape design schemes (ecological and landscape urbanism) [4].

Most often writing themselves into the long tradition described above, these approaches all shared a bias toward speculative theory, wherein the analytical support for the solutions proposed was often elusive. This places considerable stress on practice in the field, which as a result lacked knowledge support when facing the major new knowledge challenges that arose from global demographic and consumption changes, growing social inequalities, peak oil, global warming, and biodiversity loss (Brito and Stafford-Smith, 2012). As the world becomes more urbanized, and the majority of people live in cities and urbanized and suburbanized regions, cities needed to be in the forefront of dealing with these urgent issues. We also saw how these changes were starting to make an impact, altering the requisites for future planning, urban design, and the role of the professional as we knew it [5].

In contemporary times, we consider not only the public space itself, the physical aspects it contains, but also various elements beyond them. The reason for this is that public space requires close interaction with the various elements it holds for sustainability, because sustainability can only be obtained when considering cultural and ecological interactions, as well as physical permanence.

In this context, sustainability is conceived in terms that include not just practices tied to development but also forms of well-being and social bonds, community building, social support, and urban infrastructure renewal. Processes such as urbanization and globalization have been changing the nature of community [6].

### 2.2. Sustainable Public Space in the Urban Context

Interest in public space has a profound history. Historically, public space which originated from long-established community characteristics, such as the ancient Greek Agora and the Roman Forum, was a "reflection of the social solidarity and community life of the citizens". According to Jurgen Habermas, "Public space is a physical space where the public domain is expressed in space, and it is a real public space of urban democracy that guarantees social interaction and political action among members of society". Therefore, public space was based on very political and communicative publicity. Political and communicative expression was also based on free participation and the understanding of others. These public spaces constituted "places" as a realm of various forms of participation and

understanding, and the place of public space was an aggregate of all the elements that defined its character, such as traffic, history, culture, and so on, as well as physical elements. Public space in this context was a space that the masses of the people used for various purposes, and thus secured its publicness. Matthew Carmona emphasized the specificity of the culture of each region, the particularity of the people living in the area, and the need for the characteristics the place had, rather than the uniform approach of globalization in planning and designing the public space of the city [7].

In the urban public space, the background of the interest in and necessity of sustainable design can be found in the macroscopic change of the global environment, each country's trends in the process of global agreement change and implementation, and thus urbanization and increase in the desire for public space improvement [8].

The study of public space should focus on the various types of tangible and intangible elements that make up the city, and also consider the ecological factors in the direction of sustainable cities. The classification of sustainable public space components can be divided into physical components, cultural components, and ecological components. Table 1 below shows the detailed components.

**Table 1.** Categories of sustainable component [7].

Physical component	Scale	Large (square type), small size, pocket space, etc.
	Spacial form	Open type (free type), straight type (straight type), curved type (irregular type), network type, etc.
	Location	Residential area, commercial area, industrial area, etc.
	Facility	Landmark, street facilities, etc.
	Accessibility	Walk, public transportation, cars, etc.
Cultural component	Materials	Pavement, surface and construction materials
	Contents	Cultural community, cultural programs, etc.
	Context	Cultural connection with surrounding environment etc.
	History	Local historical facts, tales, etc.
	Function	Rest, activity, move, play, versatile, etc.
Ecological component	Users	User characteristics, size, usage time, etc.
	Vegetation	Shield, full layer, accent, harmony, comfort, etc.
	Water	Experience, emblem, decoration, etc.
	Sound	Natural sound, artificial sound, noise, etc.
	Lighting	Daytime natural light, night illumination, night scenery, etc.
	Wildlife	Natural habitat

### 2.3. Scopes of Urban Sustainability

The sustainable development paradigm pursued in modern society is explained as covering economic, environmental, and socio-cultural factors. Each perspective has a systematic role to play. The economic aspect focuses on the welfare of people, and is responsible for services including supply, consumption, and production of goods. The environmental aspect is focused on maintaining the local ecology. The socio-cultural aspect is responsible for the quality of human life, and harmony through socio-cultural diversity. For the scope of sustainability, many scholars discuss three dimensions: these are environmental sustainability, social sustainability, and economic sustainability. In 2002, the World Summit on Sustainable Development (WSSD) also adopted the Johannesburg Declaration, which is designed to promote the balanced development of the environment, society, and economy [9].

The goal of sustainable design is to eliminate negative environmental impacts through skilled and sensible design, to exclude non-renewable resources, to make the least impact on the environment, and to symbolize the connection between natural environment and humans. Sustainable design has been applied in all human-related fields. Sustainable design from an urban perspective has been based on the views of many scholars. Urban sustainability could be classified into three scopes. Each viewpoint corresponds to a domain or system with a distinct driving force. The economy is geared towards improving human welfare mainly through increases in the consumption and production of goods and services. The environmental domain mainly focuses on protecting the integrity of ecological systems. The socio-cultural system seeks to enrich the human dimension by harmonizing social relations and cultural pluralism. Culture may be viewed as the glue that binds together all other concerns and becomes one of the main issues of sustainability in this century. Culture provides the building blocks

of identity and ethnic allegiances and moulds attitudes to work. It underlies political and economic behavior. Most importantly, it builds the values that can drive collective action for a sustainable future in the new global context [9].

According to the Sustainable Communities Plan, sustainable communities are places where people want to live and work, now and in the future. They meet the diverse needs of existing and future residents, are sensitive to their environment, and contribute to a high quality of life. They are safe and inclusive, well planned, built and run, and offer equality of opportunity and good services for all [10].

The first scope of urban sustainability is environmental sustainability. The goal is to maximize the efficiency of land use through the conservation of energy and of natural terrain, the minimization of pollution, creation of parks and green areas, securing of open space, and the maximization of land use efficiency through multi-dimensional and complex development [8]. This includes a comfortable environment, a passive circulation system for natural ventilation, and recycling. Ultimately, considering the long-term impact of urban development on the environment, we must reconsider the value of the ecosystem as the sole source of supply of air, water, and soil on which human beings and all life depend, in addition to efficiently utilizing existing natural resources. Specifically, it includes revitalization and maintenance of the natural environment through restoration of natural resource utilization and reuse facility systems, greening, and water circulation systems [10].

A passive circulation system is a planning element to realize environmental sustainability. It refers to sustainable architectural requirements in an environmental sense. The most important planning requirement for sustainable buildings is to provide natural circulation and self-sustainable measures for temperature control of the internal environment, without resorting to any mechanical devices. Above all, it is necessary to empty building complexes for ventilation and circulation.

The second scope is social sustainability, which aims to preserve historic buildings and places, to preserve social norms, customs, and values, and revitalize local communities. Based on this, we want to implement cultural and local identity, accessibility, safety, and the redistribution of space [9]. Urban communities should be dealt with in terms of the social and cultural aspects of the region. In addition, efforts should be made to develop local communities by the voluntary participation of residents, and to take over the cultural elements of the region in the process of urban development. The creation of public spaces to promote social interaction with local residents and to revitalize communities should be combined with high accessibility to various social facilities. Plans for public spaces should not be a temporary solution, but should be able to evolve continuously and adaptively in the future [11].

Through outdoor space, the “Ground” could be manipulated around the building. This is an important planning factor that determines whether the relationship between the building and its surroundings is sustainable. Therefore, amenity and mobility are planning elements that embody social sustainability [12].

The third scope is economic sustainability. The goal is economic growth, reduction of development costs, mitigation of the gap between classes through the securing of urban infrastructure and amenities, and quality of life. This is achieved through balanced relationships, efficient growth and development, and improved productivity [9]. This started with the recognition that environmental resources are limited in meeting the needs and wishes of the present and future generations. In other words, economic sustainability is recognized as a consideration for maintaining stable development of urban and regional economies hereafter by harmonizing resource utilization, direction of investment, and direction of technology development. Specific measures for these include energy conservation, development of new materials, recycling of materials facilitation of remodeling, logistics cost reduction in the development area, and transportation systems for energy saving [11].

Depending on how complexity is implemented, the physical and visual areas of each element can be exchanged. It is possible to realize various effects of complexity, such as the boundary between the inside and the outside, and external conditions such as earth, walking, and green space being



infiltrated into the inside of the building. This could be expressed as flexibility. Thus, complexity and flexibility are planning elements of economic sustainability [12].

K.C.Boyce, Deputy Executive Director, Membership and Regional Impact, ICLEI-Local Governments for Sustainability, discussed how progress toward sustainability might be measured in the region. He presented the STAR Community Index, which used comparative analysis to provide a common way of measuring progress in sustainability economic, environment, and equity indices [13]. Urban sustainability can be realized by the complex interaction of these three scopes.

### 3. Comparative Analysis of Urban Public Architecture

As the physical boundaries between cities have been broken down, the environment has become an important variable in urban design [14]. European countries, in particular, share a similar cultural and ethnic background, but also show prominent regional differences. Therefore, the architectural, landscape, and urban devices based on the public urban space, are divided into northern, middle, and southern regions, according to regional characteristics (Figure 2).

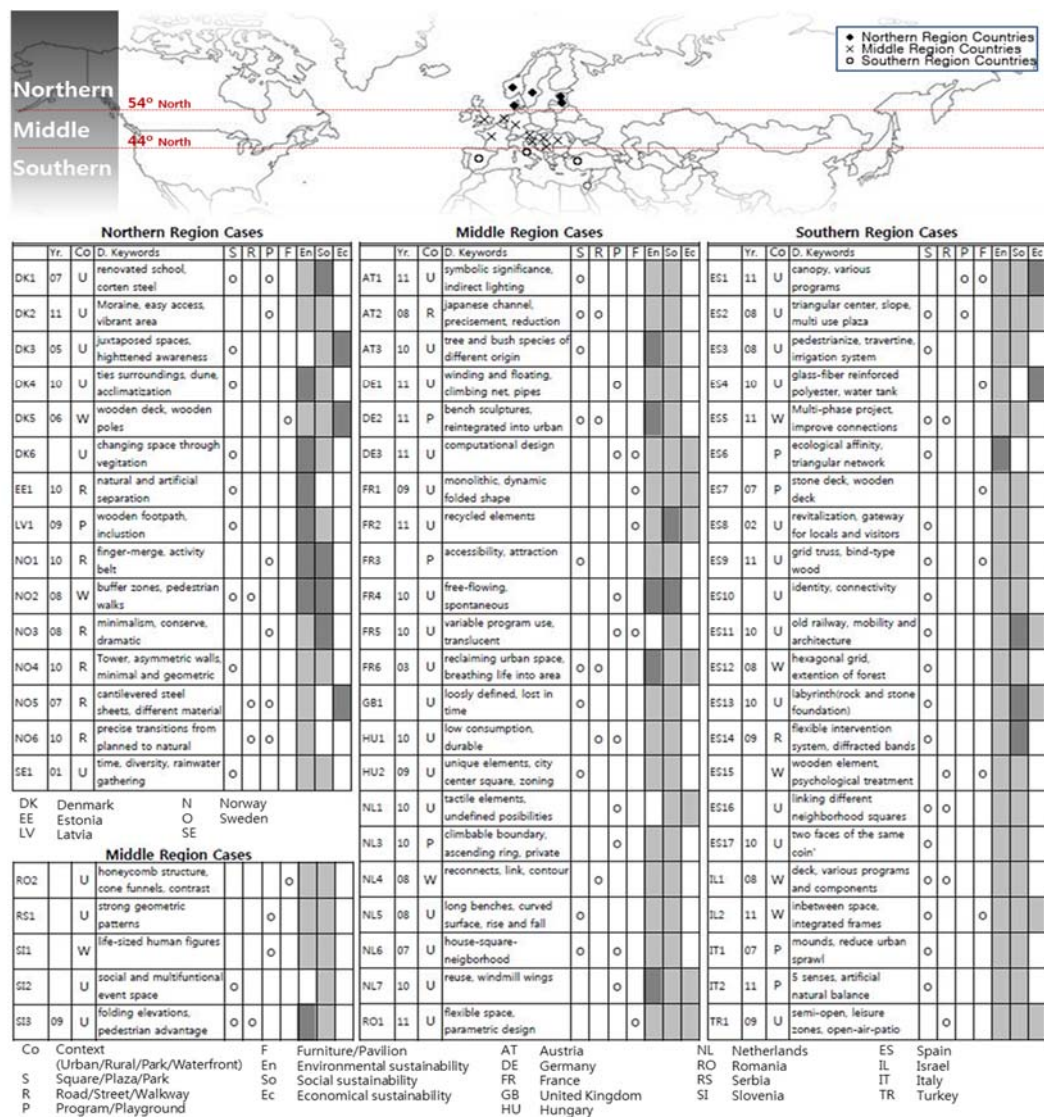


Figure 2. Map of regional sustainability [15].

### 3.1. Northern Region

The northern region of Europe consists of the countries of Denmark, Estonia, Latvia, Norway, and Sweden. The *Nicolai kultur center* (DK1), located in Kolding, Denmark, and completed in 2007 on a 3400 m<sup>2</sup> site, serves as both a street and a square in the city center. It shows economic sustainability, in that development costs were reduced by utilizing urban infrastructure as a renovated school facility. By using thermoplastic paint and corten steel sheet, which are eco-friendly materials, the development aimed to realize environmental sustainability by minimizing pollution. In order to reuse existing space rather than new construction, the purpose was to preserve the place and value of the school, by preserving the symbolism of the past. In this respect, a social sustainability approach has emerged.

*Fluent landscapes* (DK2), located in the city of Malov, Denmark, was completed in 2011 on an area of 1000 m<sup>2</sup>, and is located in the center of the city. It is a space with the theme of moraine, and it is directed to an active space that is easy to access. In terms of environmental sustainability, the space forms a valley shape due to glacier erosion that is suitable for the area and surrounding environment. In terms of social sustainability, it is easy to access and use, by linking parks and lakes to each other.

*The Frederiksberg new urban spaces* (DK3), located in the Frederiksberg area of Denmark, were completed in 2005 through two stages on a 1.8 ha site. These are urban plazas filled with ideas of various aspects, such as overlapped space, change, coincidence, mutation, recognition of movement, climate, and seasons. The environmental characteristics of the spaces change according to seasonal changes, so that the environment and a natural ventilation system were possible. The aspect of complexity and flexible utilization of spaces, by overlapping spaces with various characteristics within one space, is characteristic of economic sustainability.

*The city dune* (DK4), located in Copenhagen, Denmark, and completed in 2010 on a land area of 7300 m<sup>2</sup>, is a city center square that focuses on climate adaptation, and the integration of surrounding land conditions. In terms of environmental sustainability, it is remarkable that the overall situation around the site is considered. It is also characterized by the fact that it is designed to reflect ultraviolet rays in the season of high temperature, the weather condition is adjusted in the ground by an external humidifier, and all the rainwater is treated in the ground through pipes. Designed to remind users of the sand dunes in northern Denmark and snow hills in the winter, social sustainability has emerged as one of the ways to bring local identity to life.

*The Esberg beach promenade* (DK5), located in Esbjerg, Denmark, is a timber fixture that was built in 2006. Wooden decks and pillars are installed in the form of piers. This promenade shows aspects of environmental sustainability in terms of using wood, which is an environmentally friendly material. The characteristics of social sustainability are seen in the fact that it pursued culture and local identity by providing conditions that mean that the place can be used in various ways according to the tide, and causing curiosity about the place. It has shown economic sustainability, in that the stuff, such as hammocks and nets, can be practically applied to the fixture in case of necessity, and maintenance cost is saved.

*Charlotte garden* (DK6), located in the city of Copenhagen, Denmark, spreads over 1.3 ha of land. It shows environmental sustainability, in that the whole form is expressed in the form of organic curves, and planting is made considering the seasons. In order to expand the availability to the public, social accessibility has been improved in terms of physical accessibility, changing landscape, and pursuing change in images using lighting [16].

*Open air exhibition grounds* (EE1), located in Varvuse, Estonia, was completed in 2010. It is a square park on the plains of the suburbs, and serves as a public space, excluding the museum space. It shows the characteristics of environmental sustainability, in that it separates the natural and artificial elements, and keeps the remaining space as close as possible to a natural state, except for the specific space.

*Dzintari forest park* (LV1), located in Jurmala, Latvia, was completed in 2009 on an area of 131,108 m<sup>2</sup>. It is a resting and leisure space located in the park, and provides a walkway with a wooden deck. By incorporating nature into the city infrastructure, economic sustainability is implemented, in terms of reducing development costs and securing amenity through urban infrastructure. It is focused

on making public use of the habitable natural environment, which is difficult to access in general, and achieves social sustainability by encouraging people to approach using inline skates, walking paths, and resting places. It shows environmental sustainability, in that it tries to include the city in nature, and uses a wooden deck that matches the prevailing situation of the forest [5].

*The Rommen school and cultural center* (NO1), located in Oslo, Norway, was completed in 2010 on a site of 36.2 ha. Located on the outskirts of the city, it has amusement facilities for children of all ages, and has a characteristic layout that consists of programs with an activity-belt band. It also aims to realize environmental sustainability through greening of the ground layer, which facilitates rooftop greening and rainwater handling. By forming a green space with a gentle slope of 1:20 over the entire area, a barrier-free area was realized at the same time, it became natural scenery that shows seasonal changes with various plant species distribution. Therefore, it shows social and economic sustainability in order to secure the amenity of the city.

*Nansen park* (NO2), located in Oslo, Norway, was completed in 2008 on 200,000 m<sup>2</sup> of land. It serves as a walking area as a waterside park and a side street. It is intended to achieve spatial integration with the surrounding parks, and the fact that it constitutes a buffer zone between the city and nature is characteristic of environmental sustainability. It shows social sustainability, in that it plays a role as a new center for large-scale rehabilitation projects, and promotes the formation of local identities.

*The Aurland lookout* (NO3), located in Aurland, Norway, was completed in 2008 on a 120 m<sup>2</sup> site. It is located overlooking the water and designed with emphasis on minimalism and dynamism. The attempt to keep the land in a natural state appears to be an aspect of environmental sustainability. On the other hand, it shows social sustainability, in that it emphasizes the lack of presence, in order not to harm the surrounding context.

*The Solberg tower & rest area* (NO4), located in Sarpsborg, Norway, was completed in 2010 on a 2000 m<sup>2</sup> site, with squares and public areas in the suburbs serving as a resting place. Starting from the tower in the square, it is characterized by asymmetrical walls, shapes of geometric minimalism, and materials representing the flow of time. From the viewpoint of environmental sustainability, it is characterized by the use of eco-friendly materials made of wood in the resting space. The location of the tower with the symbolism of the center shows the social sustainability aspect.

*The Gudbrandsjuvet* (NO5), occupying 350 m<sup>2</sup>, was completed in 2007. It is a prospective resting place located in the suburbs, and features cantilever steel plates and various materials. Environmental sustainability can be confirmed by selecting materials that blend well with the surrounding landscape. The cantilevered structures show economical sustainability, in that they were factory produced, and use pc concrete.

*Trollstigplataet* (NO6), located in Fjord, Norway, was completed in 2010 on a site of 150,000 m<sup>2</sup>. It is an observatory and a promenade in the suburbs and emphasizes the transition between natural and artificial elements. Additionally, it shows environmental sustainability, in that it uses the natural elements in the vicinity, such as water and snow, as dynamic elements.

*Anchor park* (SE1), located in Malma, Sweden, was completed in 2001 on a 2.9 ha site. It is designed emphasizing a sense of time and diversity as a park in the center of a city. In addition to collecting and using excellence, it also shows environmental sustainability as well as economical sustainability, in that it uses native stone and various species of plant material for landscaping [17]. Comparative analysis of northern Europe public architecture are summarized in Figure 3.





**Figure 3.** Comparative analysis of northern Europe public architecture [18].

### 3.2. Middle Region

The middle region of Europe consists of Austria, Germany, France, the UK, Hungary, Latvia, Netherlands, Romania, Serbia, and Slovenia. *The Eduard-Wallnofer-Platz* (AT1), located in Innsbruck, Austria, was completed in 2011 on an area of 9000 m<sup>2</sup>, has a symbolic character as a square in the city center. It is characterized by night-time indirect lighting, and emphasizes the harmony of slope, flat ground, and stairs in the site. In terms of environmental sustainability, the nature-friendly tendency of a curved floor and voids in urban space are provided. It has shown social sustainability, in that it is designed to play a universal role, such as creating programs and spaces for men and women of all ages, providing drinking fountains with variable heights, and providing local identity by acting as a symbolic center.

*Roman quarry redesign* (AT2), located in St Margarethen, Austria, was completed in 2008 on an area of 5580 m<sup>2</sup>. It shows social sustainability, in that it plays the role of a citizen space that emphasizes the identity of the region by remodeling the existing mine sites. From the viewpoint of environmental sustainability, rather than transforming the terrain further, it tried to maintain the existing state.

*Arboretum Klinkum* (AT3), located in Carinthia, Austria, was completed in 2010 on a site of 60,000 m<sup>2</sup> in the center of the city. The landscape planning, using a variety of edible wild plants and trying to prevent allergies, shows the aspects of environmental sustainability. In terms of social sustainability, it forms an overall unified theme while each space has its own identity [16].

*The Sculptural Playground* (DE1), located in Wiesbaden, Germany, was completed in 2011. It is a public space serving as a street and park and is characterized by its sculptured benches. In terms of environmental sustainability, it provides open spaces and programs, rather than playground facilities that are blocked. Additionally, the project shows social sustainability, in that it functions as a public space through the play equipment.

*Park am Gleisdreieck* (DE2), located in Berlin, Germany, was completed in 2011. It is a public space serving as a street and park and is characterized by its sculptured benches. In terms of environmental sustainability it tries to make wide grass fields and regenerates the site for creating a public park.

Social sustainability can be felt in the approach of transforming the image of the abandoned land, and integrating the space into the city.

*Treehugger, One Fine Day* (DE3), located in Koblenz, Germany, was completed in 2011, and plays the role of a public space in the city center. It shows environmental sustainability through the use of environmentally friendly materials and creating space around existing trees. It also shows social sustainability, in that it plays the role of meeting place in the urban space, and it also shows economical sustainability, in that it uses economic materials generally [18].

*A canopy and a pavilion* (FR1) is located in Paris, France. It is a 252 m<sup>2</sup> pavilion in a residential area, and was built in 2009. It is characterized by a dynamic structure using a single material and a single color. In terms of environmental sustainability, open spaces and shade are created. In terms of social sustainability, it can play the role of contributing to regional symbolism, due to its unique form. In terms of economical sustainability, it is a structure painted with a single material.

*Holding Pattern* (FR2), located in Paris, France, was completed in 2011. It is an example of transforming its image using a scaffold. In terms of environmental sustainability, the shade is partly made up of fixtures, and furniture is installed using recycled materials. From the point of view of social sustainability, it is remarkable, in that it led to citizen participation through events and the rest space. It has shown economical sustainability, in that it involves various activities in the use of the space.

*Lyon meadows park* (FR3), located in Champagne province, France, is designed to maximize accessibility and usability over an area of 6 ha. The environmental sustainability can be felt in the composition of the green space and the open space, and the natural rise and fall of the earth. In terms of social sustainability, it is a park that functions as a program for inducing various people.

*Playground in Belleville Park* (FR4), located in Paris, France, was completed in 2010. It is an urban public space with a free flowing and natural form. It shows environmental sustainability, in that it uses the original terrain of the land to make the most of the slopes, and uses environmentally friendly materials in this process. The social sustainability ranks well, in that it serves as a playground, and is well integrated with the surrounding landscape.

*Georges Environment* (FR6), located in Toulouse, France, occupies a site of 10,000 m<sup>2</sup>. It is a public space with parks and streets located between downtown buildings. In terms of environmental sustainability, it creates green spaces and open spaces for good ventilation. We showed social sustainability in terms of redistributing urban spaces and rejuvenating specific areas. In terms of economical sustainability, it also plays a role in connecting commercial areas [19].

*Brixton Square* (GB1), a square located in the center of London, UK, has been designed in a vague form that has lost its sense of time. It shows social sustainability in its efforts to secure the openness of the urban space and also shows the characteristics of environmental sustainability, in that it functions as a landmark in the city. It also shows the characteristics of environmental sustainability, in that it plays a role as a pleasant open space.

*The 3K—phase 1* (HU1), located in Budapest, Hungary, was completed in 2010. It is a public space in the city center, serving as a street, and providing rest to the citizens. It shows environmental sustainability, in that LED lighting was installed as a major light source emphasizing sustainability and low energy. The characteristics of social sustainability were characterized by activating the landscape using night-time environment.

*Ubada city center* (HU2), located in Budapest, Hungary, was built in 2009. The center of the city is highlighted with unique elements, centrality, and zoning. It shows environmental sustainability, in that it forms voids in urban areas. Social sustainability is implied through the use of the existing parking space as the public plaza, and allowing free use to the public. *The Dzintari forest park* (LV1), located in Jurmala, Latvia, was completed in 2009 on an area of 131,108 m<sup>2</sup>. This space is a park where the wooden walkway stands out. It is a characteristic example of efforts to make part of nature a part of the infrastructure. It shows environmental sustainability, in that it uses eco-friendly materials that fit the surrounding environment, and tries to include the city in nature. In addition, social sustainability

is shown by installing various programs, such as inline skates and walking trails, which encourage many people to approach [4].

*Van campenvaart playground* (NL1), located in the Hague, the Netherlands, was completed in 2010. This is characteristic of the playground in the city, which leads to strategic elements and undefined coincidence. The elements of social sustainability can be found in the inclusion of various elements, such as lamps, and hammocks for children with disabilities and non-disabled children to play together. In addition, as the whole program rises and falls according to individual ability, and various paths are established to encourage mutual cooperation, a lot of programs are put into one space. From this point of view, economical sustainability can be seen.

*Melis stoke park* (NL3), located in the Hague, the Netherlands, was completed in 2010, and serves as a playground space in the park. Environmental sustainability is characterized by the use of environmental materials to match the surrounding context. Social sustainability is also shown, in that children can feel more secure than in places that are fully open, and in that they are able to block visibility appropriately and induce diverse activities through branch-like designs.

*Maaskade Cuijk* (NL4), located in Cuijk, the Netherlands, was completed in 2008 on an area of 11,000 m<sup>2</sup>. It takes the form of a street on the waterside, and is an example of focusing on connectivity. In terms of environmental sustainability, flow is induced by continuing the separated space, and the open space leads to a sense of openness in the water. In terms of social sustainability, it plays the role of a waterside park walkway to utilize the environmental advantages of the waterside.

*The Arena boulevard/Amsterdamse poort* (NL5), located in Amsterdam, the Netherlands, was completed in 2008 on a 4.2 ha site. It is an example of a square located in the city center that focuses on the rise and fall of long benches, curved surfaces, and land made of wood and natural stone. In terms of environmental sustainability, it forms an open space suitable for functioning as a square. Regardless of the number of users, it has tried to create a comfortable environment, and it shows social sustainability, in that it is attracting people through the creation of a unique and cozy space through lighting on the street at night.

*Van Beuningenplein* (NL6), located in van Beuningenplein, the Netherlands, was completed in 2001, and is a park and playground in an urban space. It has the purpose of connecting the residence, square, and neighborhood. Environmental sustainability can be found in a design that provides a well-ventilated rest area by installing a semi-exterior space, and a tree that protects it from nature. In terms of social sustainability, the city has been transformed into a city space for citizens by restricting access to cars.

*Wikado Recycled Playground* (NL7), a playground located in urban space in Rotterdam, the Netherlands, was completed in 2010. Environmental sustainability is well implemented, in that the wind turbine, which is also a symbol of the Netherlands, was reused as a play space, and the use of recycled materials was considered from the design stage. It is remarkable that in terms of social sustainability, the playground itself performs the functions of open space, and reveals the regional characteristics. Economical sustainability has also been partially realized, because it is possible to reduce costs by using recycled elements [19].

*Za11 Pavilion* (RO1), in Cluj-Napoca, Romania, built 2011, is a pavilion in the center of the city that creates a flexible and comfortable space. The principle of formation is through parametric design, and it has a hexagonal structure. It shows environmental sustainability, in that it is a prefabricated eco-friendly structure. In terms of social sustainability, it is installed over a wide walking distance, enabling an accidental meeting with an event in a simple area. In terms of economical sustainability, it is made of prefabricated wood and is economical, and it shows the characteristics of a pavilion.

*Hexitloo pavilion* (RO2) is an installation located in the city streets of Bucharest, Romania. It has the basic structure of a honeycomb, similar to a funnel. In addition, the inversion of inside and outside is characteristic. In terms of environmental sustainability, it can be easily disassembled and recycled in the form of cardboard. It also shows the characteristic of good ventilation of the movable space, and shows social sustainability in inducing events on a street with daily characteristics.

The USCE shopping center (RS1), an urban shopping center in Belgrade, Serbia, presents an intense geometric facade. Environmental sustainability is partly due to the fact that it is a horizontal mass, and considers the surrounding elevation structure. It is located in a place where a river meets a wide urban park, and the pattern sense indicating geographical identity shows social sustainability, in that it represents regional identity.

General Maister memorial park (SI1), located in Ljubno ob Savinji, Slovenia, is located on a 1500 m<sup>2</sup> site. It is a waterside memorial hall with distinctive human-scale sculptures. In addition, the floor and the sculptures that create the green space give rise to an artificial sensation that contrasts with the surrounding landscape. The park shows environmental sustainability, in that it is landscaped regardless of the viewpoint of the riverside. The fact that the memorial is reproduced through natural space gives a glimpse of social sustainability.

Comparative analysis of middle Europe public architecture are summarized in Figure 4.

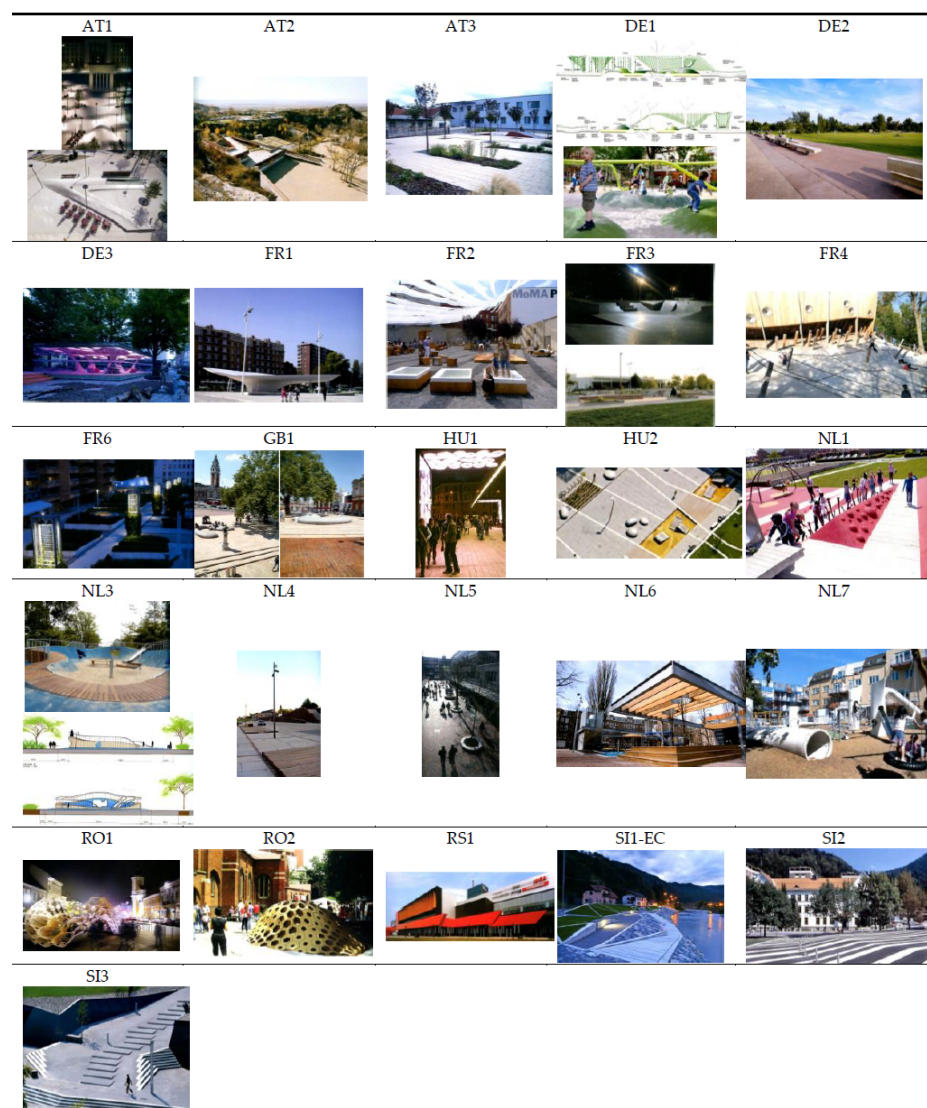


Figure 4. Comparative analysis of middle Europe public architecture [18].

Cufar's Square (SI2), occupying an area of 3000 m<sup>2</sup> in Jesenice, Slovenia, is a space designed to diversify social events and activities in the city center square. In terms of social sustainability, it can be said that it provides an open space for citizens, and has other features installed in the form of fountains.



*Orhidelia Wellness* (SI3), located in Podcetrtek, Slovenia, was completed in 2009 on a site of 9990 m<sup>2</sup>. It is a square and street-like space in the city center. It is characterized by a folded level and pedestrian-oriented design. In terms of environmental sustainability, efforts to minimize the traces of the building are outstanding, and attention to natural slopes and landscapes is prominent. Social sustainability has also emerged in the emphasis on this sense of place [17].

### 3.3. Southern Region

*The Merida factory youth movement* (ES1), a public space located in the city center of Merida, Spain, was completed in 2011 on an area of 3090 m<sup>2</sup>, and serves as a container for youth culture. The characteristics of this space include internal programs and a geometric canopy that is 1 m in thickness. In terms of environmental sustainability, it is worth noting that separate cooling is unnecessary, due to the 1 m thick canopy. It also provides shade of its own, as well as the arrangement of trees in the structure. It was designed to accommodate as many programs as possible in the space, and the fact that the entire space is available at night due to the lighting inside the night canopy shows social sustainability. Economical sustainability is evident in that space has been constructed to maximize program acceptance, and energy savings due to the absence of cooling.

*Municipal market building and plaza* (ES2), a facility located in Barcelona, Spain, was completed in 2008. It has a total area of 9700 m<sup>2</sup>, and is a park and play facility. It has the characteristics of a triangular center, a ramp, and a square that can be used for various purposes. In terms of environmental sustainability, it has water space, and gives life to the surroundings. In addition to the role of the playground, it strengthens the connection between port and city, and provides social activities that encourage children to use it dynamically. Economical sustainability is found, in that it has a positive effect on the surrounding commercial areas, through the enhancement of regional vitality.

*Banyoles old town public space* (ES3), located in Banyoles, Spain, was completed in 2008 on an area of 18,000 m<sup>2</sup>. As the title suggests, it is a square in the center of the city, with small spaces in the center of roads between public buildings creating public spaces. It is characterized by collecting rainwater into a stone space. It shows social sustainability, in that it strengthens the locality by using the same materials that fit well with the surrounding environment and area. Economical sustainability is evident as a result of restructuring the existing rainwater dispenser system, and transforming it into water space that is available to children.

*Informab10 pavilion* (ES4), a pavilion located in downtown Madrid, Spain, was built from 2009 to 2010. It is characterized by a water tank of which reinforced polyester component is the main material, and it has about 100 circular openings. In terms of environmental sustainability, the space is completed with a small amount of material, and the ventilation is smooth through many openings. The use of standardized materials has led to economical sustainability, in that it is more economically efficient.

*Madrid Rio* (ES5), a project in Madrid, Spain, was realized in 2011, and covers an area of 800 ha. It is a large-scale project with many stages, and is a park and a space along the waterside. The project started with the objective of enhancing the connectivity of the existing watersheds. In terms of environmental sustainability, the flow of space follows the river, an urban element. Here, the civic space following the city context is also considered as social sustainability.

*El jarddin Botánico de Barcelona* (ES6), a park on the outskirts of Barcelona, Spain, is divided into five Mediterranean regions, characterized by nature-friendly tendencies and a network of three-tiered structures. From the viewpoint of environmental sustainability, efforts to minimize transformation of the shape of the earth were outstanding. As a result, it can be interpreted to form a network of triangles, and is excellent in reproducing the native environment of the five regions of the Mediterranean Sea.

*The Monjuic garden and pavilion* (ES7), located in Barcelona, Spain, was built on a 1500 m<sup>2</sup> site in 2007. It is a pavilion located in a park, and features a stone deck and a wooden deck. In terms of environmental sustainability, factors such as the composition of horizontal mass and garden are noticeable, and show social sustainability, in that it strengthens the sense of locality due to the design



connectivity with surrounding buildings. The use of recycled materials has created economical sustainability, in that it has economic advantages as sustainability increases.

*Park diagonal mar* (ES8), a city park located in the center of Barcelona, Spain, was completed in 2002, and restores the vitality of the area and serves as a gateway for local residents and visitors. In terms of environmental sustainability, it is characterized by reuse of rainwater, landscaping with native planting, and habitat for native birds. It has social sustainability, in that it provides a space for gathering by functioning as a square and a park [19].

*Metropol Parasol* (ES9), located in Seville, Spain, was completed in 2011. It is a pavilion in the center of the city, and provides shade to the city. In terms of environmental sustainability, the porous structure, and thus the shade formation and the prefabricated use of the environmentally friendly material wood, are noteworthy. Social sustainability is shown, in that the square that is the social space is formed under the generated shadow space. Economical sustainability is shown in the construction, which consists of grid trusses and prefabricated timber.

*Parc Central de Nou Barris* (ES10), a park located in Nou Barris, Barcelona, Spain, in an urban area of 170,000 m<sup>2</sup>, was completed in 2004, and emphasizes identity and connectivity. In terms of environmental sustainability, it can be noted that it provides green space composition, water space distribution, and open space. It shows social sustainability, in that the overall park layout is linked to urban organization.

*VIAS space* (ES11), an urban plaza in Leon, Spain, was completed in 2010, and is a modified example of a renewed railroad facility on over 1450 m<sup>2</sup> of land. In terms of environmental sustainability, it provides open space. The lines of dynamic tendency emerge because of the traces of the existing railway facilities, and emphasize the place that reflects historic memory. The possibility of change into citizen participation space is high, and economical sustainability can be achieved by securing economic efficiency by retaining a part of the pre-existing form.

*The Pinar de Perruquet park* (ES12), located in La Pineda, Spain, was completed in 2008 on an area of 28,000 m<sup>2</sup>. It is characterized by the use of a hexagonal grid, and the fact that it serves as an extension of the forest to parks and plazas on the waterside. In terms of environmental sustainability, we can refer to landscaping with various trees and vegetation in an open space. In terms of social sustainability, it emphasizes local identity and image by providing real trees and tree type landscaping connected with a program that attracts citizens.

*Ricard Vines Square* (ES13), located in Lleida, Spain, was built in 2010, and stands on a site of 9200 m<sup>2</sup>. It is characterized by the fact that it is represented by the use of stone in the inner city square. In terms of environmental sustainability, it uses a method of creating green spaces in the remaining space according to the bottom pattern. Social sustainability has been strongly shown in the fact that it is designed to be the subject of the user, by arranging a space where the diversity of a pedestrian center is felt. The change in function according to the user's intention leads to the aspect of economical sustainability.

*The Forum of Granada* (ES14), in Granada, Spain, occupying an area of 11,000 m<sup>2</sup>, provides a square and park space in the suburbs that feature a flexible system and a refracted band. In terms of environmental sustainability, green space and water space are created, and time-consuming materials are used. It shows social sustainability, in that it is designed to permit the natural influx into each place through the use of slope.

*Negras Waterfront* (ES15), located on the waterside of Almeria, Spain, is a space with a facility for visitors. In terms of environmental sustainability, the selection of environmentally friendly materials and the formation of horizontal objects appear. The wooden fixtures are reproduced as a space for the psychological stability of the people, showing social sustainability in the selection and function of material that is suitable for the function and purpose of therapy, which can strengthen the locality of the area.

*Las Arenas Square* (ES16), a street and plaza space that occupies an area of 22,000 m<sup>2</sup> in the inner city of Vizcaya, Spain, connects two remote areas. In terms of environmental sustainability, it is noteworthy that it prevents the open space in the city from being cut off, and induces urban flow.

In addition, in terms of social sustainability, it plays the role of connecting two squares, and forms a social gathering place.

*The Urban spaces and library park* (ES17), located in the city center of Torre Pacheco, Spain, was completed in 2010, with an area of 8500 m<sup>2</sup>. It is characterized by urbanized space, compatibility with the park, and “the same side of the coin”. In terms of environmental sustainability, rectangular mass, grass, and landscapes are seen, and in terms of social sustainability, the spaces function as local gathering places [18].

*Tel Aviv port public space regeneration* (IL1), located in Tel Aviv, Israel, was completed in 2007 on an area of 20,000 m<sup>2</sup>. The space is a recreational project on the waterside. In terms of environmental sustainability, we emphasized the use of eco-friendly materials and the city connection to the waterside, due to the connectivity of the eyes. Social sustainability is shown in the unique space created by curved floor and objects, as diverse programs and components induce a variety of coincidences.

*Sensational Garden* (IT2) located in Frosinone, Italy, was completed in 2011. It is a park that expresses the five senses in a metaphorical arrangement, and is characterized by the harmony of natural and artificial elements. In terms of environmental sustainability, the landscapes are distributed on the basis of the circular sculptures, and the development shows social sustainability, in that the unique identity of the program forms the identity of the program.

*The Asmacati shopping center* (TR1), located in Izmir, Turkey, was completed in 2009 on 22,760 m<sup>2</sup> of land. It is a horizontal space that connects the city space with a semi-exterior space, leisure space, and open patio space. From the viewpoint of environmental sustainability, the exterior space and the partial shade that can be ventilated are distinguished. Also, social sustainability has been shown in the formation of natural leisure spaces and the regional characteristics that favor outdoor activities [18].

Comparative analysis of southern Europe public architecture are summarized in Figure 5.



Figure 5. Comparative analysis of southern Europe public architecture [18].

## 4. Regional Sustainability of Urban Public Architecture

### 4.1. Environmental Sustainability

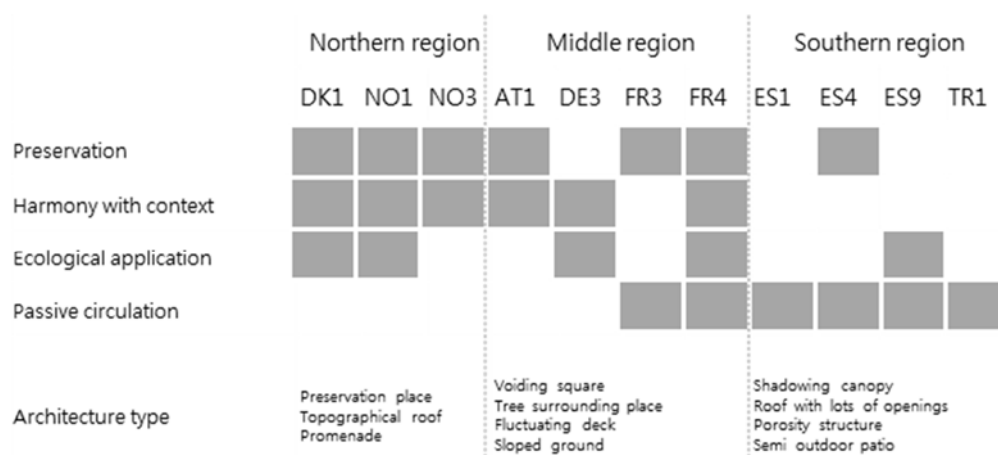
On the environmental side, efforts can be seen to secure sustainability by constructing a public space, or using materials to create a situation similar to the existing environment, or a more pleasant environment [9].

In the case of the northern region, trees and timber were utilized efficiently amongst the existing natural resources, leading to environmental sustainability. Additionally, environment-friendly materials were used to minimize pollution, and to create a pleasant environment. The Danish case DK1 minimizes pollution by using eco-friendly thermoplastic paint and corten steel sheets. In the case of Norway NO1, the rooftop was covered with planting material taken from the existing environment, and all the rainwater flowing into the ground was moved to the area where the vegetation was present. Case NO3 is also very impressive, in that the structure is made to look like a part of the original environment, by making the presence of the building blend in, keeping it as natural as possible, without harming the surrounding context.

The features that appear in the middle region not only utilize the existing natural environment, but also void it to create a natural environmental flow. In one of the cases in Austria AT1, a curved floor was formed to create voids in the urban space, with squares and landscapes, enabling the gathering of people and the natural flow of water. In Germany, in case DE3, eco-friendly materials and horizontal structures were used, in order to match the existing trees around the center, and create meeting spaces within the urban context. In the French case FR3, parks with vegetation and open spaces reflect the ascent and descent of nature. This formation of land maximizes accessibility and usability, showing environmental sustainability. FR4 is an example that shows the original terrain of the site being fully utilized to create a slope. Additionally, the eco-friendly materials used in this process also serve to keep the existing environment more pleasant.

In the southern region, the focus is on creating shade, lowering the temperature, and paying more attention to ventilation conditions. The ES1 case in Spain is designed to have a 1 m thick canopy to reduce the air temperature, so that no additional cooling is required. In the case of ES4, more than 100 circular openings are made in the existing abandoned water tank, creating a pleasant environment with good ventilation. Case ES9 is a pavilion on a hexagonal grid, using a porous structure and consequent shade formation and environmentally friendly prefabricated timber, which has been shown to be a beautiful and environmentally friendly architectural method. Some of the cases of Spain implement sustainability through a canopy or a pavilion with a porous structure. A building space that allows smooth ventilation using a grid truss or hexagonal grid with a large number of openings is also proposed. Stone and wood decks are frequently used in the area of active exterior activity. The intention to lower the temperature through the application of water is well shown. In Turkey, TR1 introduces a planned patio as a transverse space connecting urban space, allowing ventilation, comfort during hot times, and enabling outside activities, thus creating a more sustainable public space.

The characteristics of environmental sustainability can be summarized as preservation of the ecosystem, harmony with context, ecological application, and passive circulation. Figure 6 shows a comparison of the features of each region by frequency. In the Northern region, architectural devices such as preservation place, topographical roof, and promenade were commonly used. In the middle region, architectural places such as voiding square, tree surrounding place, fluctuating deck, and sloped ground were frequently seen. In the southern region, architectural objects such as shadowing canopy, roofs with lots of openings, porosity structure and semi outdoor patios were observed as typical types of public architecture.



**Figure 6.** Distribution of frequency by region in the characteristics of environmental sustainability.

#### 4.2. Social Sustainability

The social aspect shows public spaces where historical values can be left as traces of architectural places, kept in people's memories, or filled with programs in which citizens can gather and recess. In addition, the architectural method is more influenced by the cultural conditions, and shows variety, depending on the region [9].

The Northern region is focused on enhancing the locality by increasing the openness to places that have been partially disconnected due to environmental constraints. This is mainly done through the installation of trails and observation decks. Danish example DK2 is planned to facilitate access and use by linking parks and lakes to the north and south respectively, and is used as a public space to encourage diverse events to take place on the theme of mountain moraine. NO2, a Norwegian example, is planned as a large buffer zone and a walkway on the site, which not only achieves spatial integration with surrounding parks, but also plays a role as a new center for large-scale recycling projects and forms local identity. The NO4 case plays a role as a landmark in a suburban plaza, serving as a resting place, with its symbolic tower.

In the Middle region, active voluntary participation of residents in the socio-cultural aspect of the community is sought to activate the community. The Danish example DE1 shows a floor level variation in the vacated space leading to an interesting sense of space. Additionally, a new program was introduced, called a play space for children. Through the empty space, the integration with the generation of children becomes natural. In France, FR2 is a public space where people can gather, stay, and socialize using the established furniture made of recycled materials. The case of Slovenia SI3 is characterized by a folded level and a pedestrian-oriented design in the center of the city. Efforts to minimize the traces of the building are outstanding, and natural inclination and landscaping space play a role in highlighting the place.

The Southern region focuses on strengthening the linkages between the creation of public spaces that promote social interaction with local residents and the community, and providing a high degree of accessibility to various social facilities. The Spanish example, ES2, is a park and amusement facility that features a central triangle, ramp, and square that can be used in various ways. Along with the role of the playground, it plays a role in connecting the port and the city through the water space, and also helps revive the surrounding area.

The characteristics of social sustainability can be summarized as identity, rehabilitation, exposed to the public, and social activity. Figure 7 shows the comparison of the features of each region depending on frequency. In the Northern region, architectural devices such as stepped plaza, promenade, and tower appeared. In the Middle region, architectural sites such as playground, arcade, and stair plaza



were frequently seen. In the southern region, architectural objects such as waterfront deck, 5 sense garden, and deck plaza were typical types of public architecture.

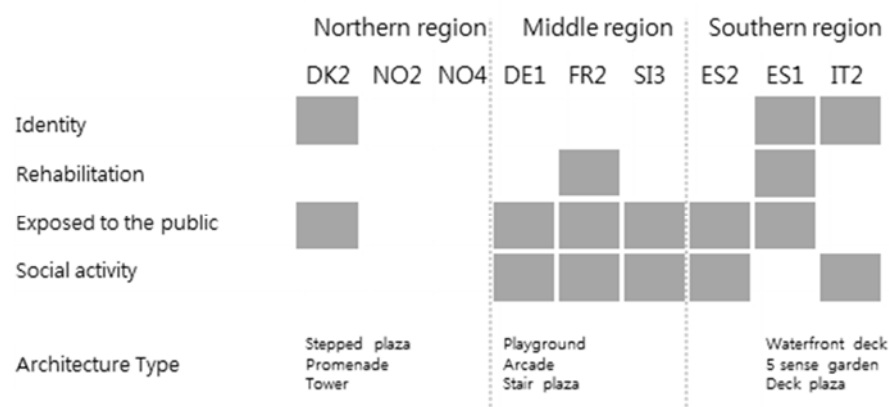


Figure 7. Distribution of frequency by region in the characteristics of social sustainability.

#### 4.3. Economic Sustainability

Economic sustainability is provided through the cost savings through the recycling of materials or facilities, or the reduction of energy using environmental factors. This differs according to the resources available in each environment, rather than depending on the region [9].

The Northern region is characterized by economic construction by utilizing timber from existing natural environments. The Danish example DK5 is a structure that consists of wooden decks and pillars installed on the waterside, making it possible to use the place in various ways, depending on the tide. Hammocks and nets are installed on the fixture, and are applied practically as needed to save maintenance cost, so not only the economic efficiency of the material but also the economic efficiency of the space utilization is sought. The Norwegian case NO5 is a prospect and resting place located in the suburbs, which is characterized by the use of cantilever steel plates and various materials. It is economically effective, because it uses local concrete materials that are well suited to the surrounding landscape, and pc concrete that can be produced in factories. Sweden's case SE1 is a park for walking in the city center, which not only collects and uses excellence, but also uses native stone and native species of various species for landscaping, which is not only cost-saving, but also environmentally friendly.

In the middle region, there are cases where the economic aspect is solved by architectural design. One example attempts various designs of sloping floors for the utilization of storm water. The French example FR1 is a single-material monochrome structure that creates open space and shade. Due to its unique form, it is a factor that adds to the symbolism of the region. The Hungarian example HU1 is a public space in the city center, which is a street that provides furniture that allows citizens to rest. LED lighting has been installed as the main light source, focusing on sustainability and low energy. The Dutch case NL7 pursues economic sustainability by reusing windmills in urban space, and transforming them into a playground, and applying recycled products from the design stage.

In the southern region, green areas and water areas, which are natural elements of each area, are actively utilized. This can be evaluated as an attempt to economically solve the treatment of rainfall with the effect of lowering the temperature. The shape is simplified, and the economic effect increased, through the use of minimal materials. The Spanish case ES3 is characterized by small pedestrian spaces between buildings creating public spaces, and gathering rainwater into the stone space used there. The economic efficiency is very high, in that it uses the same materials that are well suited to the surrounding environment and the area, and that it reconfigures the existing storm water system, and transforms it into water space that can be used by children. ES7 uses stone decks and wooden decks located in parks, each of which pursues economic sustainability through the use of recycled materials. ES8 is a city park located in the heart of the city, which restores the vitality of the area, and serves



as a gateway for local residents and visitors, maximizing economic efficiency by reusing rainwater, landscaping with native planting, and habitat for native birds.

The characteristics of economic sustainability can be summarized as recycling, low cost, local resources, and flexible space utilization. Figure 8 shows a comparison of the features that are highlighted frequently in each region. In the Northern region, architectural devices such as waterfront installations, observatory resting places, and promenade parks could be seen. In the Middle region, architectural places such as gathering monument, furniture arcade, windmill playground were frequent. In the southern region, architectural objects such as rainwater parks, deck pavilion, and watery park were typical cases of public architecture.

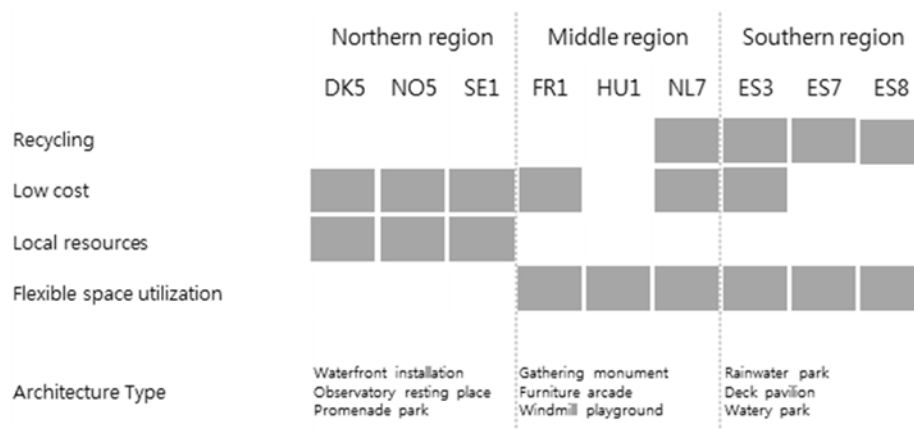


Figure 8. Distribution of frequency by region in the characteristics of economic sustainability.

## 5. Conclusions

We have examined the ways and means of implementing sustainability through the public architecture of cities in Europe. The proposed architectural direction differs depending on the area, and the cultural factors in the same area show differentiation. Based on this, we can suggest the following issues to consider in public architecture design.

First and foremost is the construction method, in which the method of voiding the urban space through an architectural device is used, rather than the method of filling. In other words, the intention is for the facility to become part of the city as “ground”, making better places as a result. As a type of architecture for the public, it is possible to provide for more activity. By implementing “ground” rather than “figure”, the heat island phenomenon can play a role in creating a pleasant microclimate in the contemporary cities.

In the northern region, visual ground is effective because it is suitable for the architectural form as scenery. In this case, if memory that reinforces the local identity is embedded, it will intensify social sustainability. In the middle region, the focus should be on the physical ground that people use directly. It emphasizes environmental sustainability by enabling people to maintain a pleasant environment during use. In the southern region, ground that combines natural resources such as water or wood to cope with high temperatures is effective. This is also related to economic sustainability, which has a cost saving effect.

Next, public architecture design is related to skin with materials, and has a strong relation with the environment. Because it is a public building exposed to the open air, it is most important that it is durable, and fits well with the given environment. It is essential to use local materials that are well suited to harsh environments, especially in the northern region, which encompasses many ornamental architectural forms, such as observatories and trails. Durability is more important in the middle region, where many people have direct access. Sustainability is ensured by processing the exterior of the skin, rather than the material itself. In the southern region, preference should be given to the choice of

materials that are not affected by material deformation by high temperatures, and the shape of the exterior should be porous allowing maximum ventilation.

Finally, public architecture design should ensure flexible use of the program, by influencing local and environmental characteristics. This becomes a crucial part of a city being sustainable. In the northern region, programs related to scenery are frequently used. Comparably, programs where people to stay or play, which means communicative programs, are normally adopted in the middle region; this is partly influenced by its culture. In the southern region, programs using a deck are selected because materiality of the deck allows durability against water or wet conditions. In general, architecture targeting the public is not aimed for profit, and there is little time and cost consideration for the programs to be introduced. However, if we refer to the various programs presented in the above examples, and reference them in the future, we expect that many public spaces to be built will be better utilized. (Figure 9).

Regional sustainability of urban public space			
	Method of voiding the ground	Durable skin with the materials	Flexible use of the program
Northern region	visual ground	local materials suited to environments	programs related to scenery
Middle region	physical ground	processing the exterior of the skin	communicative programs
Southern region	ground with the natural resources	porosity allowing maximum ventilation	programs using the deck

Figure 9. Regional features toward the sustainability.

In conclusion, sustainability should take into account the priorities of each region on the properties that are shared from the basics. Cities continue to grow, and it is nearly impossible to imagine the scale that they will come to reach. Considering the rapidly changing lifestyle of modern society, design research into public architecture that is oriented towards urban sustainability will be a task to be carried out by the present generation for the millennial generation.

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**Conflicts of Interest:** The authors declare no conflict of interest.

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