*International Journal of Architecture and Urbanism Vol. 07, No. 01 (2023) 106 – 118*

**International Journal of Architecture and Urbanism**

Journal homepage: https://talenta.usu.ac.id/ijau

# A Study of the Application Sustainable Architecture at Horas Siantar Market Buildings

***N Vinky Rahman[1], Roni Simarmata[1*]***

*[1]Architecture Department Faculty of Engingeering, Universitas Sumatera Utara, Medan, Indonesia*

*Corresponding Author: alfajrironi@gmail.com

**ARTICLE INFO**

**Article history:**
Received 08-01-2023
Revised 06-02-2023
Accepted 09-03-2023
Available online 31-03-2023

E-ISSN: 2622-1640
P-ISSN: 2622-0008

**How to cite:**
Rahman NV and Simarmata R. A Study of the Application Sustainable Architecture at Horas Siantar Market Buildings. International Journal of Architecture and Urbanism. 2023. 7(1):106-118.


**http://doi.org/ 10.32734/ijau.v7i1.11694**

**ABSTRACT**

Pasar Horas is a traditional market with the most extensive building as a traditional market in Pematang Siantar. Pasar Horas provides all the needs of tools and household materials to meet the community's needs, which makes Pasar Horas an essential role in meeting the community's needs. The impact given by the Pasar Horas building must be considered both on the environment and its users. Pasar Horas itself has fairly bad implications when viewed from the aspect of Sustainable Architecture, such as the wrong direction of building orientation, not eco-friendly materials, inefficient land use, and waste management due to market activities, where Sustainable Architecture itself calls for the negative impact of the establishment of the building is not too big. Therefore, the application of Sustainable Architecture in Pasar Horas buildings is needed so that the negative impact caused by the market on the environment and its users can be minimized, which will later be able to adapt Pasar Horas to the new era and become a traditional market that can compete with modern markets to meet household needs of the Pematang Siantar community.

**Keywords:** sustainable architecture, traditional market building

## 1 Introduction

The importance of sustainability is increasing every day. Based on the proportional increase in the human population from time to time and the decrease in natural resources. For example, an architectural concept can be said to be a sustainable architecture if the architectural concept can meet the needs of its users in the present, without endangering the ability of future generations to meet their needs [1]. Unfortunately, in this case, some people still have not thought about what happens to the environment, for example, in the traditional market. Traditional markets are currently a concern of many parties, especially after the government launched a traditional market revitalization program. The Ministry of Trade, for example, in 2011, has budgeted Rp 505 billion for market revitalization programs throughout Indonesia. The AC Nielsen survey in 2010 described: modern markets increased by 31.4% per year, while traditional markets decreased by 8.01%. In the food sector, the market share of supermarkets has risen from 11 percent to 40 percent [2].

This condition threatens the existence of traditional markets. In fact, traditional markets contribute significantly to economic development. The concept of Sustainable Architecture calls for natural resources and land potential not to be used arbitrarily, the use of the land potential for energy-efficient architecture, and so on [3]. This discussion is seen from the concern that environmental pollution is worsening now. This damaged environment is becoming critical, and one example is in traditional markets.

In some sectors, the quality of the value of the building also dramatically impacts the community in their daily activities inside and outside the building when conducting buying and selling transactions in the traditional market, which causes discomfort. The availability of supporting facilities has not been fulfilled. The use of land is inefficient, and the absence of waste management in buildings [4]. To overcome the problems caused by the traditional market building, it is necessary to provide a solution based on Sustainable Architecture in the Horas Siantar Traditional Market building to make Horas Market a trading center that can adapt to changes and compete with modern markets. It can be done by providing design recommendations for market buildings, improving the quality of buildings and communities around the Horas Market building.

## 2 Literature Review

### 2.1 Sustainable Architecture

Sustainable architecture is an applied concept in the field of architecture to support the idea of sustainability, namely the idea of maintaining natural resources to last longer, which is associated with the life of the strong potential of natural resources and the human ecological environment [5], such as the planetary climate system, agriculture, industry, forestry systems. And of course the architecture. There are many benefits when using vacant land and large enough in planning because it can maximize the environment such as sunlight, solar heat, or wind direction control [6]. Sustainable Architecture has the goal of achieving environmental awareness and utilizing natural resources of sustainable quality and carrying capacity to continue to be able to carry out a sustainable development process as well as to create an architecture that is in harmony with the environment and emphasizes the principle of minimizing damage and maximize the use of the natural environment [7].

Building a new environment will have an impact on the existing environment. Therefore, choosing the right location can reduce the negative effects on city accessibility. Studying urban spatial planning is a process of selecting a location that is suitable for the city's accessibility to the environment that will be created and considering the density of the surrounding environment with the new environment [8].

### 2.2 Principles of Sustainable Architecture

Based on the theories and principles of sustainable architecture from the experts above, the principles of sustainable architecture can be summarized into five aspects: efficiency and waste management, which will be seen in their application to Horas Market buildings. The five aspects are the efficiency of energy use, the

efficiency of land use, the efficiency of material Use, use of the latest technology and materials, and then waste management [9].

### 2.3 Traditional market

Traditional markets are places where sellers and buyers meet and are marked by transactions between sellers and buyers directly through interaction and communication, and usually, there is a bargaining process [10]. Traditional markets also can be interpreted as public spaces that become the city's identity. A successful market is a market that is bustling with economic and social activities, which is characterized by the availability of comfortable, accessible spaces, and a place for socio-cultural activities [11].

The physical form of the building usually consists of kiosks or outlets, stalls, stalls, and open grounds, which sellers or a market manager available. Formatting table, graphic content, Equation, and reference. A building is considered effective if the elements evaluated are successful or can be used optimally. The effectiveness of the building can be seen from the technical aspects of the building, elements of the building's function, and user elements [12]. In general, market classification can be divided based on the size of the market, the type or type of market being traded, operating time, type of activity, ownership status, and visitor capacity [13].

## 3 Methodology

The method used in this research is a qualitative descriptive method. The data collection technique used by the researcher is to make direct observations in the field [14], namely the Horas Siantar traditional market area. The results of the data obtained will be linked to the theory of the principles of Sustainable Architecture. The object of this research is the Horas Market building located on Thamrin street No. 6c, Pematang Siantar City, North Sumatra. A traditional market building with an area of ±17,000m2, Horas Market Building has three buildings, one building with three floors and two buildings with two floors [15].The following is a description of the object of research which includes the condition, specific location, shape of building and area of the Horas market building (Figure 1).

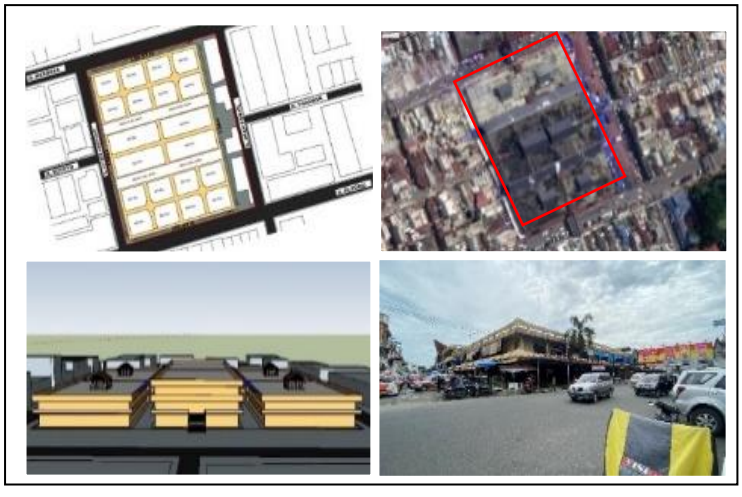

**Figure 1** Horas Market

## 4 Result and Discussion

Based on research conducted through observations related to the object of study, the data obtained will be discussed and analyzed in this chapter. For example, to find out how the implementation of sustainable architecture in Horas Market buildings includes energy use efficiency, land use efficiency, material use efficiency, the use of the latest technology and materials, and waste management.

### 4.1 Analysis of the orientation of the building

After looking directly at the research location and through Google Earth, the orientation of the facade of the Horas market building leads to the east. Direct sunlight and radiation are very disturbing and not suitable for the user and the building itself (Figure 2).

**Figure 2** Building orientation analysis

Analysis of the reception of sunlight and wind on the building

From the shape of the Horas Market building, there is no shading that covers direct sunlight, only the overhang of the building, which has a size of 2m from the room, which slightly reduces the natural light that enters the room (Figure 3). Still, it is not enough so that some stalls use tarpaulins/curtains to cover their rooms against direct sunlight.

**Figure 3** Sunlight reception analysis

For the use of electrical energy in the Horas Market building, there is no use of electrical power or AC and does not have windows or ventilation to regulate the air temperature in the room because the shape of the Horas Market building can receive maximum air circulation. There are four air vents on the roof building (Figure 4), that can help air circulation into the building so that the room is not too hot during the day.

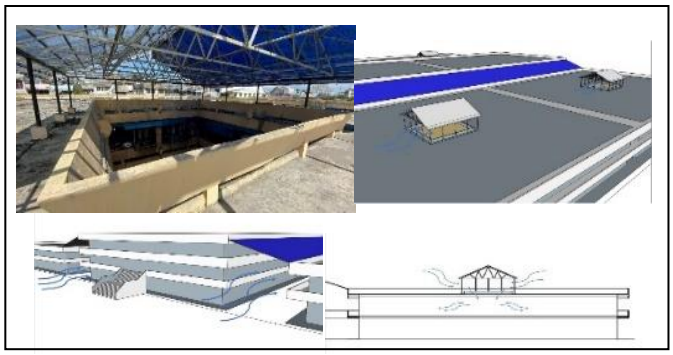

**Figure 4** Wind reception analysis

Room Organization Analysis

From the shape of the building plan, the spatial pattern formed in the Horas Market building is linear (Figure 5) because a straight road can be the primary organizing element for the row of spaces circulating within the building as we can see in figure 6.

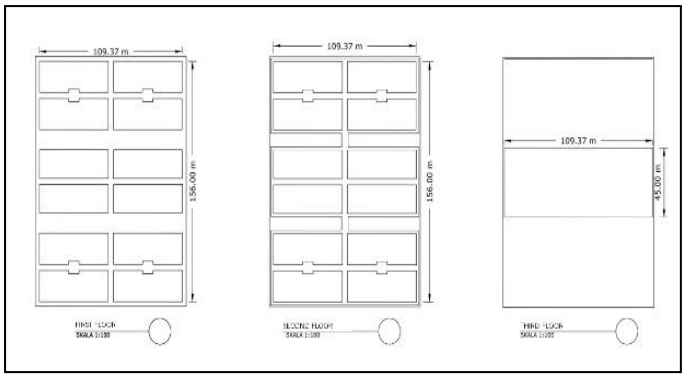


**Figure 5** Floorplan Pasar Horas

**Figure 6** A room that requires light (left) and a picture (right) does not need a light source from a lamp

**Summary:** The Horas Market building uses electrical energy to meet building needs efficiently and efficiently. However, there are also shortcomings in the selection of the direction of the building facade, which is oriented to the east. From the shape of the building plan, the spatial pattern that is formed in the Horas Market building is linear because there is a straight road that can be the primary organizing element for the row of spaces that circulate within the building.

**Solution recommendation:** The addition of trees as shading and improvement of the new roof covering will reduce the impact of direct sunlight on the building as we can see in figure 7 and with the vegetaion as shading can reduce the direct sunlight at figure 8, which will provide comfort to market users from sunlight.

**Figure 7** Shading conditions on building

**Figure 8** Recommended shading design with trees and improvement of roof covering materials

### 4.2 Efficiency of landuse on Pasar Horas building

The following are the results of the analysis of the efficiency of land use in the Horas market building which includes, land use analysis, analysis of plant utilization, efficiency of material use, use of the latest technology and materials, and waste management.

*Land use analysis*

The Horas Market building uses almost the entire land provided to construct its buildings, and there is no green open space on the ground so that the use of parking areas on land is used on sidewalks and road shoulders which can interfere with market activities and traffic on some roads (Figure 9).

**Figure 9** Land use analysis of pasar horas

*Analysis of Plant Utilization*

Existing vegetation types found in Horas Market are one betel nut and some grass arranged on the sidewalk of Sutomo Street (Figure 10); the potential for vegetation that can be developed such as trees on Horas Market land is not too much and does not have space to be planted and its placement


**Figure 10** Analysis of the use of green plants/vegetation

**Summary**: Horas Market building in terms of land use is very inefficient and harms the surrounding environment. There is also no potential for green open space and adequate parking areas around the land.

**Solution recommendation:** To make plant utilization better and more useful, it is better if the type of plant in the form of a tree is placed in front of the building (Figure 11) and the sidewalk is rearranged for pedestrians (Figure 12).

**Figure 11** The sidewalk area and the shoulder of the road that are used as parking lots

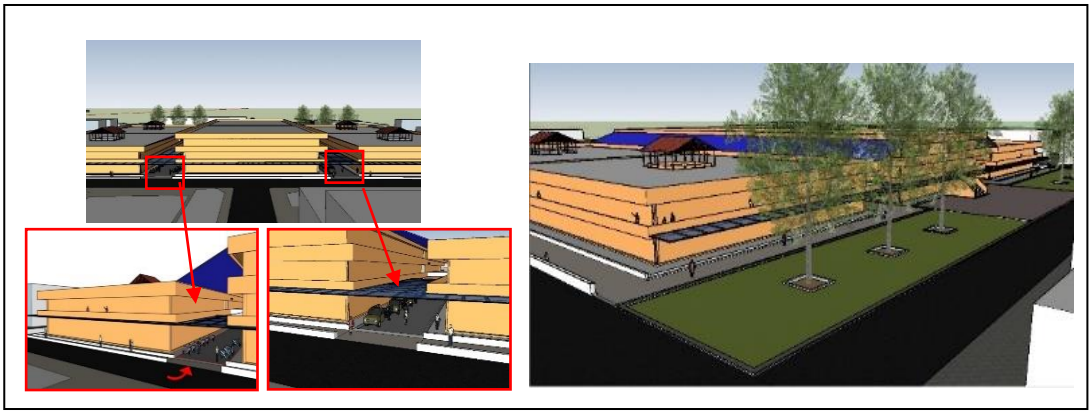

**Figure 12** Land use efficiency design recommendations

*Efficiency of materials use*

There is no use of hazardous materials for users in the column and beam structures even though they are exposed because the Horas Market building does not have a ceiling as we can see at figure 13.

**Figure 13** Column and beam structural materials

The material used to cover the roof of the Horas Market building is divided into 2, namely non-concrete material, which is almost everywhere in the building, and some of them have air ventilation voids measuring 4x5 meters using light steel structures and canopies as roof covering materials (Figure 14), then there is a roof with the same material which used as a cover for the hallway underneath but placed between the sides of one building and another.

**Figure 14** Roof materials

The material used for the stairs in the Horas Market building is concrete, for the railings utilizing a combination of iron and wood materials. In addition, a ceramic floor covering is given for each stair on the first floor leading to the second floor (Figure 15). For the floor covering material on the first floor, not all use ceramic floors, but some still use plaster or cast cement, while for the second floor, the use of ceramic materials is used as a whole (Figure 16). For wall materials, the Horas Market building as a whole uses concrete walls, but some retailers use wood and use folding doors made of aluminum metal (Figure 17). In the Horas Market building, the ceiling does not use a ceiling in every room and hallway (Figure 18). Horas Market building does not appear to have any openings in its walls such as windows or ventilation (Figure 19).

**Figure 15** Stairs materials

**Figure 16** Floor covering materials

**Figure 17** Wall covering materials

**Figure 18** Ceiling materials

**Figure 19** Window materials

**Summary:** Overall, the use of the types of materials in the Horas Market building uses materials that are often found in other buildings in general, but to say it is a building that does not damage the environment, the

selection of materials cannot be said to be the best, because there are some unfinished materials under construction, some of which can harm users and have a bad impact on the environment.

**Solution recommendation**: From the conclusion regarding the efficiency of material use which is a problem in the use of Horas Market materials, the recommended solution from the researchers is to re-fix the finishing of building materials at Horas Market and provide a schedule for carrying out maintenance on buildings so that building materials remain durable and do not have adverse effects to its users.

*Use of the latest technology and materials*

The Horas Market building itself has not used or utilized any of the latest technologies and materials in its buildings to reduce the use of electrical energy and water needs to meet the needs of building users (Figure 20).

**Summary**: In the Horas Market building, there has been no use of the latest technology and materials used in the building. Moreover, the Horas Market building is an old building that was unfamiliar with the technology.

**Solution recommendation:** There is a potential area that can be used to apply the latest technology and materials at Horas Market, precisely on the roof of the building which is made of non-concrete material by adding solar panels or solar panels to reduce energy use (Figure 21), then adding rainwater collection equipment for the needs of market activities that require water (Figure 22).

**Figure 20** The area where the latest technology is installed

**Figure 21** Solar panel technology

**Figure 22** Water Reservoir technology

*Waste management*

The waste disposal process carried out at Horas Market looks very bad. Too much waste disposal is not placed in its place or is disposed of carelessly (Figure 23). A garbage disposal center is located opposite the Horas market building on Bangsal street (Figure 24). However, the distance from the building to the waste disposal center is quite far, making it difficult for market users to dispose of their waste.

**Figure 23** Garbage thrown carelessly

**Figure 24** Horas Market waste dumping site

Dirty water waste from the disposal of fish sellers on the first floor also looks like it is not managed correctly as we can see at figure 25, there are drainage and water channels, but it is not shaped. Therefore, it does not lead properly to drainage so that it spreads and causes roads in the building to be muddy and slippery.

**Figure 25** Horas Market sewage waste stream

**Summary**: The waste disposal system for waste and water used by Horas Market activities looks terrible, the procurement of garbage bins is inadequate, the rules for disposing of waste are also not implemented. Moreover, the drainage paths and the drainage of dirty water are irregular and not maintained, making the waste disposal system very bad so that management waste so inconsistent.

**Solution Recommendation**: In terms of handling waste from former market activities, Horas Market looks very bad, the procurement of waste disposal areas is considered inadequate and adequate, so it is better to have a garbage disposal site in every corner of the building, especially in areas that do many activities and produce waste that generates large amounts of garbage. A lot, so that disposal and management are easy to do so as not to pollute the environmental area around Horas Market. Procurement of waste disposal sites must also have their respective classifications so that the generated waste can be reused and processed for other needs.

## 5 Conclusion

Based on the results of the research that has been carried out, the application of Sustainable Architecture on the Horas market still cannot be said to be a sustainable building because there are problems found in the Horas market building which causes the Horas market building to harm the surrounding environment and its building users. So to ensure the sustainability of Horas Market without harming the surrounding environment, it is necessary to plan or recommend the right solution so that its existence as a Trade Center in the city of Pematang Siantar can continue.

And the suitable planning suggestions and recommendations to initiate changes or improvements to Horas Market itself are to apply the Sustainable Architecture planning recommendations that have been shown previously so that Horas Market can adapt and develop with changes as experienced in modern markets then it does not disturb the surrounding community, but can support and provide change as a result of the impact of the sustainable Horas Traditional Market.

**Acknowledgement**

This research is a study of architectural research to find out how applying a sustainable architectural concept to traditional market buildings can be a recommendation for further researchers to examine how the application of sustainable architectural concepts to market buildings in their respective areas.

## REFERENCES

[1] J. Steele, *Architecture Sustainable:(Principles, Paradigms, and Case Studies)*. McGraw-Hill, 1997.
[2] A. Nielsen, "Gerai Tradisional dan Modern.Badan pusat statistic," 2010.
[3] M. Roodgar, M. M. Mahmoudi, P. Ebrahimi, and D. Molaei, "Sustainability, architectural topology and green building evaluations of Kashan-Iran as a hot-arid region," *Procedia Eng.*, vol. 21, pp. 811–819, 2011, doi: 10.1016/j.proeng.2011.11.2082.
[4] S. Kurniasih, "EVALUASI TENTANG PENERAPAN PRINSIP ARSITEKTUR BERKELANJUTAN ( Sustainable Architecture ) Studi Kasus : Gedung Engineering Center & Perpustakaan FTUI," *Arsitron*, vol. Vol. 1, pp. 1–26, 2010, [Online]. Available: http://riset.budiluhur.ac.id/wp-content/uploads/2013/09/010105-011026-SKurniasih.pdf.
[5] A. Pitts, "Establishing priorities for sustainable environmental design in the rural villages of Yunnan, China," *Buildings*, vol. 6, no. 3, pp. 1–22, 2016, doi: 10.3390/buildings6030032.
[6] A. Pitts, *Planning and design: strategies for sustainability and profit*, Architectu. London, 2004.
[7] A. George, *Sustainable Architecture, Alternative Concepts and Waste Reduction*. Elsevier Ltd., 2020.
[8] A. Ragheb, H. El-Shimy, and G. Ragheb, "Green Architecture: A Concept of Sustainability," *Procedia*

- *Soc. Behav. Sci.*, vol. 216, no. October 2015, pp. 778–787, 2016, doi: 10.1016/j.sbspro.2015.12.075.
[9] A. Y. Mila, *Arsitektur Berkelanjutan*. ERLANGGA, 2015.
[10] Permendagri, "PERATURAN MENTERI DALAM NEGERI No42 Tahun 2007 Tentang Pasar Desa," 2007.
[11] D. Duerk, *Architectural Programming*. New York, 1993.
[12] Preiser, "Building Performance Evaluation," 2005.
[13] Karolina, "Klasifikasi Pasar," p. 15, 2005.
[14] J. Shao, "Sustainable strategies applied on commercial architecture in Australia," *Front. Archit. Res.*, vol. 2, no. 3, pp. 362–372, 2013, doi: 10.1016/j.foar.2013.04.005.
[15] S. Lusiana, "STUDI TENTANG PASAR HORAS SEBAGAI PASAR TRADISIONAL DI KOTA PEMATANGSIANTAR," 2018.