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PROMOTING CAMPUS SUSTAINABILITY THROUGH GREEN INFRASTRUCTURE ATTRIBUTES FOR QUALITY HIGHER EDUCATION

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Introduction

The well-being of university students is essential for fostering a supportive and productive learning environment. Throughout their educational journey, students may face various challenges including managing their social interactions, overcoming academic pressures, and navigating personal growth, all while maintaining their physical and mental health. The importance of addressing students' mental health has been highlighted by research, especially in the context of the stress of coursework and adjusting to university life. According to Park S.Y. *et al.* (2020), academic stress is a significant factor that contribute to the low level of well-being and mental health problems reported by many university students. Exposure to greenery areas has been shown to alleviate stress and reduce depression symptoms (Liu *et al.*, 2022). Therefore, it is critical to ensure that campus green space is properly

designed, upgraded and restored to meet the needs of students, with special attention to gender-specific considerations (Foellmer *et al.*, 2021) to enhance the quality of life among university students.

Integrating natural materials and processes into the built environment is known as "green infrastructure," a sustainable approach of

managing urban environments. While green infrastructure is often associated with stormwater management, limiting its scope to this function risks overlooking the broader landscape ecosystem structure and function (Grabowski *et al.*, 2022). To address this limitation, an integrated framework for green infrastructure has been

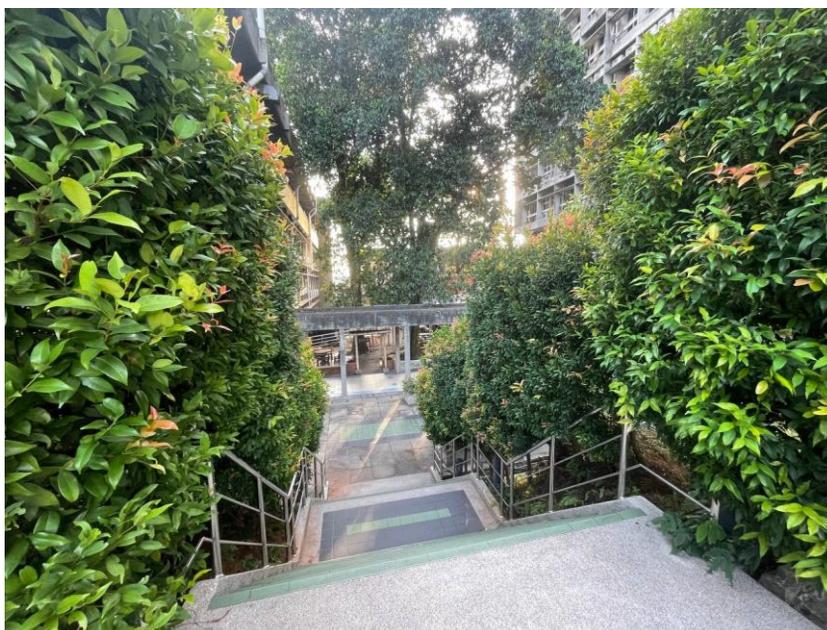


Figure 1: Hedge plant across stairs (Source: Author's own collection)

developed to integrate built infrastructure within the context of environmental networks (Szulczewska et al. 2017; Childers et al. 2019).

Green walls, rain gardens, permeable pavements, green roofs, and urban forests are a few examples of green infrastructure (Camus, 2017). Each type has a distinct function, ranging from improving air quality and supporting biodiversity to offering insulation and lowering stormwater runoff. These methods are designed to manage water and other environmental resources more sustainably by copying natural processes like evapotranspiration and infiltration.

Green Infrastructure Concept

Green infrastructure (GI) is a structural approach to developing infrastructure and urban planning that incorporates the environment, natural processes and mechanisms. Despite the term "green," green infrastructure (GI) frequently consists of blue (water) elements, like wetlands and swales, which are mainly utilised for sustainable drainage systems (Osei et al., 2022). This concept refers to a network of interdependent ecosystems, ecological-technological hybrids, and constructed infrastructures that offer a variety of advantages, such as being multipurpose buildings that serve the environment, economy, and society in

Table 1: Green Infrastructure Principles

| Principles | Description |
|--------------------|--|
| Connectivity | Ensuring public access to and connectivity within green spaces promotes ecosystem health and biodiversity |
| Multifunctionality | Green Infrastructure offers a variety of advantages, such as economic, social, and ecological services. |
| Multiscale | From local to regional, Green Infrastructure operates on a variety of scales and can be incorporated into urban planning and design. |
| Integration | Green Infrastructure should be incorporated into current plans for urban development and infrastructure, encouraging a comprehensive approach to sustainability. |
| Diversity | A wide variety of natural and semi-natural areas, such as green and blue spaces and other ecosystems, should be included in the Green Infrastructure. |
| Applicability | Green Infrastructure should be suitable in a range of settings, such as suburban, rural, and urban areas. |
| Governance | To guarantee the long-term viability and prosperity of Green Infrastructure, efficient governance and management are necessary. |

multiple ways (Grabowski et al., 2022). Green Infrastructure is closely associated with mitigating urban heat islands, improving stormwater management and adapting to climate change. It is also regarded as a strategic approach to addressing the ecological and social impacts of urban sprawl. Systematic literature reviews have emphasized the significance of green infrastructure, highlighting its role in promoting sustainability and achieving urban planning objectives.

Green infrastructure, a concept that has garnered significant attention in recent years, refers to the strategically planned and managed network of natural

and semi-natural areas, features, and green spaces that are designed and managed to deliver a wide range of ecosystem services and benefits for the environment and human well-being (Sin et al., 2021). This concept emphasizes the importance of integrating natural elements into the urban and peri-urban landscape, in contrast to traditional approaches that often prioritize built infrastructure. (Vázquez et al., 2020).

In Malaysia, the implementation of green infrastructure has been gaining momentum through various initiatives and policies aimed at promoting its adoption. The Malaysian government has

taken proactive steps to encourage the use of green building technologies and sustainable practices in the construction industry, recognizing the role that these can play in mitigating environmental degradation and fostering more sustainable development (Mahat et al., 2019). For example, the Construction Industry Transformation Plan 2016-2020 has identified the institution of more environmentally sustainable practices as one of its strategic goals, highlighting the growing importance of green infrastructure in the country's development agenda.

There are cases of successful GI implementation in Malaysia despite the difficulties. For example, the 50-acre Gamuda Gardens Central Park includes GI features like a lake, wetlands, and a forest trail (Nizarudin, 2021). In addition to offering recreational opportunities and stormwater management, the park offers a number of environmental, engineering, economic, and social benefits (Yeo et al 2022). The conceptual framework for green infrastructure in KL, which describes the establishment and planning of GI in the city, is another example. The framework requires the designation of green areas, the creation of green corridors, and the addition of GI into the processes of urban development and planning.

Green Infrastructure (GI) adoption in university settings has received a lot of attention because of its numerous benefits. GI refers to a network of natural and semi-natural systems that provide a variety of ecosystem services, including stormwater management, climate regulation, and biodiversity enhancement. University campuses, with their large land expanses and various activities, offer a unique opportunity to deploy GI for educational, environmental, and social purposes. For example, the University of California, Davis' Arboretum and Public Garden have shown how GI may increase biodiversity and provide habitat for a variety of species. Similarly, the University of Michigan's Campus Farm serves as a living classroom

for sustainable agriculture and environmental science courses, demonstrating GI's teaching opportunities (University of Michigan, 2021).

Benefits of Green Infrastructure Implementation

Green Infrastructure does give benefits in terms of social aspects. According to Mazlina et al. (2009), there are six parameters for cognitive outcomes from Green Infrastructure including relief negative emotion, giving relaxing and comforting environment, providing satisfaction, solitude and contemplation, become a favourite place of comfort and a sense of attachment. Navarrete-Hernandez & Laffan (2023), highlight that increasing



Figure 2: Greenery open space in College of Built Environment, UiTM Shah Alam (Source: Author's own collection)

green coverage in urban areas leads to notable reductions in stress, irritability, and feelings of fear. For example, exposure to natural environments helps individuals recover from stress and reduces anxiety and anger, particularly in urban settings where residents often face high stress levels due to environmental factors. Similarly, Mansor et al., (2009) found out that a substantial percentage of respondents believed that green areas as sources of comfort and relief from negative emotions, emphasising the importance of natural surroundings in urban contexts. The opportunity to engage with nature not only enhances happiness but also fosters a sense of safety and satisfaction among community members.

Mansor et al., (2009) explained that the presence of green infrastructure can stimulate positive emotions such as peace and cheerfulness, both of which are necessary for general well-being. Furthermore, as highlighted by Aswani (2023), green infrastructure creates environments that foster social interactions and community bonding, further enhancing satisfaction levels among residents. Additionally, Mansor et al., (2009) emphasized that having access to green spaces promotes a sense of solitude, allowing people to find quiet periods for contemplation, which is essential for mental health. Olszewska & Marques, (2016) found that many people



Figure 3: Artificial Garden in university environment setting
(Source: Author's own collection)

see these natural settings as their favourite places for solitude, validating the notion that green infrastructure is critical for creating personal serenity and mental clarity within urban environments.

Mansor et al. (2009) stated that considerable number of study participants identified their favourite green places as sources of comfort and relief from unpleasant feelings, underscoring the notion that these locations are critical for developing a sense of well-being and happiness in urban environments. Green Infrastructure create spaces that promote social contact and community participation, which strengthens people' loyalty to these areas. According to Navarrete-Hernandez & Laffan (2023), people who visit green places on a regular basis report more emotional benefits, such as stress and anxiety reduction, which strengthens their bond

with these environments. Therefore, it is crucial for higher education institutions to take a serious action in providing a conducive green infrastructure setting for students.

Conclusion

Challenges to the implementation of GI in Malaysia include limited awareness of its benefits and concerns about the costs associated with its development. However, with collaboration between the community and the government, Malaysia has the potential to lead in GI implementation and create more sustainable and equitable future for all started from its university settings.

References

