

ARSITEKTUR

**LAPORAN AKHIR PENELITIAN MANDIRI**  
KATEGORI A



**PERSEPSI MASYARAKAT TERHADAP  
PENERAPAN *REUSE* MATERIAL DAN KOMPONEN  
BEKAS PADA BANGUNAN**

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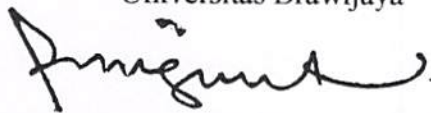
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# RINGKASAN

## PERSEPSI MASYARAKAT TERHADAP PENERAPAN REUSE MATERIAL DAN KOMPONEN BEKAS PADA BANGUNAN

Industri konstruksi memiliki dampak yang cukup besar terhadap keberlanjutan lingkungan. Penerapan *reuse* material berperan besar karena dapat mengurangi penggunaan bahan mentah dan *embodied energy* di awal konstruksi serta mengurangi timbunan sampah konstruksi di akhir masa hidup bangunan. Walaupun secara teori dapat dipahami dampak positif *reuse* material dan komponen bangunan baik secara sosial, ekonomi, maupun lingkungan, namun praktik di lapangan tidak sejalan. Belum banyak ditemui bangunan yang memanfaatkan kembali material dan komponen bekas dalam konstruksinya. Penelitian ini berupaya mengidentifikasi persepsi masyarakat terhadap penerapan *reuse* material dan komponen bekas pada bangunan, sehingga dapat diketahui minat dan potensi penerapannya di Indonesia. Pengumpulan data dilakukan melalui kuesioner online yang dibagikan pada tiga target responden: arsitek, developer-kontraktor, dan masyarakat umum. Teridentifikasi potensi penerapan *reuse* material/komponen bekas pada bangunan di Indonesia dengan tingginya minat untuk *reuse* material/komponen bangunan bekas. Masyarakat juga telah memahami pentingnya *reuse* dan dampak positifnya terhadap lingkungan. Selain itu masyarakat juga terdapat respon positif masyarakat pada aspek tampilan, harga, kualitas, resiko kesehatan dan keamanan penggunaan material/komponen bekas. Hambatan pada aspek ketersediaan, perawatan, dan ketahanan/ durabilitas memerlukan perhatian khusus.

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**Kata kunci:** *reuse*, persepsi, material-komponen bekas, bangunan

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## **SUMMARY**

### **PUBLIC PERCEPTION ON THE APPLICATION OF REUSED MATERIALS AND COMPONENTS IN BUILDINGS**

The construction industry has a big impact on environmental sustainability. Materials and components reuse plays a more significant role than recycling because it reduces raw materials and embodied energy at the beginning of construction and minimizes construction waste at the end of the building's life. Although the social, economic, and environmental benefits of reusing materials and components are well established, field practices are not. There are not many buildings that utilize reused materials and components. This study seeks to identify public perceptions on the application of materials and components reuse in buildings. Data were collected from the three target research respondents: architects, developers-contractors, and the general public using online questionnaires. The research has identified the potential for reused materials/components in buildings in Indonesia, where there is a high level of interest in reusing materials/components. The community has also recognized the importance of reuse and its positive impact on the environment. Furthermore, the community also has a positive opinion of the aesthetic appearance, costs, quality, health risks, and safety of reused materials/components. Barriers in terms of availability, durability, and maintenance require extra attention.

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**Keywords:** reuse; perception; material; component; building

## PENGANTAR

Puji syukur kami panjatkan kehadiran Allah SWT yang telah melimpahkan rahmat dan ridlo-Nya sehingga terselesaikannya laporan akhir penelitian dengan judul "PERSEPSI MASYARAKAT TERHADAP PENERAPAN *REUSE* MATERIAL DAN KOMPONEN BEKAS PADA BANGUNAN". Semoga penelitian ini dapat memberikan manfaat yang sebesar-besarnya baik dalam keilmuan maupun dalam kondisi nyata. Atas segala keterbatasan dan kekurangan dalam usulan penelitian ini kami memohon masukan dan saran dari para pembaca.

Malang, 15 November 2021

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# Public Perception on the Application of Reused Materials and Components in Buildings

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## Abstract

Materials and components reuse plays a more significant role than recycling because it reduces raw materials and embodied energy at the beginning of construction and minimizes construction waste at the end of the building's life. Although the social, economic, and environmental benefits of reusing materials and components are well established, field practices are not. There are not many buildings that utilize reused materials and components. This study seeks to identify public perceptions on the application of materials and components reuse in buildings. Data were collected from the three target research respondents: architects, developers-contractors, and the general public using online questionnaires. The research has identified the potential for reused materials/components in buildings in Indonesia, where there is a high level of interest in reusing materials/components. The community has also recognized the importance of reuse and its positive impact on the environment. Furthermore, the community also has a positive opinion of the aesthetic appearance, costs, quality, health risks, and safety of reused materials/components. Barriers in terms of availability, maintenance, and durability require extra attention.

*Keywords: reuse; perception; material; component; building*

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## 1. Introduction

The construction sector has a big impact on environmental sustainability. Building material waste accounts for half of the world's total solid waste, according to World Bank figures from 2012 [1]. Building demolition waste accounts for 90% of all construction waste, with the remaining 10% coming from the renovation and new building construction [2].

The concept of materials/components reuse is an embodiment of circular economy in architecture. Reclaimed materials/components are reused in a new environment without undergoing chemical transformations, and their physical form remains unchanged [3]. Reusing materials offers far lower environmental impacts than recycling due to the significantly lower treatments and processing required [4]. According to Arora et al. [5], public residential buildings in Singapore currently have 125.7 million tons of non-metallic minerals, 6.52 million tons of steel, 6.45 million windows, 8.61 million doors, 1.97 million toilet accessories, 15.33 million lighting features, 0.99 million kitchen accessories (including stoves and kitchen cabinets) and 52.54 million m<sup>2</sup> of tiles. If these components can be salvaged during demolition, they have the potential to be used to construct 830–1910 new housing units [6].

Although the social, economic, and environmental benefits of reusing materials and components are well established, field practices are not. There are not many buildings that utilize reused materials/components.

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This study seeks to identify public perceptions on the application of reused materials/components in buildings. Thus, public interest and potential applications in Indonesia can be understood.

## 2. Research Methods

Data was collected through an online questionnaire (Google Form). The questionnaire and research method were based on prior studies by Jin [7] and Strauss [8]. Questionnaires were distributed online during August-October 2021 through social media and email to three target categories of research respondents: architects, developers – contractors, and the general public. The questionnaire is divided into two sections.

1. The first section focuses on the demographics of respondents. It consists of 5 questions (gender, age, education level, residence, and profession or type of respondent group) to understand the respondents' backgrounds.
2. The second section focuses on public perception. This section consists of 16-17 questions (14 general questions for all respondents; 2 additional questions specifically for general public respondents; 3 additional questions specifically for architect and developer-contractor respondents), aimed to determine the level of knowledge, interest, and public perception on the application of materials/components reuse in buildings.

## 3. Discussions

### 3.1. Demographic Distribution of Questionnaire Respondents

181 responses were collected from respondents. The majority of respondents is in the age range of 45-54 years old (36.5%), with the following age groups in order of percentage: 35-44 years old (26%), 55-64 years old (21%), 25-34 years old (9.4%), 18-24 years old (5%), and >64 years old (2.1%). Most respondents had a doctoral degree (39.8%), followed by a master's degree (36.5%), a diploma/bachelor's degree (22%), and a high school/equivalent education level (1.7%). 93.3% of respondents reside in Java, 3.3% in Sumatra, 2.8% in Kalimantan, and 0.6% in West Nusa Tenggara. Responses were obtained from the three target respondent groups with the following distribution:

- developers-contractors (3.3%) with the majority have >10 years work experience (50%)
- architects (16%) with the majority have >10 years work experience (62.1%), and
- the general public (80.7%).

### 3.2. Knowledge, Interests and Perceptions Regarding the Application of Reused Materials and Components in Buildings

Almost all respondents agree that reuse is a more sustainable waste management option than recycle and they have seen buildings constructed using reused materials. More than 60% of respondents have experience with reusing building materials such as wooden beams and planks, plywoods, door and window frames, roof tiles, galvanized roofing, zinc, steel bars and beams, glass, bricks, paving blocks, ceramic tiles, stones, prefabricated wall panels, formwork in building castings, sanitary wares, furniture, plastics, to wood sawdust. More than 66% of respondents want to reuse building materials. 72.6% of general public respondents stated that the application of reused materials should be encouraged because it positively impacts the environment.

If they have building materials that can be reused, all three groups of respondents choose to save them for later use (50-53.4%). Another alternative by architect respondents is to pay a reasonable fee for someone to pick it up for reuse as long as it is less expensive than the cost of sending it to a landfill (44.8%),



developer-contractor respondents prefer to sell (50%), and general public respondents prefer to give it away for free (51.4%).

The lack of understanding about whether or not materials may be reused is thought to be the main barrier impeding the usage of reused materials/components in construction. The second reason is that it is easier to dispose of the material than to reuse it. The third issue is the difficulty in obtaining old reusable materials. The result is in line with Sassi's research [9] which states that cost, awareness, and technology are three main barriers to using recyclable materials/ components.

The three groups of respondents consider several things that can encourage them to reuse building materials to overcome these barriers; the following is the priority list in order:

1. The availability of a system that assists in discovering, reporting, purchasing, and selling reusable materials.
2. Clear regulations on procedures for materials/components reuse in buildings
3. Clear regulations for sorting and registering reusable materials/component
4. Building codes that require the application of reused materials/components
5. Building tax relief

69% of architects have recommended reusing building materials/components to the client throughout the design phase, and 62.1% of architect respondents have received requests from clients to reuse building materials/components. Likewise, 83.3% of respondents in the developer-contractor group have advised architects/clients to reuse building materials/components. 66.7% of developer-contractor respondents have even interacted with collectors or distributors of used materials to explore the possibility of using them in their projects.

There is potential for reusing materials/components in buildings in Indonesia. Most respondents thought the reused materials/components were as good as new materials regarding aesthetic appearance, costs, quality, health risks, and safety. However, it is considered quite difficult in terms of availability and maintenance, some also questions about the material's durability.

Table 1. Comparison of used materials and new materials

Question	Choice of answers	Responses (%)		
		Architect	Developer-Contractor	General public
<b>In your opinion, when compared between used materials and new materials:</b>				
Availability of reused building materials/components	• available & easy to access	17.2	<b>66.7</b>	30.1
	• available but difficult to access	<b>72.5</b>	33.3	<b>62.4</b>
	• not available	10.3	-	7.5
Aesthetic appearance of building with reused building materials/components	• excellent	17.2	16.7	6.2
	• acceptable	<b>79.4</b>	<b>83.3</b>	<b>82.8</b>
	• unpleasant	3.4	-	11
Costs of reused building materials/components	• lower than new materials	<b>75.9</b>	<b>83.3</b>	<b>80.8</b>
	• same	24.1	16.7	8.9
	• higher than new materials	-	-	10.3
Maintenance of reused building materials/components	• lower than new materials	3.4	33.3	6.8
	• same	<b>48.3</b>	16.7	<b>46.6</b>
	• higher than new materials	<b>48.3</b>	<b>50</b>	<b>46.6</b>
Quality of reused building materials/components	• higher than new materials	10.3	16.7	13.7
	• same	<b>58.7</b>	<b>50</b>	<b>45.2</b>
	• lower than new materials	31	33.3	41.1
Health risk arising from reusing building materials/components	• non-existent health risk	17.2	16.7	25.3
	• same	<b>55.2</b>	<b>66.6</b>	<b>58.3</b>
	• higher risk than new materials	27.6	16.7	16.4
Durability of reused building materials/components	• longer lasting than new materials	10.3	-	11
	• same	<b>48.3</b>	<b>66.7</b>	30.1
	• shorter lasting than new materials	41.4	33.3	<b>58.9</b>

8	Safety of reused building materials/components	• more safe than new materials	10.3	-	6.2
		• same	<b>51.8</b>	<b>66.7</b>	<b>54.8</b>
		• less safe than new materials	37.9	33.3	39

#### 4. Conclusion

The research has identified the potential for reused materials/components in buildings in Indonesia, where there is a high level of interest in reusing materials/components. The importance of reuse and its positive impact on the environment has also been recognized by the community. Furthermore, the community also has a positive opinion of the aesthetic appearance, costs, quality, health risks, and safety of reused materials/components. Barriers in terms of availability, maintenance, and durability require extra attention.

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