Building for tomorrow: a green building approach to children and youth activity center in Medan City

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Abstract. The rapid urbanization in North Sumatra, particularly in Medan, poses significant challenges to the well-being of children and youths due to increased industrial activities and traffic, leading to heightened air and noise pollution levels. The "Building for Tomorrow" concept emphasizes a green building approach for a children and youth activity center in Medan. The study employs qualitative and descriptive methods, including surveys and analysis based on green building parameters by the Green Building Council Indonesia. The proposed center aims to provide a safe, healthy, and stimulating environment to counteract the adverse impacts of urbanization, prioritizing the well-being of younger generations and fostering environmental consciousness. The key design aspects of this study focus on Appropriate Site Development, Energy Efficiency, Water Conservation, Material Resource and Cycle, Indoor Health and Comfort, and Building Environment Management, while offering essential facilities such as education, sports, open spaces, art centers, cafes, and toilets. By meeting green building standards, the center aims to contribute to a healthier environment for future generations in Medan.

1 Introduction

Indonesia, being one of the countries with the highest rate of urbanization since the 80s and 90s, has been facing a huge leap in its number each year. In 2022, 57.93% of Indonesia's population lived in urban areas, a significant jump from 51% in 2010. The World Bank has also predicted that 220 million of Indonesians are going to live in urban areas in 2045 which is equal to 70% of the total population of Indonesia (273 million). These numbers were driven by Economic factors like industrialization, service sector growth, and infrastructure development [1]. Additionally, factors like rural poverty and limited resources in rural areas contribute to the migration towards urban centers. These high numbers are also apparent in the city of Medan (7th most populated city in Indonesia) which has been facing more challenges as the green and open spaces are replaced into the urban areas; diminishing availability of safe and conducive spaces for the children and youths to interact with each other.

Fig. 1. Prediction of the population percentage of urban and rural areas in Indonesia in 2010-2035

This study focuses on Sutomo Street in the City of Medan, which is a densely populated area known for its diverse range of commercial and educational institutions (schools and universities). However, the lack of recreational spaces in the city deprives the opportunities for young individuals to experience creative play and social interactions with their peers; which is crucial for their physical and mental wellbeing.

Even with a huge number of children and youths, ranging from age 5-9 years old for children and from 10-14 years old for youths shown in Table. 1. As you can see at Table. 2, Sutomo Street has been having challenges such as inadequate infrastructure and environmental degradation. Hence, a children and youth activity center is vital in this area to offer a safe environment for play and social interaction in the midst of urbanization. Additionally, the application of green building for the
activity center provides the opportunity to instill these ideas of environmental consciousness and sustainable living in the minds of future generations as the number of population keeps on rising.

Fig. 2. The comparison of urban sprawl in Medan City from 1984 to 2020

Table 1. Total population Medan City by age group and gender (Badan Pusat Statistik Kota Medan, 2022)

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Total Population of Medan City by Age Group and Gender</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male</td>
</tr>
<tr>
<td>5-9</td>
<td>99 796</td>
</tr>
<tr>
<td>10-14</td>
<td>96 664</td>
</tr>
<tr>
<td>15-19</td>
<td>97 998</td>
</tr>
<tr>
<td>20-24</td>
<td>101 921</td>
</tr>
<tr>
<td>Total</td>
<td>396 379</td>
</tr>
</tbody>
</table>

The idea of sustainable living could be applied to the social, economic, and environmental aspects of their lives as they grow up [2]. The change of behavior is divided into 4 stages: knowledge, persuasion, decision, and implementation [3]. The first step (knowledge) is where people should be aware of the consequences of their actions and behaviors, as well as the importance of preserving the environment. The second step (persuasive) is where the positive and negative attitudes of sustainability are formed, where the good is encouraged, and the bad is frowned upon. Hence, instilling the importance of a sustainable living mindset towards the children and youths. The third step (decision) is where people are applying green behaviors in their daily lives. The fourth step (implementation) is where people start to make modifications of green living to suit their needs [4][5]. It is expected that the research would be useful to provide insight and knowledge in designing a children and youth activity center which acts as a haven in the midst of urbanization, while providing education in green living for the future generations as the population rises in the future.

2 Research Methods

The research method in this research uses a descriptive qualitative research method, where this method describes the data concerned with the situation that occurs, the relationship between variables, the differences between facts, and others.

These data consist of primary and secondary data, where primary data is the data obtained from observation and documentation carried out through the analysis and review of the existing conditions of the area and conducting interviews to find out all the activities and facilities needed. Secondary data is obtained from literature studies conducted by studying various references such as reviews of Children and Youth Center buildings, parameters in the Green Building Council Indonesia (GBCI), rules and regulations that apply to that area, and previously published scientific works.

Afterwards, the data that has been collected will be analyzed using a mixed method: qualitative and...
quantitative which are processed in order to obtain conclusions and facilitate the discussion process.

3 Results and Discussion

3.1 Location

The Sutomo street shown in Figure 3 spans at 1.7 km which is the combination of Medan Perjuangan, Medan Kota, and Medan Timur sub district. Known for its densely populated commercial area as well as the education institutions, this area would be suitable for a children and youth activity center where younger generations who experience the urbanization challenges the most are able to experience the opportunity to play and socialize with their peers.

3.2 Children and youth center facilities

In designing a space where children and youth can thrive, it is essential to provide a variety of facilities to suit their diverse needs.

<table>
<thead>
<tr>
<th>Facilities</th>
<th>Function and Utility</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Education</strong></td>
<td>- Classroom: Space to educate the children, designed with a suitable theme as their interests.</td>
</tr>
<tr>
<td></td>
<td>- Children library: Space for children to expand their knowledge; designed in a fun and interactive way.</td>
</tr>
<tr>
<td></td>
<td>- Medical room: Space for children who are sick or injured during activities.</td>
</tr>
<tr>
<td></td>
<td>- Storage room: Space to store important files related to education.</td>
</tr>
<tr>
<td><strong>Sports and hobbies</strong></td>
<td>- Movie theater: Space for children to watch movies together.</td>
</tr>
<tr>
<td></td>
<td>- Swim class: Space for children to learn swimming.</td>
</tr>
<tr>
<td></td>
<td>- Children sports center: Space for children to exercise (designed in a fun and interactive way to promote physical activities.</td>
</tr>
<tr>
<td></td>
<td>- Jogging track: Space for the youths to jog without bumping into other pedestrians.</td>
</tr>
<tr>
<td></td>
<td>- Swimming pool: Space for the youths to swim.</td>
</tr>
<tr>
<td></td>
<td>- Basketball court: Space for the youths to play basketball.</td>
</tr>
<tr>
<td></td>
<td>- Soccer court: Space for the youths to play soccer.</td>
</tr>
<tr>
<td></td>
<td>- Badminton court: Space for the youths to play badminton.</td>
</tr>
<tr>
<td></td>
<td>- Table tennis and tennis court area: Space for the youths to play tennis and table tennis</td>
</tr>
<tr>
<td></td>
<td>- Game area: Space for the youths to play dart, fussball, billiard, and boardgames.</td>
</tr>
<tr>
<td></td>
<td>- Fitness area: Space for the youths to exercise.</td>
</tr>
<tr>
<td><strong>Open space</strong></td>
<td>- Playground: Space for the children to play and socialize</td>
</tr>
<tr>
<td></td>
<td>- Skatepark: Space for the youths to skate.</td>
</tr>
<tr>
<td></td>
<td>- Amphitheater: Space for the youths to watch outdoor shows during specific events.</td>
</tr>
</tbody>
</table>

Fig. 3. Keymap of the Sutomo street

Fig. 4. The combination of Medan Perjuangan, Medan Kota, and Medan Timur sub district
The children and youth activity center is designed as a space to facilitate a wide range of mixed activities through universal design. The facilities in education, sports, arts, and hobbies will promote their creativity and ideas in academics as well as non-academics, providing a chance for them to grow well.

### 3.3 Green building approach

Based on the Table 3., the design of facilities needed in the building should also refer to the 6 green building parameters established by the Green Building Council Indonesia (GBCI)[6]. This ensures that the children and youth activity center is designed with a green approach. The 6 parameters by the Green Building Council Indonesia (GBCI) are:

**1. Appropriate Site Development (ASD)**

Keeping the building and the city green, through the balanced clean water and groundwater, increasing the quality of microclimate, reducing the drainage load through a well planned rainwater management system, reducing the use of privately owned vehicles, and encouraging the development of well planned connectivity buildings.

**2. Energy Efficiency and Conservation (EEC)**

Appreciation of the monitoring procedure and consumption inventory, the building envelope management, application of energy efficiency measures, the use of natural ventilation, understanding of energy consumption efficiency patterns in climate change, use of natural lighting, and on-site renewable energy. This will result in an increase of knowledge and awareness in energy efficiency throughout the construction phase.

**3. Water Conservation (WAC)**

The importance of awareness in water conservation, managing water systems through meter installation, usage recording, and employing efficient water features; implementing water recycling units, collecting rainwater, and utilizing alternative water sources are significant conservation efforts. Choosing an efficient landscape irrigation system can also reduce clean water consumption.

**4. Material Resource and Cycle (MRC)**

Appreciation of responsibly sourced timber cultivation, use of recycled, renewable, certified management materials, prefabrication, ozone-safe, and local products to reduce the use of new raw materials. Hence, reducing waste in landfills and extending the lifespan of a material, while also reducing its carbon footprint.

**5. Indoor Health and Comfort (IHC)**

Efforts to maintain a conducive indoor environment by providing adequate ventilation rates for the user’s health, monitoring carbon dioxide (CO2) concentrations, reducing exposure to secondhand smoking, minimizing indoor air pollution from building material emissions, offering distant views, ensuring visual comfort and lighting levels, maintaining the temperature comfort, indoor air humidity, and noise levels to enhance building productivity.

**6. Building Environment Management (BEM)**

The importance of a planned and standardized management standard is emphasized to guide the building management in demonstrating environmentally friendly results (green performance). By fostering coordination and synergy among building experts involved in technical planning, construction execution, and construction supervision.

The application of the green building concept in its design is based on the parameters above. Through those, the younger generation will be able to have a healthy and open space to socialize with each other; as well as the new knowledge in green living which will be useful for the future generations.

### 3.4 Implementation of Green Building Approach in the Children and Youth Activity Center

**3.4.1 Appropriate Site Development (ASD)**

1. **Accessibility in Public Facilities**

   Areas around the street are filled with abandoned bus stops, causing difficulties for children and youths who rely on public transport to reach nearby buildings and facilities.

   The revitalization of the abandoned bus stops and pedestrian routes in the area with a distance of less than 1000 meters increases the mobility of the children, youths and pedestrians nearby; hence, reducing the use of private vehicles. Guide paths for disabled individuals should also
be incorporated within the pedestrian routes, marked by textured yellow tiles, with the size of 30x30 cm, and 0.5 cm lined textures in accordance with Ministerial Regulation No. 30/PRT/M/2006 regarding guide paths.

2. The Use of Energy Saving Parking Lots

Energy saving parking lots should have a well-planned lighting and air circulation to reduce pollution and help the vehicles to maneuver better. The parking pattern adopts a 90° angle parking with one-way circulation. Each parking space measures 2.4x5.3 meters with a circulation width of 5.8 meters, which complies with the standard parking space size of 2.3x5 meters. The use of car stoppers and parking lines acts could also help the safety of the users.

3. Landscape Development

The landscape development around the building relies on plants around the building, acting as natural air filters to battle Sutomo street's traffic emissions. Some of the plants which could be used to improve energy efficiency and optimize the use of the building include:

1. Troll Model Plants
   - The troll model functions well as a shade tree; it is also able to absorb carbon dioxide (CO₂) and release a lot of oxygen (O₂). Some of the troll model plants are: Muntingia calabura, Samanea saman, Leucaena leucocephala, and Pterocarpus indicus.

2. Scarrone Model Plants
   - Trees with the Scarrone model generally have dense and wide crowns, which act as windbreaks, barriers, shade trees, stabilizers of soil, and fillers for empty land, and also have an aesthetic value. An example is the Sempur tree (Dillenia indica).

3. Roux Model Plants
   - The Roux model generally functions as a guide plant and a dust pollutant absorber. It is also commonly used to add aesthetic value to its surroundings. An example is the Ylang Ylang plant,

3.4.2 Energy Efficiency and Conservation (EEC)

1. Air Conditioning
   - The use of Variable Refrigerant Volume Air Conditioning (VRV) utilizes the inverter compressor with motion sensors to adjust cooling capacity by slowing down or speeding up the compressor. A unique feature of VRV systems is that a single outdoor unit can support up to 29 indoor units, which could achieve the energy savings of 20-30%. (Satwiko 2008)[8].

2. Electricity Consumption
   - One of the ways to save electricity is to implement a double-tariff kWh system, which involves dividing the calculation of electricity consumption into two periods: peak load time (WBP) and off peak load time (LWBP).
   - Another alternative source of electricity is solar energy, which is harnessed using solar panels on buildings to convert sunlight into electricity.

3.4.3 Water Conservation (WAC)

1. Water Recycling and the Quality of Water
   - Through the technology of STP (sewage treatment plant) based on the biotech system, wastewater could be recycled to make it suitable for garden irrigation. The treated water from the STP is regularly monitored by the Environmental Protection Agency. This ensures that the resulting water is clean, safe, and suitable for garden irrigation.[9].

2. Faucet Efficiency and Water Conservation
   - It is important to apply automatic faucets with infrared sensors with a flow rate of 5.8 liters per minute and a dual flush system for the toilets in the building with 3 liters of water for the small button and 6 liters of water for the large button to improve water conservation and save up almost 50% on water usage [9].

3.4.4 Material Resource and Cycle (MRC)

1. Use of Material
   - The materials used for the building should be locally produced: Medan and nearby cities within North Sumatra. Materials such as lightweight bricks, glass, ceramics, paint, and energy-saving granite from companies with green labels. These building materials are durable, safe for the users, and recyclable.
   - Moreover, the use of low-emissivity glass helps to increase the energy efficiency within the building and optimizes the natural sunlight to reduce the use of electricity in the building.

   - The types of waste generated in the building would be dominated by paper, food, and plastic waste, but the majority of the waste is tissue and paper waste. This waste is then collected and taken to the waste storage room, and collected by the waste collectors from the sub-district.

   - The waste is then channeled to a third party, namely a waste collector who sorts the waste that can still be used, such as paper, plastic, and cardboard. The sorted waste from the collector is then bought by a larger collector who then distributes it to factories to be processed into new goods using the recycle principle. For example, plastic bottle waste is crushed into plastic powder and then used as a material for making buckets.

   - However, the waste that cannot be reused, such as tissues, food scraps, and broken glass, is collected by the sub-district's waste collectors and taken to the nearest final disposal site. There are several ways to process and utilize waste, including: sanitary landfill, composting, and generating methane gas from organic waste (PLTSA).

3.4.5 Indoor Health and Comfort (IHC)

1. Indoor Air Comfort
   - The maintenance of the air conditioner is scheduled every month, three months, and a year to prevent damage.
In order to provide clean and comfortable indoor air circulation, it is necessary to carry out periodic maintenance on the indoor ventilation equipment, preventing the formation of moss and mold that could disrupt the health of building users. Since the thermal comfort for a tropical climate is 24°C – 26 °C [8], using an air conditioner with a low temperature, causes energy efficiency. Moreover, the fresh air supply placed outside the building helps to direct the fresh air indoors.

2. Indoor Lighting Comfort

Sunlight is dynamic in nature due to the changing motion of the sun and clouds in the sky. As a result, the amount and direction of natural light in a space can change, which often causes glare, which should be fixed with the use of vertical blinds.

The type of lamp used for the initial building’s construction is a Fluorescent lamp. After the room is handed over to the tenant, it is replaced with LED lights with a luminous life of 15,000 hours with the same capacity, and up to 80% more energy efficiency.

3.4.6 Building Environment Management (BEM)

1. Building Management System

The building management has a goal to create an environmentally friendly and comfortable building for the users. It is the responsibility of the building management to carry out maintenance and care of the building through regular training and certification of employees. Building data such as the Built Drawing documents, technical specifications and utility equipment maintenance must be stored for operational and maintenance purposes.

2. Sustainable Construction

The construction of buildings has a significant impact on the environment. However, it can be minimized through the use of sustainable materials, waste reduction, energy conservation, and water quality preservation. It is also important to use the principle of 3R: reduce, reuse, and recycle in selecting the building materials (reusing concrete to create car stoppers) Moreover, it is also important to plan the use of materials to minimize its waste. Most of the time, there is a 5% waste for the tiles. However, with better planning in the storage system and its application, it could be reduced to less than 5%. The principle of recycling that is carried out is to collect leftover pieces of iron for recycling by collaborating with a third party, namely an iron factory.

4 Conclusion

Integrating the green building approach in the design of a children and youth activity center is crucial to ensure that the younger generation is able to have a space where they can play and socialize with each other, at the same time, promoting a green and sustainable mindset. The activity centers are usually equipped with several facilities: classroom, library, sports area, playground, art space, and cafeteria.

However, in order to create those facilities needed in the building, it is important to fulfill the 6 parameters of a green building set by the Green Building Council Indonesia (GBCI): Appropriate Site Development (ASD), Energy Efficiency and Conservation (EEC), Water Conservation (WAC), Material Resource and Cycle (MRC), Indoor Health and Comfort (IHC), and Building Environment Management (BEM). By adhering to those parameters, the center can minimize its environmental impact, reduce operational costs, and provide a conducive space for the holistic development of young individuals.

References