*International Journal of Engineering Inventions*
*e-ISSN: 2278-7461, p-ISSN: 2319-6491*
*Volume 15, Issue 1 [January 2026] PP: 119-123*

# Typology of Behavior Setting and Spatial Adaptation in the Vernacular Architecture of Smokehouses in Bandarharjo, Semarang

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***ABSTRACT:****Kaliasin Village in Semarang is a prototype of a productive settlement that transformed from a fishing village to a fish smoking industry center through bottom-up initiatives. This study aims to critically examine the typology of behavior setting and spatial adaptation in the vernacular architecture of smoking houses. Using a qualitative descriptive approach with behavior mapping techniques in 37 residential units, this study reveals that architecture in this area has evolved into an adaptive "production machine".The results of the study identified ten variations of behavior setting typologies formed by three main variables: furnace location (side or back), activity limit (internal or external), and production capacity (number of furnaces). Morphologically, settlement patterns deviate from formal grid plans to organic linear patterns that follow river paths as logistic arteries. The findings show a strong synmorphy between physical space and social behavior, which is reflected in gender-based division of labor and activity rhythms that are in sync with worship time (Fajr to Magrib). This synergy allows a simple residential unit measuring 4x6 meters to achieve an extraordinary production capacity of up to 400 kg of fish per day. This study concludes that the typology of vernacular architecture in Kaliasin Village is not just a slum dwelling, but a manifestation of local wisdom that is able to integrate domestic and economic functions efficiently for the resilience of coastal communities.*

***Keywords:*** *Typology, Behavior Setting, Vernacular Architecture, Fish Fumigation, Spatial Adaptation, Kaliasin Village.*

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Date of Submission: 10-01-2026 Date of acceptance: 23-01-2026

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## I. INTRODUCTION

Kaliasin Asapan Village, located in Bandarharjo Regency, North Semarang, is a unique case of a productive settlement that has undergone a significant functional transformation. Originally established as a traditional fishing village, the area has developed into a self-organized industrial hub for the production of smoked fish (fish smoking). This shift from the purely residential domain to the center of the home-based industry highlights the resilience of the community and their ability to manage marine resources independently, making it an important node in Semarang's local economy.

The development of the smoked fish industry in this settlement is not the result of formal planning from the top down but an initiative from the bottom up. Started in 1990 by a local pioneer, Muhammad Irwan, the production house was designed based on the direct functional requirements and cultural nuances of the coastal community. While early urban planning for the area suggested rigid grid patterns, the actual spatial realization strayed toward the linear morphology that followed the natural course of the river. This alignment shows how social realities and environmental constraints often override formal planning in a vernacular context.

The people of Kaliasin Bandarharjo village, who mostly work as fish smokers, are carried out in smokehouses that are located separately from settlements. The smoking activity begins after dawn prayers, and is completed before Maghrib time. The length of work time depends on the number/quantity of fresh fish that will be made for grilled fish. So if the number of fish to be smoked is not much, then the smoking activity can be completed before the Maghrib time. In general, every day, each smokehouse is able to produce 3-4 quintals of smoked fish.

The smoking activity began after fresh fish was brought in from the Kobong Market at dawn. Residents usually work after dawn prayers because the people of Kaliasin Bandarharjo village are Muslims, so their activities usually start after dawn prayers to maghrib prayers. When the ingredients/fish to be smoked have arrived, the men are the ones who carry out the activity. Because the activity of smoking fish begins by cutting/separating the fish's head from its body. This activity is quite strenuous so that the men do it. After the

fish body is separated from the head, the next stage is to slice the fish into thin slices, but before slicing the fish is washed first. This activity is carried out by women who have slicing skills, the number of slices of each fish is adjusted to the purchase price of fresh fish. After being sliced thinly, the fish is then attached with a skewer with the intention that the fish meat does not crumble/crumble. The next stage is grilling/smoking fish. Fumigation is usually carried out by the women/women of the Kaliasin Bandarharjo village. In general, everyone is able to work smoking fish with three furnaces. After the fish is finished smoking, then aerated and then packed and counted. Then the fish is ready to be deposited or taken by the buyer/orderer who has subscribed.

The following is described the process of fish smoking activities by the people of Kaliasin Bandarharjo village, Semarang as follows:

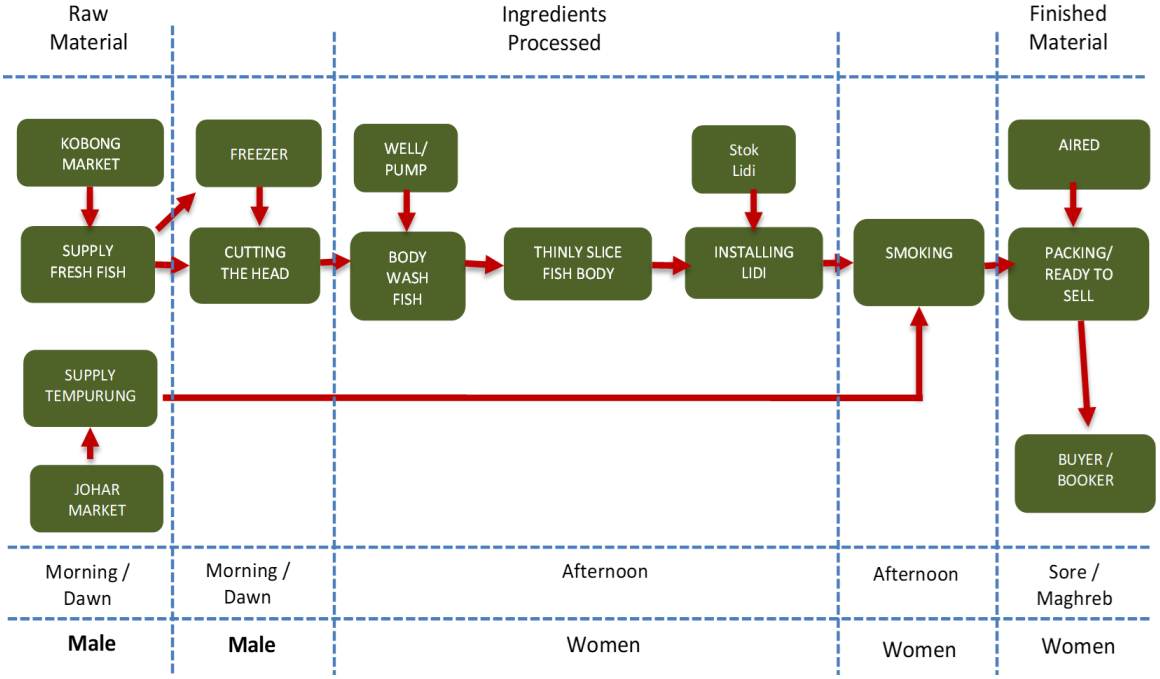


**Fig. 1. Fish Fumigation Process**

## II. EXPERIMENTAL SETUP

Research Design this study employs a qualitative descriptive approach to explore the phenomenon of behavior settings within a productive settlement. This design was selected for its efficacy in uncovering the underlying meanings behind community activities and their physical manifestations in vernacular architecture. The study focuses on the synchronization between human behavior and the organically formed built environment in Kampung Kaliasin.

The subjects of the study include: fish smokers (business owners and workers). Family members involved in the production process. Neighbors, consumers, and parties who interact with production activities. Observations were made on the daily activities of the community in 37 smokehouses. In-depth interviews were conducted with community leaders and active artisans to explore the history, development, and meaning behind the spatial planning and behavior that took place.

Data collection techniques to ensure data validity through triangulation, three primary techniques were utilized:

a. Participatory Observation and Spatial Mapping: Intensive observations were conducted across 37 smoking houses. This process tracked daily routines, activity duration, and spatial movement from dawn to dusk to understand the operational flow of the smoking industry.
b. In-depth Interviews: Interviews were held with community pioneers and active fish smokers to gather historical insights, the rationale behind spatial layouts, and the socio-cultural values influencing domestic design decisions.
c. Visual Documentation: Field photography and floor plan sketching were employed to document the materiality of the structures specifically the use of repurposed materials and the configuration of smoking kilns as essential components of the physical milieu.

The collected data were processed using behavior mapping and typological analysis. By identifying recurring patterns in space utilization and production workflows, the study formulated ten distinct behavior

setting typologies that define the unique architectural character of the settlement.

## III. RESULTS AND DISCUSSION

Kaliasin Village in Bandarharjo is not just an ordinary settlement, but a "living factory" where the house and workplace are harmoniously united. Here are interesting findings from the field:

### *A. History and Changes in the Shape of Buildings*

Initially, the smokehouses here were designed very simply, which was in the form of a box measuring 4 x 6 meters. In the initial plan, this village wanted to be built with a grid pattern (like neat chess boxes). However, the real need on the ground says otherwise.

Because communities rely heavily on rivers for transportation and disposal, the village pattern naturally changes to linear (extending along the river). Over time, the previously uniform building began to change independently. Every homeowner expands or changes the shape of his building according to how much fish they produce each day. This shows that houses in Kaliasin are very flexible and continue to "grow" following the economic pulse of their owners [4].

### *B. The Shape and Layout of the House*

If we take a walk in Kaliasin Village, we will see two models of house positions: one stands perpendicular to the river, and some are parallel to the river. The basic shape remains square, but what is unique is the material [5}.

Residents use a combination of natural materials and manufactured materials. The walls or structure may use bamboo and wood, but the roof uses zinc or asbestos. The use of these used or simple materials is not without reason; The material was chosen because it is functional, inexpensive, and easy to repair if damaged by exposure to the heat of the smoke fire every day. One of the most striking features is the chimney. Each house has its own way of laying its chimney; Some are on the side, behind, or in the center of the roof—depending on the position of the furnace inside. The sloping roof shape is also specially designed so that smoke is not trapped in the house, so that workers remain comfortable while doing activities.

### *C. Work System and Gender Roles*

Activities in this village have a very regular rhythm. Life begins very early, right after the Fajr prayer, and only ends at sunset or before Maghrib. This is where the very neat division of labor between men and women is seen:

a. Male Role: Usually doing more strenuous physical work in the early stages, such as transporting fish from the harbor, chopping and preparing raw fish.
b. Women's Role: Playing a very important role in the core process. They are very skilled in slicing fish with precision, arranging fish on a smoking stove, maintaining the stability of the fire, and wrapping (packing) cooked fish.

Just imagine, an average house is capable of processing 3 to 4 quintals (300-400 kg) of fish every day! This large job is usually done by a small team of 4 to 5 people. This proves that the smokehouse in Kaliasin is not just a place to live, but a small industrial unit that supports many heads of families through extraordinary teamwork [6].

The initial building of the smokehouse was designed in the form of a box with a base size of 4 x 6 meters. Initially planned in a grid pattern, but the development formed a linear pattern because it followed the flow of the river. The building unit then develops independently based on production needs.

### *D. Behavior Setting dan Tipologi*

An average smokehouse unit in Kaliasin demonstrates a remarkably high production capacity, processing approximately 300-400 kilograms of fish per day. This level of output is typically achieved by a small workforce of only four to five individuals, indicating a highly efficient division of labor and strong collective work practices. Such productivity illustrates that the smokehouse functions not merely as a residential space, but as a small-scale industrial unit that plays a vital role in sustaining household livelihoods and supporting the local informal economy [7].

Architecturally, the initial smokehouse structure was designed as a simple box-shaped building with a base dimension of approximately 4×6 meters. Although the early layout concept followed a grid-based arrangement, subsequent spatial development evolved into a linear pattern aligned with the river corridor. This transformation reflects the strong influence of environmental context and logistical considerations, particularly access to water and transportation routes [8]. Over time, individual building units expanded organically and independently in response to increasing production demands, resulting in a flexible spatial configuration that integrates residential, productive, and economic functions within a single built form.

**Table 1. Based on Building Function**

| | |
|---|---|
| Fumigation and Residential Housing | House No : 26, |
| Fish Fumigation | House No: 1,3,4,5, 9, 10, 11,12,13, 14, 15,17,18,19,20,21,22,23,24,25,26,30,31,32, 33,34,35,37 |
| Other functions / not recorded | House No.:2,6,7,8, 27,28,29,36 |

*Behavior setting* of fish smoking every day, starting after dawn prayers until before Maghrib (time), for places of activity there are some that are carried out outside the house and inside the house (place) [9]. The position of the furnace as a baking/smoking activity is located on the side or behind the house, with furnace patterns 3, and 6. With the number of furnaces from 3 to 12 pieces, (*milieu*). This activity takes place repeatedly every day.

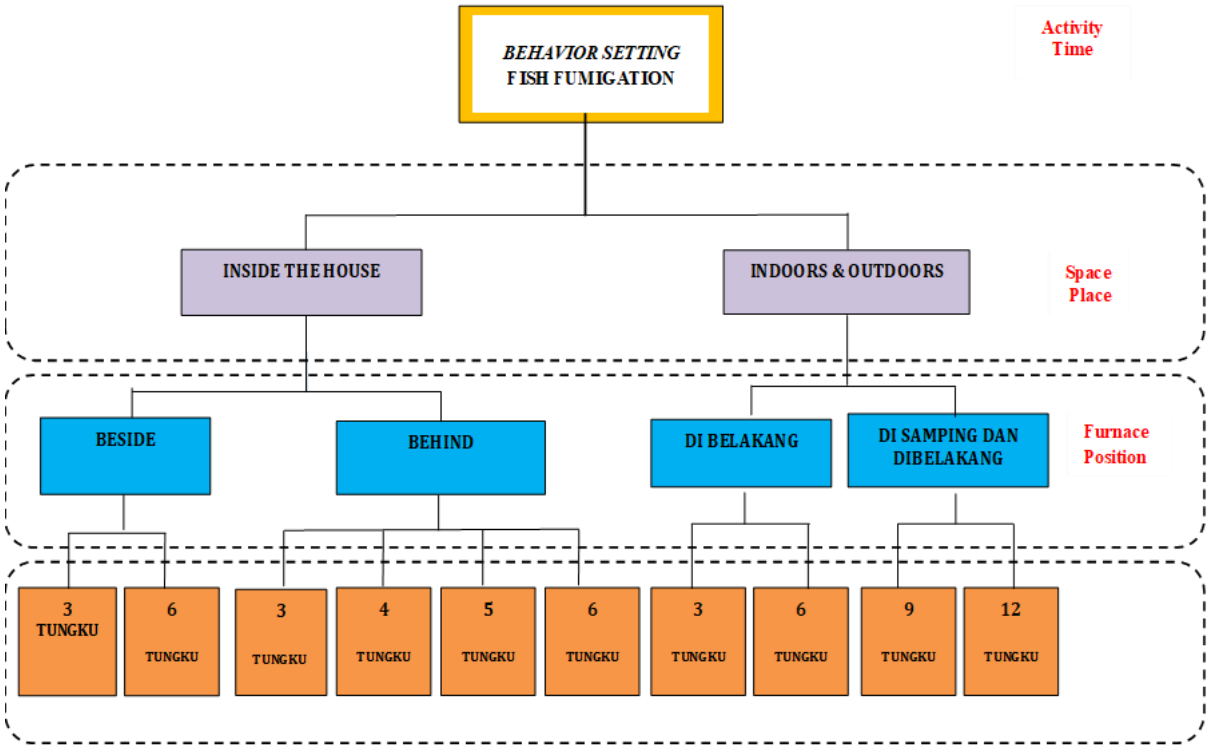


**Figure 2. Typology *of Behavior Setting* in Kampung Asapan**

The types of *behavior setting* types of fish smoking, from time to afternoon are as follows:
Type 1: inside the house – the furnace on the side – number of furnace 3, namely: house no.11.
Type 2: inside the house – the furnace on the side – the number of furnaces 6, namely: house no.12 and no.13.
Type 3: inside the house – the furnace at the back – the number of furnace 3, namely: house no.31.
Type 4: inside the house – furnace at the back – number of furnace 4, namely: house no.27 and no.28.
Type 5: inside the house – the furnace at the back – the number of furnaces 5, i.e.: house no.30.
Type 6: inside the house – the furnace at the back – the number of furnaces 6, namely: house no.1, no.33, and no.35.
Type 7: inside and outside the house – the furnace at the back – the number of furnaces 3, house no.11.
Type 8: inside and outside the house – the furnace at the back – number of furnaces 6, i.e.: house no.26.
Type 9: inside and outside the house – the furnace behind and beside the furnace – number of furnace 9, namely: house no.3, no.4, and no.5.
Type10:inside and outside the house – the furnace behind and beside the furnace number 12, namely: house no.17,
no.19, and no.20.

## IV. CONCLUSION

Kampung Kaliasin merupakan manifestasi arsitektur vernakular produktif di mana sepuluh tipologi behavior setting terbentuk secara organik mengikuti alur sungai dalam pola linier. Tipologi ini diklasifikasikan berdasarkan letak tungku (samping atau belakang), batas ruang aktivitas (internal atau meluas ke eksternal), serta kapasitas produksi yang didukung oleh 3 hingga 12 tungku. Adaptasi spasial pada unit bangunan dasar 4x6 meter ini membuktikan kecerdasan lokal dalam mengoptimalkan sirkulasi asap dan keterbatasan lahan, mengubah hunian domestik menjadi "mesin produksi" yang efisien dan fungsional.

Sinergi antara ruang dan perilaku (sinomorfi) terlihat pada ritme kerja harian yang sinkron dengan waktu ibadah, mulai dari fajar hingga senja, dengan pembagian peran gender yang sangat rapi. Laki-laki menguasai fase logistik dan persiapan, sementara perempuan menjadi aktor utama dalam proses pengasapan inti di dalam ruang produksi, memungkinkan pengolahan hingga 400 kg ikan per hari. Secara keseluruhan, tipologi Kampung Kaliasin adalah model permukiman mandiri yang resilien, di mana desain "tanpa arsitek" dan penggunaan material daur ulang berhasil menciptakan keberlanjutan ekonomi bagi masyarakat pesisir Semarang.

**Acknowledgments**

The author would like to thank the residents of Kaliasin Bandarharjo Village for their openness and participation in this research, as well as those who have provided technical and logistical support. We also express our gratitude to LPPM Universitas Tunas Pembangunan Surakarta (UTP)

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