

A New Form of the Co-Housing Open Space Concept Application for Low-Income Community Housing in the New-Normal Era which Environmentally Friendly

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ABSTRACT

Along with the narrowness of urban land and the more expensive, it is making people in dense cities who live more in slum areas require alternative solutions to the problem of providing houses with open spaces that be used together but which are affordable and environmentally friendly, incredibly energy efficient. Co-Housing is a concept where a community group plans, finances, and builds their house together on the same land/parcel and has communal/shared spaces. The concept of Co-housing is usually applied in new housing, but given the high price of land in dense cities, this concept will be tried to be used to housing in existing slums. Where a group of people's houses are revitalized and equipped with communal/shared open spaces that are environmentally friendly, especially energy efficient so that people do not have to spend a lot of money to get all the existing facilities available in these communal/shared open spaces. The purpose of this research was to create a new form of the Co-Housing Concept of open shared spaces in environmentally friendly low-income housing. The research method used was descriptive qualitative, which was supported by the identification of land for the Co-Housing concept application and city regulations. The result of the research was a layout draft (master plan) of a new concept of open shared spaces in environmentally friendly low-income housing in several dense urban slum areas.

Keywords: co-housing, housing, open, shared, spaces

1. Introduction

Rapid urbanization in developing countries has intensified land scarcity, housing shortages, and environmental degradation in metropolitan areas. In Indonesia, the growth of informal settlements along riverbanks and marginal urban land has become a persistent urban issue, particularly in cities such as Medan. Limited access to affordable housing and increasing land prices have forced low-income communities to occupy environmentally vulnerable areas, often without adequate infrastructure and public space provision. Recent studies emphasize that conventional slum relocation policies frequently fail due to the disruption of social networks and the loss of community-based social capital [1][2]. Therefore, alternative housing strategies that preserve social cohesion while improving environmental performance are urgently required.

One emerging approach is the co-housing model, which has been widely developed in Europe and North America as a community-oriented housing system integrating shared spaces and participatory planning mechanisms [3][4]. Contemporary research shows that co-housing promotes collective resource management, strengthens neighborhood interaction, and enhances spatial efficiency in dense urban environments [5]. In Asian contexts, participatory housing and cooperative residential models have demonstrated significant potential in maintaining social capital while upgrading settlement quality [6]. The fundamental principle of co-housing lies in collaborative planning, financing, and development of residential clusters that integrate private dwellings with shared communal facilities, as illustrated in Figure 1. Such spatial organization enables cost-sharing, optimized land use, and stronger community engagement [7].

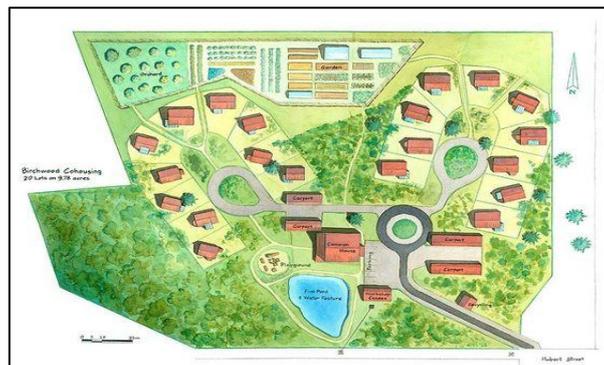


Figure 1. The concept of co-housing

In Indonesia, although cooperative housing practices have begun to emerge, their application remains limited and has not been systematically integrated into slum rehabilitation policies. Riverbank settlements such as those along the Deli River in Medan represent both environmental challenges and spatial opportunities. These areas often contain underutilized open land that can be reorganized into structured communal spaces without displacing existing residents. International experiences, such as the Chapeltown co-housing project shown in Figure 2, demonstrate how shared open spaces can become central elements in building sustainable and socially cohesive neighborhoods [8]. However, adaptation to local socio-cultural and regulatory contexts remains critical for successful implementation [9].



Figure 2. Chapeltown co-housing

The relevance of co-housing has become even more significant in the post-pandemic or “new-normal” era, where access to open space, communal resilience, and decentralized infrastructure systems are increasingly emphasized [10]. Research after 2020 highlights the importance of flexible shared environments that support health, social interaction, and localized resource systems [11]. Furthermore, sustainable housing strategies now prioritize energy-efficient design and renewable energy integration as part of climate-responsive urban development [12]. Buildings account for a substantial proportion of urban energy consumption, particularly through artificial lighting and mechanical ventilation systems. The integration of solar photovoltaic systems in

low-income housing has been identified as a feasible long-term strategy for reducing energy dependency and operational costs [13][14].

Eco-friendly housing concepts extend beyond energy efficiency to include water management, green open spaces, and climate-adaptive landscaping. Studies on sustainable neighborhood regeneration indicate that integrating green corridors and communal gardens can simultaneously improve environmental quality and social interaction [15]. Therefore, combining co-housing principles with eco-friendly infrastructure may offer a viable model for upgrading informal riverbank settlements without relocation.

Based on these considerations, this study proposes a new form of co-housing open space application tailored for low-income riverbank communities in Medan. Unlike conventional relocation-based upgrading, this model emphasizes in-situ rehabilitation, participatory spatial restructuring, and the integration of shared eco-friendly infrastructure systems. The research seeks to answer the following question: How can the co-housing concept be adapted to rehabilitate riverbank slum settlements through environmentally friendly shared open spaces while preserving community social capital? By developing a master plan framework grounded in participatory and sustainable design principles, this research contributes to contemporary discourse on inclusive urban regeneration and community-based housing innovation.

2. Method

This study employed a descriptive qualitative research approach combined with spatial analysis to develop a conceptual master plan for eco-friendly co-housing in riverbank slum settlements. The research focused on identifying both physical and non-physical characteristics of selected study areas to formulate a context-responsive design framework. The study was conducted in two riverbank slum locations in Medan City, namely the Central Petisah Slum Settlement Area and the Polonia Slum Settlement Area. The spatial distribution and geographical context of the Central Petisah site are illustrated in Figure 3, while the Polonia settlement area is presented in Figure 4. These two locations were selected due to their proximity to the Deli River, high settlement density, and the presence of underutilized open land that potentially allows spatial restructuring without relocation.

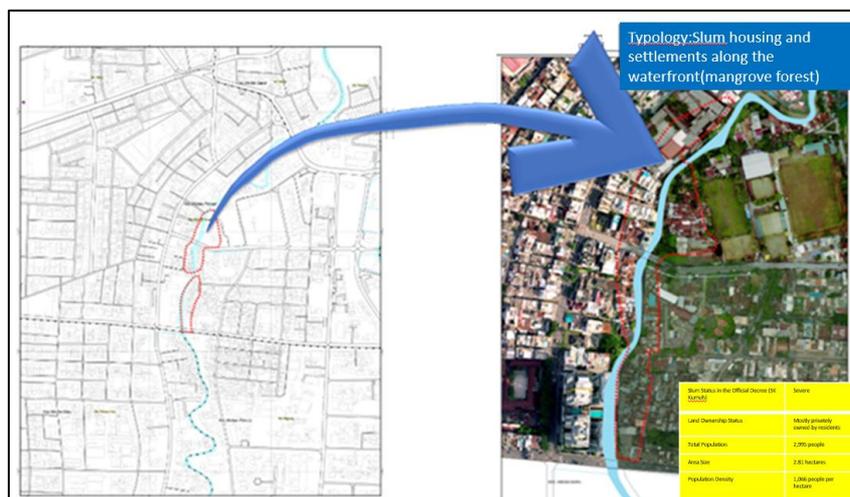


Figure 3. Map of the Central Petisah slum area

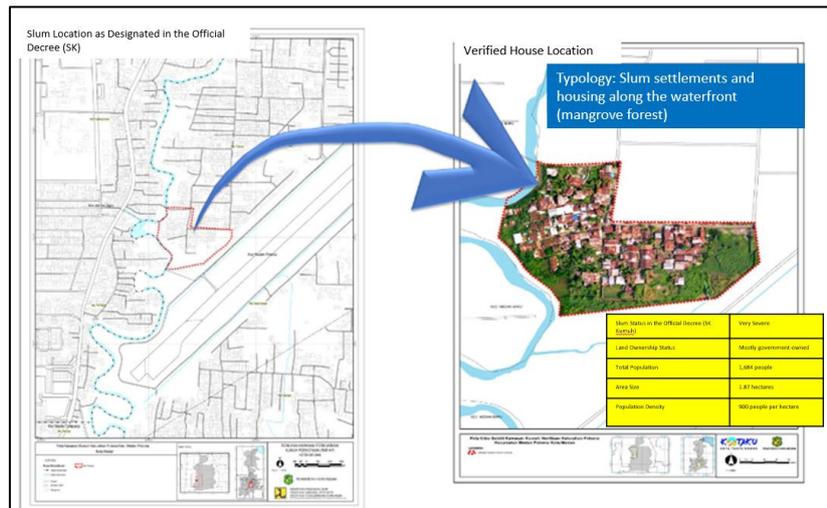


Figure 4. Map of the Polonia slums

The research process began with field observations aimed at documenting the existing environmental conditions of the settlements. This included assessing settlement morphology, zoning patterns, circulation systems, building density, and the availability of open spaces. The analysis was guided by secondary data obtained from the Medan Municipal Government, particularly official documents related to the Urban Slum Area Development Plan. The maps shown in Figure 3 and Figure 4 were used as base maps to identify spatial boundaries, road networks, river setbacks, and potential communal open space areas.

Physical data collection was conducted through direct site measurement, photographic documentation, and spatial mapping to identify private spaces and potential shared spaces within the settlement fabric. This mapping process enabled the identification of vacant or semi-vacant land parcels suitable for communal functions. In addition to physical data, non-physical data were collected through informal observation of community activities to understand social interaction patterns, communal behavior, and the existing use of outdoor spaces. These observations supported the evaluation of community readiness for participatory co-housing implementation.

Site identification analysis was further undertaken to obtain a comprehensive understanding of access roads, land area dimensions, topographical conditions, riverbank boundaries, and environmental risks. The distinction between private residential space and potential shared or inclusive space was systematically categorized. Based on this classification, a preliminary spatial restructuring scheme was developed by reallocating underutilized land into shared facilities such as communal drying areas, green open spaces, pedestrian pathways, and energy-efficient utility zones.

The final stage of the research involved the preparation of a draft master plan based on the co-housing concept integrated with eco-friendly design principles. The planning framework emphasized the transformation of selected spaces into shared or inclusive areas that can be accessed by both residents and the surrounding community. The master plan was designed to incorporate renewable energy systems, particularly solar-powered utilities, as well as green landscape buffers along the riverbank. The spatial proposal was therefore grounded in site-based analysis (as presented in Figures 3 and 4) and aligned with sustainable settlement principles.

3 Result and Discussion

The spatial analysis of the study area reveals that the existing settlement along the Deli Petisah Tengah River is characterized by high density, irregular building patterns, and the absence of organized communal open space. As illustrated in Figure 5, the housing units are built very close to the riverbank without respecting the designated River Border Line (Garis Sempadan Sungai/GSS). This condition increases environmental

vulnerability, particularly the risk of flooding and riverbank erosion. The site currently lacks structured public facilities, and no formal shared open spaces are available for collective activities. Two underutilized vacant plots were identified within the settlement, which are presently used informally by children as playing fields. Circulation infrastructure is also inadequate, as access roads remain unpaved and consist primarily of compacted stone surfaces, limiting mobility and accessibility.

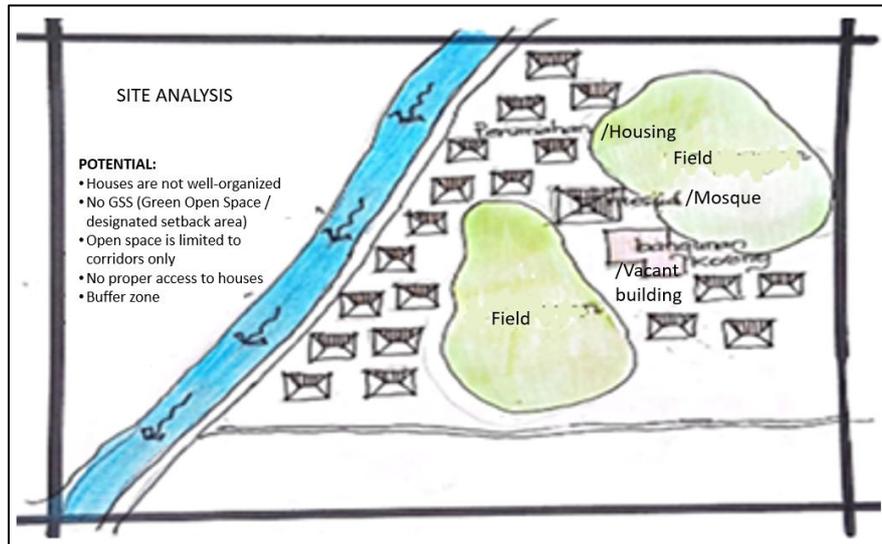


Figure 5. Site analysis

Based on these findings, a mass zoning restructuring strategy was developed according to co-housing principles. The proposed mass zoning concept, shown in Figure 6, reorganizes residential units by establishing a setback distance of approximately 15–20 meters from the riverbank in compliance with environmental regulations. This buffer zone is designed as a green corridor with protective vegetation, including shade and fruit-bearing trees such as jackfruit and mango, which function both as erosion control and productive landscape elements. The restructured zoning also introduces designated shared open spaces, including a communal drying area, shared parking facilities, a sports area, a green garden, and a children’s playground. Public amenities such as a small mosque and pedestrian pathways are integrated within the spatial layout to enhance accessibility and community interaction.

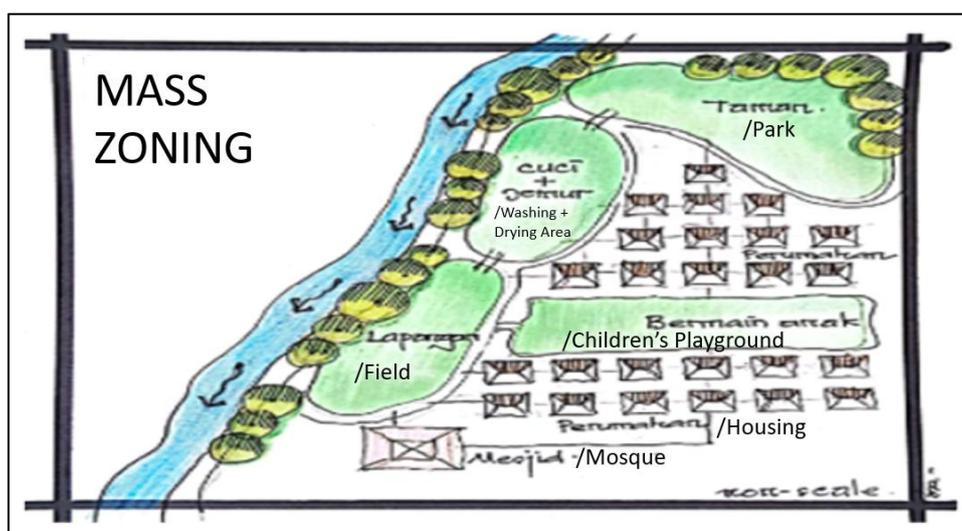


Figure 6. Mass zoning concept

The circulation concept further supports the co-housing framework by prioritizing pedestrian connectivity. As depicted in Figure 7, the redesigned road access system includes pedestrian pathways that connect individual housing units with communal open spaces. Two types of construction materials are proposed: bamboo bridge

structures for lightweight connections across minor drainage channels and precast concrete pathways for primary pedestrian routes. Access to the riverbank is also provided through bamboo decking, allowing controlled interaction with the river environment while maintaining ecological sensitivity. This circulation restructuring improves safety, accessibility, and spatial cohesion within the settlement.

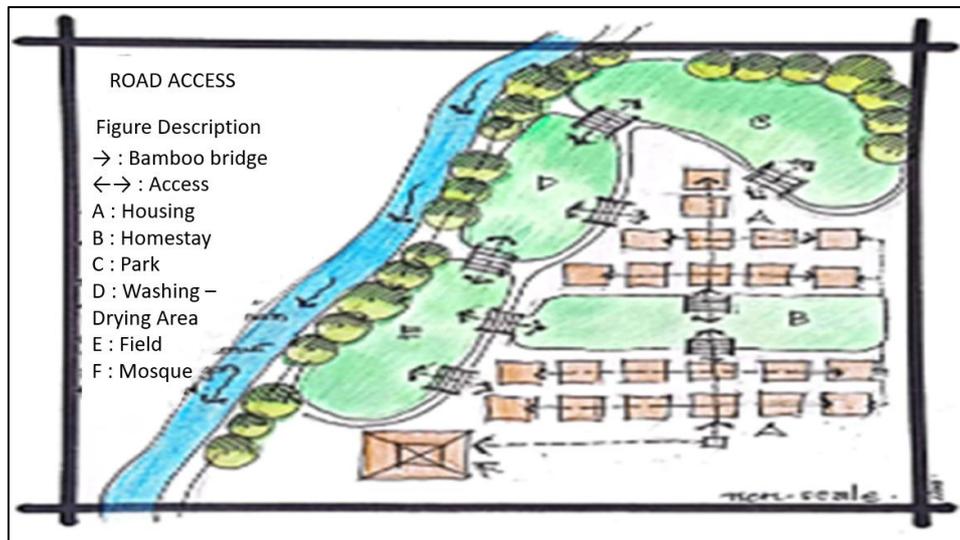


Figure 7. Road access concept

The outdoor spatial design strengthens the social dimension of the co-housing model. Figure 8 presents the first outdoor concept, which integrates a shared parking area and a sports zone consisting of a jogging track and futsal field. The centralized parking arrangement prevents vehicles from occupying narrow residential pathways, thereby improving pedestrian safety and environmental quality. The adjacent sports facilities are intended exclusively for residents to encourage regular physical activity and community engagement. A children’s play area is also incorporated, equipped with swings, slides, seesaws, and a sand play zone, with grass surfaces and shading trees to ensure thermal comfort.

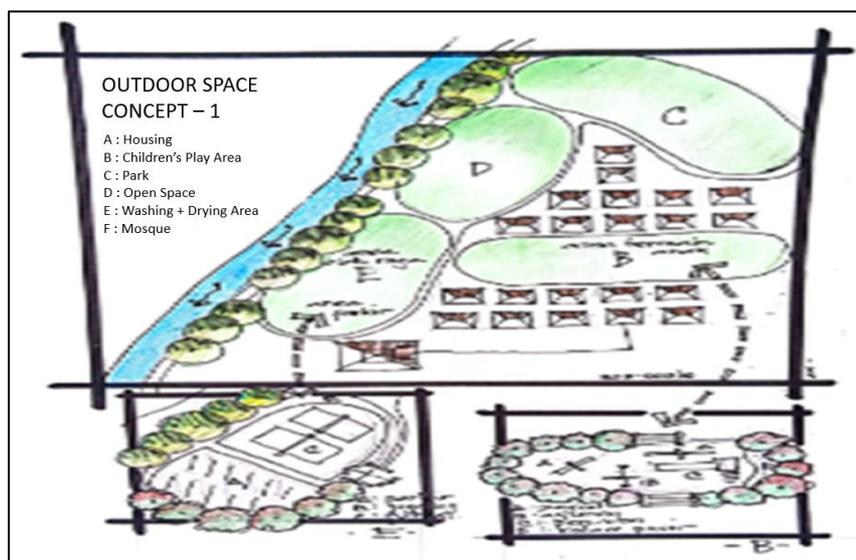


Figure 8. Outdoor concept 1

Complementing this arrangement, Figure 9 illustrates the second outdoor concept, which focuses on communal productive spaces. A shared drying and washing area is designed to accommodate collective domestic activities. Water is supplied from a communal well equipped with a solar-powered pumping system to reduce electricity consumption. Wastewater from laundry activities is filtered through a sedimentation pond before

being discharged into the river, thereby improving environmental management practices. Solar-powered lighting and ventilation fans are installed to enable night time use while maintaining energy efficiency. Adjacent to this area, a green communal garden is proposed, planted with fruit trees such as mango, rambutan, papaya, and banana, as well as vegetables and medicinal plants. Fish ponds are also integrated as small-scale food production elements, reinforcing the concept of community self-sufficiency.

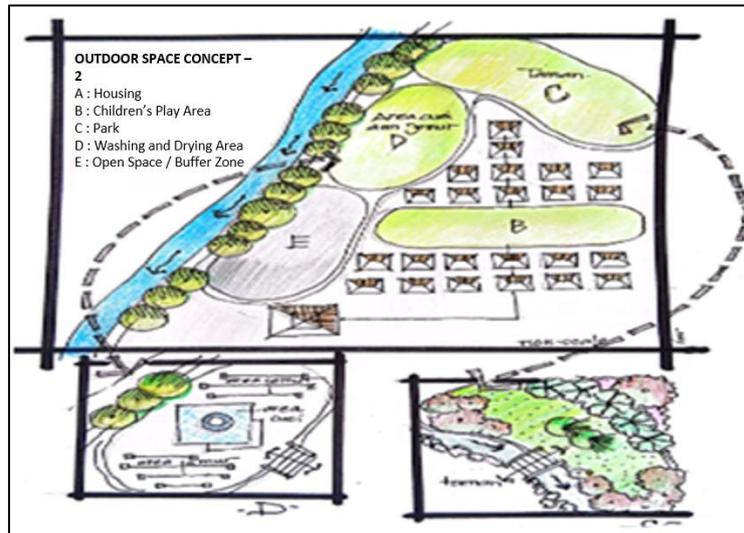


Figure 9. Outdoor concept 2

The eco-friendly utility concept is illustrated in Figure 10, which demonstrates the integration of solar panels as the primary renewable energy source for shared facilities. Solar photovoltaic systems are installed to supply electricity for lighting in communal areas, water pumps in the shared laundry zone, and pathway illumination throughout the settlement. By concentrating renewable energy use in shared open spaces rather than individual housing units, the design maximizes collective benefit while minimizing operational costs for residents. This approach supports energy efficiency goals and reduces dependence on conventional grid electricity, aligning the co-housing concept with broader sustainability objectives.

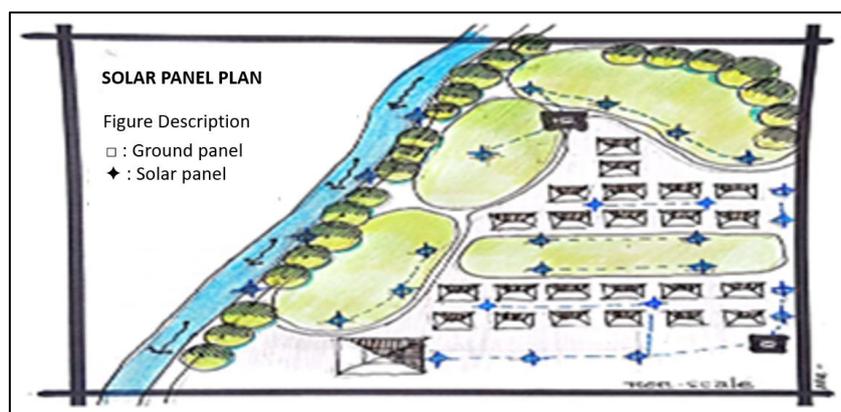


Figure 10. Utility saving concept

Overall, the results indicate that the application of a co-housing open space model can significantly reorganize informal riverbank settlements without requiring relocation. The spatial restructuring enhances environmental safety through river setbacks and green buffers, strengthens social cohesion through shared facilities, and promotes sustainability through renewable energy integration. The proposed master plan demonstrates how participatory housing principles and eco-friendly infrastructure can be combined to address both social and environmental challenges in low-income urban communities.

4. Conclusion

The concept of Co-housing is a good concept in the midst of urban challenges that cause less accessible land and high house prices today. Communities in slums and millennials can determine where and with whom they want to live and the types of public facilities that the community needs. This Co-Housing concept can also be combined with the Eco-friendly concept for the housing utility system.

Realize the concept of co-housing, requires support from all stakeholders, especially local governments, to prepare regulations related to settlements. Currently, there is a program called Community-Based Housing that is being carried out by the government. The target of the program is low-income communities. With this government program, we can see the direction of policies and innovations that support the implementation of the co-housing concept in Indonesia. However, the general public's unfamiliarity with this concept can also be an obstacle to execution.

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6. Conflict of Interest

The authors declare that there is no conflict of interest regarding the publication of this paper. The research was conducted independently without any financial or commercial relationships that could be construed as a potential conflict of interest. All authors have approved the final version of the manuscript and agree to be accountable for all aspects of the work.

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