

Typology of Backyard Transformations into Multifunctional Zones in Permanent Housing at Tondo 1, Palu City

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Abstract

This paper examines the transformation of backyards from service zones into multifunctional spaces within permanent post-disaster housing. The study aims to identify and classify the typology of these spatial adaptations based on spatial character, function, addition patterns, and spatial organization. Observations were conducted on 16 housing units at the Tondo 1 Permanent Housing site in Palu City, Indonesia. The findings reveal a significant evolution of the backyard, driven by residents' growing spatial needs and socio-economic activities. Based on the analysis, five distinct typologies were identified: Adaptive Service, Integrated Domestic, Residential Expansion, Productive Domestic, and Complex Multifunctional. These typologies illustrate a progressive adaptation process, from simple service area adjustments to the creation of fully integrated, multifunctional living spaces. This classification provides a systematic framework for understanding post-disaster housing adaptation and offers valuable insights for designing more flexible and responsive housing models.

Keywords: Backyard Typology, Permanent Housing, Post-Disaster Adaptation, Multifunctional Zone, Spatial Transformation, Tondo 1 Palu.

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I. INTRODUCTION

1.1 Post-Disaster Permanent Housing

Permanent housing represents a crucial component of post-disaster settlement recovery, aimed at providing safe, decent, and sustainable shelter for affected communities. In the planning phase, such housing is typically constructed using standard designs to facilitate rapid, efficient development and fulfill basic occupant needs. These designs delineate spatial functions into public, semi-public, private, and service zones, including the backyard, which is designated as a service area for cooking, washing, drying clothes, and supporting natural lighting and ventilation. However, the spatial requirements of residents evolve continuously after occupancy, prompting modifications to the pre-established spatial layout.

1.1.2 Adaptation and Transformation of the Backyard

The evolving need for space, driven by factors such as family growth, changes in daily activities, and increasing economic demands, leads residents to adapt their dwellings. The backyard emerges as the most frequently modified space due to its higher flexibility compared to the main building structure. Observations at the Tondo 1 Permanent Housing site in Palu City indicate that the backyard has transitioned from a designated service zone into a space capable of accommodating diverse domestic, social, and economic activities. These include the addition of kitchens, dining areas, family rooms, bedrooms, bathrooms, and even business spaces. This condition demonstrates that the backyard has undergone a transformation into a multifunctional zone, serving as a direct response by residents to the limitations of the initial housing design.

1.1.3 Typology of Spatial Change

In architectural studies, typology serves as a methodological approach to classify objects based on shared characteristics, thereby elucidating patterns of change. Applying a typological framework to spatial change allows for the classification of various resident adaptations according to spatial characteristics, functions, addition patterns, and spatial organization. This approach not only describes the physical forms of change but also systematically reveals the relationship between resident needs and the evolution of living spaces.

1.2 Research Problem

While numerous studies have addressed post-disaster housing adaptation—covering physical alterations, functional transformations, and resident behavior—a significant portion of this research describes changes on a per-unit basis or solely in terms of added functions. Systematic studies specifically classifying backyard transformations based on spatial character, function, addition patterns, and organization remain relatively scarce. Consequently, a comprehensive classification explaining spatial adaptation patterns in post-disaster permanent housing is lacking.

1.3 Research Objective

This research aims to identify and formulate a typology of backyard transformations into multifunctional zones within the Tondo 1 Permanent Housing site. The typology is constructed based on shared characteristics of space, function, addition patterns, and spatial organization. The resulting classification aims to explain residents' spatial adaptation patterns and provide recommendations for developing more adaptive post-disaster housing designs.

II. RESULTS AND DISCUSSION

2.1 Characteristics of Backyard Transformations

Observations of 16 housing units at Tondo 1 Permanent Housing revealed that all backyards have undergone changes from their initial state, which was designated as a service zone. In the original concept, the backyard served as a support area for cooking, washing, and drying, as well as providing open space for natural lighting, ventilation, and water absorption. However, after several years of occupancy, the continuous evolution of residents' spatial needs has driven various forms of adaptation in backyard utilization.

The transformations are not limited to the addition of functions but also encompass changes in spatial character, building addition patterns, and spatial organization. Some units have merely added basic service spaces such as kitchens and washing areas, while others have evolved to accommodate domestic, social, residential, and even economic activities. This variation indicates that each resident employs a distinct adaptation strategy, tailored to family needs, socio-economic conditions, and the available land area.

To systematically capture these changes, the observation results from 16 respondents were summarized based on the actual function of the backyard, the nature of the transformation, and the predominant materials used for spatial development. This compilation serves as the foundation for constructing the typology of backyard transformations into multifunctional zones, discussed in the subsequent section.

Tabel 1: Characteristics of Backyard Transformations among 16 Respondents

Respondent	Actual Backyard Functions	Character of Transformation	Dominant Materials
R-01	Kitchen, washing area, drying area, dining room, family room	Domestic - Social	Concrete + Light Steel
R-02	Kitchen, washing area, dining room	Basic Domestic	Gypsum + Light Steel
R-03	Kitchen, washing area, bathroom, family room, dining room, part-time kiosk	Domestic - Social - Economic	Red Brick + Wood
R-04	Grocery kiosk, upstairs bedroom, family room	Economic + Vertical Residential	Concrete Block + Hollow Steel
R-05	Grocery kiosk, kitchen, washing area, dining room	Domestic - Economic	Concrete Block + Light Steel
R-06	Kitchen, washing area, dining room, bedroom	Residential Expansion	Gypsum + Light Steel
R-07	Kitchen, washing area, dining room, family room, chicken coop	Domestic - Social	Concrete Block + Light Steel
R-08	Kitchen, washing area, dining room, family room, bedroom, storage, two bathrooms	Complex Multifunctional	Concrete Block + Light Steel
R-09	Kitchen, washing area, dining room, family room, storage, two bathrooms	Domestic Multifunctional	Gypsum + Light Steel
R-10	Kitchen, washing area, drying area	Adaptive Service	Wood
R-11	Kitchen, washing area, dining room, family room	Integrated Domestic	Concrete Block + Concrete
R-12	Kitchen, washing area, dining room, family room, bedroom, drying area	Domestic - Residential	Concrete Block + Light Steel
R-13	Kitchen, washing area, dining room, bedroom	Residential Expansion	Gypsum + Light Steel
R-14	Kitchen, washing area, bedroom, bathroom, dining room, production kitchen	Residential - Economic	Concrete Block + Concrete + Light Steel
R-15	Kitchen, washing area, bathroom, dining room, family room, production kitchen	Domestic - Economic	Red Brick + Concrete + Light Steel
R-16	Kitchen, washing area, dining room, additional bedroom	Residential Expansion	Gypsum + Light Steel

Based on Table 1, it is evident that the transformations exhibit varying degrees of spatial adaptation corresponding to the distinct needs of each household. The majority of backyards have evolved from their initial service function into spaces accommodating various domestic activities, such as kitchens, washing areas, dining rooms, and family rooms. In several units, the changes also include adding bedrooms, bathrooms, storage spaces, and even business areas, reflecting growing residential needs and family economic activities.

Beyond functional changes, the character of spatial transformation reveals differentiated adaptation patterns. These range from simple modifications to service functions, domestic space integration, the addition of residential spaces, the integration of economic functions, to the creation of complex multifunctional spaces. This variation is supported by the use of diverse building materials, from semi-permanent materials like gypsum and wood to permanent materials such as concrete blocks, concrete, and light steel. These findings suggest that backyard transformations are not random but follow discernible adaptation patterns, forming the basis for developing the typology.

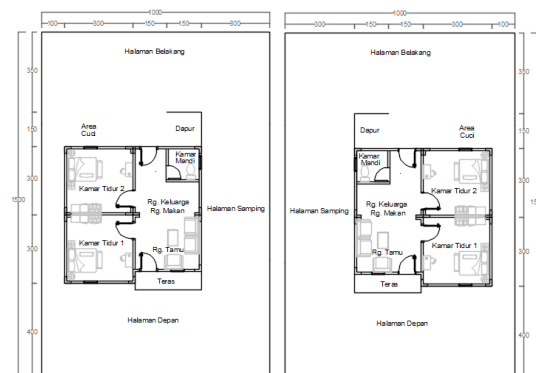


Figure 1: Initial Standard Floor Plan of the Housing Unit

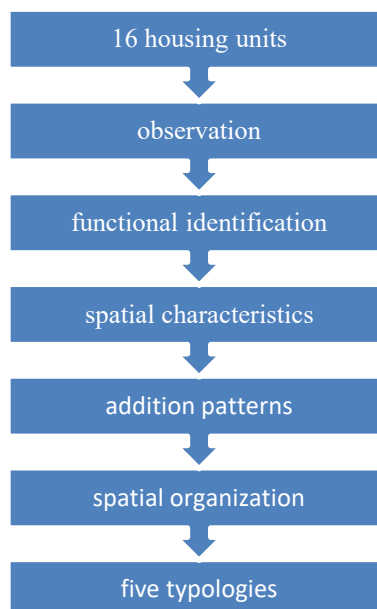


Figure 2: Diagram of Typology Formation Process

2.2 Typology of Backyard Transformations into Multifunctional Zones

The identification process across the 16 housing units reveals diverse characteristics regarding spatial function, addition patterns, and organization. Nevertheless, further analysis shows shared adaptation patterns among certain units, allowing for categorization into several groups with similar characteristics.

The typological grouping in this study is based on four key indicators: spatial character, spatial function, addition pattern, and spatial organization. These indicators are used to identify similarities in residents' adaptive strategies, resulting in a classification that systematically describes the patterns of backyard transformation. Based on the analysis, the sixteen housing units were grouped into five typologies of backyard transformation into multifunctional zones, as presented in the following table.

Table 2: Typology Characteristics

Typology	Respondents	Characteristics
Typology I – Adaptive Service	R-02, R-10	Limited changes to kitchen, washing, and drying areas; retains the essential character of a service zone.
Typology II – Integrated Domestic	R-01, R-07, R-11	The backyard develops into a hub for domestic activities through the integration of kitchen, dining, and family rooms.
Typology III – Residential Expansion	R-06, R-12, R-13, R-16	Addition of bedrooms and supporting facilities in response to increased living space requirements.
Typology IV – Productive Domestic	R-03, R-04, R-05, R-14, R-15	The backyard is utilized for economic activities, such as a grocery kiosk or production kitchen, without eliminating domestic functions.
Typology V – Complex Multifunctional	R-08, R-09	The backyard evolves into a multifunctional zone combining various functions—kitchen, washing, dining, family room, bedroom, bathroom, storage, and other supports—within a single spatial organization.

2.2.1 Typology I – Adaptive Service

This typology represents the most basic form of transformation, where the backyard primarily retains its function as a service zone. Modifications are limited to the addition of kitchens, washing areas, and drying areas, with minimal building expansion. The spatial organization remains relatively unchanged, thus preserving the service-oriented character of the initial design.

2.2.2 Typology II – Integrated Domestic

This typology illustrates the evolution of the backyard into a more integrated domestic space. Beyond its function as a kitchen and washing area, the rear space is also utilized as a dining and family room. The integration of these functions establishes the backyard as the center of domestic activity and family interaction.

2.2.3 Typology III – Residential Expansion

This typology is characterized by the addition of bedrooms and supporting facilities as a direct response to the growing need for living space. This transformation demonstrates the utilization of the backyard as an area for residential expansion, increasing the capacity and comfort of the home without significantly altering the main building structure.

2.2.4 Typology IV – Productive Domestic

This typology demonstrates the utilization of the backyard to support family economic activities, such as operating a grocery kiosk or a production kitchen, without compromising its domestic functions. The backyard develops into a productive space that integrates residential and business activities, thereby providing economic value for the occupants.

2.2.5 Typology V – Complex Multifunctional

This typology constitutes the highest level of adaptation. The backyard transforms into a comprehensive multifunctional space that combines various functions, including a kitchen, washing area, dining room, family room, bedroom, bathroom, storage, and other supporting functions within a single spatial organization. This condition signifies a complete transformation of the backyard from a service zone into a primary activity hub within the dwelling.

Tabel 3: Ringkasan Tipologi

Typology	Spatial Character	Dominant Functions	Addition Pattern	Spatial Organization
1	Basic Service	Kitchen, washing	Simple Horizontal	Linear
2	Domestic	Kitchen, dining, family	Permanent Horizontal	Integrated
3	Residential Development	Bedroom, bathroom	Full Horizontal	Expanded Private Zone
4	Productive	Kiosk, production kitchen	Horizontal/Vertical	Domestic + Economic
5	Multifunctional	All functions	Complex Permanent	Total Reorganization

2.3 Discussion

Hasil The research findings indicate that the transformation of backyards in the Tondo 1 Permanent Housing represents a form of spatial adaptation by residents in response to the limitations of the initial housing design. Originally planned as a service zone for cooking, washing, and drying, the backyard has evolved over time into a multifunctional space accommodating domestic, social, private, and economic activities as residents' needs have expanded. This condition highlights the dynamic nature of living spaces, which continuously change in response to the evolving requirements of their occupants. This finding aligns with the perspective of [1], who posits that the form and organization of housing are not solely determined by physical design but are also influenced by the activities, culture, and lifestyle patterns of their inhabitants.

The five identified typologies demonstrate that spatial change occurs progressively, beginning with adjustments to service functions, the integration of domestic activities, the addition of residential spaces, the development of economic functions, and ultimately culminating in a complex multifunctional space. This pattern suggests that spatial adaptation is a continuous developmental process shaped by changing family needs. This reinforces the concept of *Housing as a Verb* proposed by [2], which argues that a house is not a static product but an ongoing process, continuously evolving through the active involvement of residents in adapting their space to their life requirements.

The transformations also highlight the active role of residents in developing spatial organization without altering the main building structure. The backyard is leveraged as the most flexible space for introducing new functions, such as bedrooms, family rooms, business spaces, and storage. This finding is consistent with the theory of [3], which explains that buildings should be understood as systems that enable inhabitants to modify specific parts according to their needs while maintaining the primary structure. In the context of Tondo 1 Permanent Housing, the backyard functions as a space offering opportunities for residents to implement gradual, incremental development.

Furthermore, the changes in spatial organization across each typology indicate that residents' activity patterns are the primary factor influencing spatial formation. The integration of kitchens, dining rooms, family rooms, and even business spaces demonstrates that spatial organization evolves in line with the intensity of daily activities. This is in accordance with the view of [4], who states that the spatial layout of a dwelling is shaped by the relationship between inhabitant behavior, activity needs, and space utilization, thus making functional changes a consequence of shifting lifestyles.

Overall, this research formulates five typologies of backyard transformation that illustrate residents' spatial adaptation patterns in post-disaster housing. These typologies not only reveal variations in physical change but also elucidate the developmental stages of spatial function, from a basic service zone to a multifunctional hub. Consequently, this study provides a conceptual contribution in the form of a typological model of backyard transformation. This model can serve as a reference for understanding spatial adaptation in post-disaster housing and as a consideration for policymakers and planners in designing more flexible and adaptive housing that can accommodate the evolving needs of occupants in the future.

III. CONCLUSION

This research demonstrates that the backyards of the Tondo 1 Permanent Housing in Palu City have undergone a significant transformation from service zones into multifunctional zones. This represents an adaptive response by residents to the evolving spatial requirements encountered after occupancy. These transformations encompass not only the addition of domestic functions like kitchens, washing areas, dining rooms, and family rooms but also extend to the creation of private spaces (via added bedrooms) and productive spaces supporting family economic activities. This finding underscores the critical role of the backyard as the most flexible area for accommodating residents' changing needs.

Based on shared characteristics of spatial character, function, addition patterns, and organization, the backyard transformations can be grouped into five distinct typologies: **Adaptive Service Typology, Integrated Domestic Typology, Residential Expansion Typology, Productive Domestic Typology, and Complex Multifunctional Typology**. These five typologies illustrate a continuum of spatial adaptation, ranging from simple modifications to highly complex transformations. They offer a more systematic understanding of the patterns of spatial change in post-disaster housing.

The primary contribution of this research is the formulation of a typological model for backyard transformation. This model serves as a conceptual framework to explain spatial adaptation patterns in post-disaster permanent housing. It is intended to be a reference for policymakers, planners, and developers in designing more flexible and adaptive housing that is responsive to the evolving needs of residents. Furthermore, it provides a foundation for future research on spatial transformation in post-disaster settlements across various regional contexts.

Unlike previous studies that often described partial functional changes, this research provides a classification of five distinct typologies based on spatial character, function, addition patterns, and organization. This typological model enriches the scholarly discourse on spatial adaptation in post-disaster housing and can be

utilized as a basis for evaluating and developing housing designs that are more responsive to the dynamic needs of their inhabitants.

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