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TRACKING ARCHITECTURAL DEFECTS IN RESIDENTIAL PROJECT IN MALAYSIA

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ABSTRACT

Building defects are always a key concern in the construction industry. Defects represent not only a loss to the project but also hamper the smooth operation of a building. Recognising the need to resolve these continuing problems, research was mooted to track the study of defects that occurred during the Defects Liability Period for residential projects in Malaysia. This paper presents part of the research that investigates what can be learned from the analysis of architectural defects in this project. Two research objectives were developed: (1) to investigate types of architectural defects that occurred, (2) to analyse the causes of the defects, and (3) to categorise the causes of the defects. A mixed methods approach is adopted. Data for the quantitative element of the research was drawn from the project's defect records. They were sorted, grouped and transferred into the SPSS software for analysis using frequency analysis. The findings suggest defects can be effectively traced and categorised with a proper methodology in place. This can provide useful insights into their root cause and how it can be avoided in future projects.

Keywords: *Architectural defects, Residential project, Defects Liability Period, Tracking, insights*

INTRODUCTION

Construction defects are a persistent issue in Malaysian residential projects, threatening the growing construction sector despite the nation's rapid development (Isa et al., 2021; Kartina et al., 2018). These defects often result from shortcomings in project implementation, with project overseers being aware of early warning signs that enable proactive measures to address underlying issues (Isa et al., 2010; Jorgensen, 2009). The Housing Development Act (HDA) mandates a 24-month defect liability period from key receipt, emphasizing the importance for contractors and developers to minimize defects during this period, aligning with sustainable construction practices and Sustainable Development Goal 11 (Hassan et al., 2022).

The National Housing Policy 2030 in Malaysia takes a comprehensive approach to addressing construction defects in affordable housing, prioritizing the quality and durability of residential properties (Olanrewaju, 2021; Zolkafli et al., 2014). Research efforts focus on hidden defects and strategies to raise awareness among property buyers, aligning with the policy's goals. Additionally, the policy anticipates significant transformations in the construction industry, incorporating technology to mitigate defects and improve overall efficiency (Rahimin et al., 2023; Khotamov, 2023). Research endeavours aim to understand the nature of defects during the defect liability period, providing educational opportunities for project crews to enhance both cost-efficiency and quality (Lambers et al., 2023). This research aims to investigate the relationship between the types of defects and their root causes for architectural works during the Defects Liability Period (DLP) for residential projects. In line with this aim, three research objectives are developed: (i) to identify the types, (ii) to analyse the causes of the defects, and (iii) to categorise the causes of the defects that occurred during the DLP.

LITERATURE REVIEW

Construction Defects Generally

Deficiencies in design, workmanship, or materials during the construction of a building or structure led to construction defects, causing a failure to meet intended performance or contract requirements (Lambers et al., 2023; Sellakuty et al., 2017; Kraus et al., 2017). The occurrence of construction defects has become increasingly noticeable within the Malaysian construction industry in recent years, as indicated by various studies (Sandanayake et al., 2021; Dzulkifli, 2021; Sravani & Chandgude, 2020; Sellakutty et al., 2017). Despite advancements in building technology, the prevalence of building defects remains persistent, emerging as the most common issue in Malaysian construction projects (Sravani & Chandgude, 2020). These defects primarily stem from inadequate design and construction practices, leading to a decline in the overall value of the structures. Additionally, they significantly impact the quality and life-cycle costs of residential projects (Gurmu & Cole, 2018). Alomari (2021) emphasized the prevalence of construction defects globally, highlighting their significance in the construction industry. Recognizing the importance of learning from these defects, it is crucial for project teams to grasp their implications and interconnections (Isa et al., 2011; Olanrewaju et al., 2010; Jorgensen, 2009). Addressing persistent defects in newly built housing nationally and internationally is achievable through learning from these experiences (Hopkin et al., 2016).

Additionally, Lambers et al. (2023) indicated that construction defects significantly contribute to subpar quality performance, resulting in frequent project costs and schedule overruns, primarily due to the need for rework. Construction defects, as per Alomari (2021) and Ibrahim et al. (2016), are described as the failure of a building component to be erected correctly. Yacob et al. (2019) further defined defects as flaws detracting from faultlessness, while damage to a building occurs when construction work or building elements are not fully effective.

Types of Construction Defects

Defects in construction, including those arising from regular wear and tear or deficiencies in design and building processes, are diverse examples (Lambers et al., 2023; Alomari, 2021; Yacob et al., 2019; Isa et al., 2011; Olanrewaju et al., 2010). Atkinson's (2002) classification system distinguishes defects as either physical or patent. Physical defects refer to failures in meeting established requirements for construction materials, structures, or project documentation, while process defects occur when the building process consumes excessive resources or time. Patent defects are observable during inspections, but hidden defects only surface during occupation. Obtaining information on defects in occupied buildings is challenging, as Chong and Low (2005) note, given that such details are seldom disclosed until tenants formally report complaints.

Hassan (2009) and Nordin (2010) contend that RMK9 constructions commonly exhibit architectural defects, contrasting Amin's (2010) view that tenants are more likely to report architectural defects due to their visibility compared to mechanical issues. Water seepage, fractures, and finish problems emerge as prevalent defects in Malaysian structures (Hassan et al., 2022). Olanrewaju et al. (2010) categorize defects into major (e.g., structural cracking, flooding, electrical system short circuits), minor, and substantial. Correcting construction defects is deemed crucial due to their impact on project duration, construction costs, sustainability, productivity, customer satisfaction, legal responsibility, and societal consequences (Tayeb et al., 2020; Koch & Schultz, 2019).

Gonzalez (2023) emphasizes the significant impact of notable defects on a building's integrity, usability, and aesthetic appeal. Examples include mechanical, electrical, and structural integrity issues, water intrusion causing property damage, design errors, material defects, and construction defects such as poor drainage. Some defects, like undersized beams or poorly reinforced concrete, are evident during construction, have clear team responsibilities, and are cost-effective, classifying them as minor defects (Gonzalez, 2023).

Causes of Construction Defects

The causes of construction defects in Malaysia exhibit diversity and are linked to various factors, as outlined by Tayeb et al. (2020) and Hassan et al. (2022). Structural defects leading to wall cracks, discussed by Bakri and Mydin (2014) and Khan et al. (2021), can result from excessive load or settling and heaving of the structure. Borku (2020) attributes defects to factors such as the quality of construction materials, substandard craftsmanship, inadequate site supervision, improper construction practices, and design inconsistencies. According to Khan et al. (2021), natural hazards introduce unpredictability, contributing to defects ranging from minor fractures to complete structural collapse. Despite implementing construction defect management provisions to integrate safety measures into designs, challenges arise, particularly in dealing with elements like soil movement during seismic events. Identifying reasons at various project stages is crucial.

The occurrence of construction defects is influenced by multiple factors, including budget constraints, deficient design, subpar craftsmanship, inadequate maintenance practices, contractor performance issues, insufficient site management, incorrect construction methods, the use of low-quality materials, human errors, and flawed work processes. Conversely, Tayeb et al. (2020) emphasize that construction defects commonly arise from poor workmanship, substandard building materials, inadequate supervision, design errors, land instability, and non-compliance with established standards.

Alomari (2022) asserts that construction defects stem from a variety of reasons, encompassing both apparent manifestations and hidden anomalies within structures. Performance-affecting defects may arise due to faulty design or construction. Contributing factors, as highlighted by Summerlin and Ogborn (2006) and Alomari (2022), include inadequate architectural design, substandard manufacturing practices, use of inferior materials or equipment, and deviations from established plans and specifications.

Category of Construction Defects

In their study, Isa et al. (2014) proposed a comprehensive taxonomy of defects consisting of 10 distinct categories. These categories include

workmanship, design, maintenance, lack of protection, material, documentation, nature, vandalism, user maltreatment, and wear and tear.

Table 1. Category of Defects

Defects Category	Description
Workmanship	Improper joints, improper handling of the components and improper installation
Design	Poor decisions in design, i.e., specification of materials, layout and integration between different materials and systems
Maintenance	Materials systems that are not maintained properly or are non-existent during occupancy of the building
Lack of protection	Deficiencies in the construction process that result in inadequate protection against various elements, leading to defects in the building project
Material	Poor material quality
Documentation	Wrong or incomplete specification
Nature	Due to unpredictable nature
Vandalism	Due to deliberate destruction
Mishandling by users'	Due to human error
Wear and tear	Gradual damage upon daily usage of an item over time

Source: Rahimin et al. (2023); Isa et al. (2014)

Workmanship defects, which frequently arise due to the actions of contractors, stem from inadequate handling, installation, material blending, as well as the formation of joints or gaps. Design defects are characterised by poor design decisions made by designers, whereas maintenance defects pertain to material systems that have not been appropriately maintained during the occupancy of a structure. The occurrence of protection defects can be attributed to inadequate or inadequately maintained equipment protection measures. The occurrence of material defects can be attributed to the utilisation of substandard materials in the project. Documentation defects arise because of inaccurate or insufficient specifications during the pre-contract or construction phase. Natural defects and vandalism defects are ascribed to the inherent unpredictability of natural forces and the intentional act of deliberate destruction, respectively. Wear and tear defects become apparent because of the progressive damage incurred with regular usage over an extended period.

Furthermore, Lee et al. (2018) have classified eight different defect

categories: poor job performance, cracked objects, abrasion, separation, inappropriate fitting, missing mission, surface appearance, and water-related problems. In their study, Hanafi et al. (2018) categorised construction problems into two primary categories: structural and non-structural. Structural defects encompass physical harm inflicted upon specified load-bearing components, presenting potential hazards to individuals occupying the structure. Non-structural defects pertain to many components inside a structure, such as roofs, walls, columns, beams, windows, doors, floors, staircases, and aprons. These defects do not threaten the structure's safety, but they do necessitate restoration to ensure optimal performance (Suffian, 2013; Hanafi et al., 2018). According to Lee et al. (2018), a comprehensive classification of defects includes eight distinct categories. These encompass issues related to substandard job performance, water-related complications, surface irregularities, abrasion, separation, improper fitting, mission omission, and cracking.

Rationale for Tracking Construction Defects

According to Hassan et al. (2011), the rationale for tracking construction defects in Malaysia is to identify the types, causes, and categories of each defect that occurs during the construction process. By systematically recording and tracking defects, parties managing construction projects can diagnose the causes of the defect to take preventive action, and avoid similar defects from reappearing, even if the building is constructed by the same contractor (Isa et al., 2016). This is important because construction defects have incurred a substantial cost for the Malaysian government. A significant portion of government allocations for maintenance works on completed buildings is dedicated to defect rectification (Hassan et al., 2011). Isa et al. (2016); Le et al. (2007); Carillo (2006); and Ilozor (2004) added that with the help of this significant data, the project team will be able to identify what went wrong and improve project management in the future.

Moreover, the justification for tracking construction defects is rooted in promptly identifying and recording such issues to prevent expensive rework, project delays, and potential safety hazards. Construction defects can arise due to substandard craftsmanship, utilisation of inferior materials, inadequate planning or supervision, inaccurate measurements, and failure to adhere to building codes (Awasho, 2023; Tayeb, 2020).

Defects Issues in Residential Projects in Malaysia

Azmin et al. (2022) stated that in Malaysia, residential buildings face various defects affecting their quality and functionality. Some common defects include dampness, facade deterioration, sanitation problems, and low-quality construction. These defects can lead to dissatisfaction among occupants, disputes between clients, developers, and maintenance organizations, and even litigation. The causes of defects are attributed to human errors, work processes, design flaws, and construction deviations (Azmin et al., 2022).

According to Hassan et al.(2022); Azmin et al., (2022); Plebankiewicz and Malara, (2020); Suffian (2013); and Chohan et al.(2011) there is a significant percentage of quality failures and defects occur during the construction stage, highlighting the need for improved construction practices and quality control measures. In a study by Azmin et al. (2022), they found that affordable housing industries in Malaysia highlighted the criticism of low-quality construction, resulting in defective and unsatisfactory housing projects. Hassan et al. (2022) emphasised that non-structural cracks were the top first-ranked building defects in Malaysian construction projects, indicating the prevalence of structural issues. Additionally, private housing in Malaysia revealed common building defects such as dampness, facade deterioration, and sanitation problems (Chohan et al., 2011).

Defects in residential buildings in Malaysia are a significant concern, impacting the quality and maintenance of housing. Addressing these issues requires a comprehensive approach that encompasses improved construction practices, rigorous quality control, and effective maintenance strategies (Hassan et al., 2022; Azmin et al., 2022; Plebankiewicz and Malara, 2020; Suffian, 2013; Chohan et al., 2011).

RESEARCH METHODOLOGY

A single case study of 160 units of terrace houses in Kuala Terengganu was selected as the case study. This is due to terrace houses typically having a larger number of units, making the data for defects easier to study. According to REHDA (2021), Terengganu is among the states with rapid residential

construction and the fastest district in terms of construction rate in the state of Terengganu.

A mixed-methods research approach was adopted. First, document analysis was conducted on the defect reports recorded by the homebuyers to identify the types of defects that occurred during DLP. Then, a semi-structured interview with the site project manager and site officer was conducted to verify the causes and categories of defects. This data was then transcribed manually.

Next, a quantitative research method was adopted to record and classify defects identified during the DLP of the residential projects. Data on the defects obtained from these houses' reports were sorted, sieved, grouped, and transferred into SPSS software version 29.

RESULTS AND DISCUSSION

Overall Number and Percentage of Defects

Table 2 shows the overall number and percentages of defects according to work disciplines.

Table 2. Numbers of Overall Defects

Work disciplines	Number of defects	Percentage of defects (%)
Architectural	4140	85
Structural	506	11
Mechanical	107	2
Electrical	100	2
Total	4853	100

Source: Authors' own research result, (2023)

There are four work disciplines involved, namely architectural, structural, mechanical, and electrical. A total of 4,853 defects were recorded, with architectural as the most defective work (85%), followed by structural (11%), electrical (2%) and mechanical (2%).

Summary of Major Architectural Defects

Table 3 outlines the overall number of defects by element according to architectural work disciplines.

Table 3. Types of Architectural Defects

Element/Work discipline	Total	Rank
A) Architectural		
1. Roof	132	5
a) Blockage of gutter system and rainwater downpipe	104	
b) Missing roof tiles	28	
2. Staircase	52	6
a) Peeling off paint	52	
3. Wall, Floor and Ceiling Finishes	2524	1
a) Peeling of paint at wall	558	
b) Dirty and stain mark	542	
c) Peeling of paint at ceiling	380	
d) Plaster crack	256	
e) Unevenness of paint	196	
f) Poor finishing of wall plaster	185	
g) Watermark at ceiling due to roof leakage	164	
h) Poor installation of floor tiles	158	
i) Plaster peeling	76	
j) Fungus on the wall	9	
4. Windows & Fittings	438	3
a) Poor fixing of window	222	
b) Dirty and stain mark at window	188	
c) Hairline crack	28	
5. Doors	670	2
a) Dirty and stain mark at door	200	
b) Door leaf damaged	182	
c) Door frame damaged	138	
d) Poor fixing of door	94	
e) Door leaf difficult to open	56	

6. Sanitary Fittings, Fixtures & Toilet Cubicles	288	4
a) Loose fittings / Improper installation of fittings	164	
b) Incomplete installation of plug socket	86	
c) Dirty and stain mark	38	

Source: Authors' own research result,(2023)

Table 3 recapitulates the types of architectural defects that occur in residential projects. Architectural works comprise six main elements. These are Roof, Staircase, Wall, Floor and Ceiling Finishes, Windows and Fittings, Doors and Fittings, and Sanitary Fittings, Fixtures and Toilet Cubicles.

Wall, Floor and Ceiling Finishes involve ten types of defects. These are peeling paint on the wall, dirty and stain marks, peeling of paint at ceiling plaster cracks, unevenness of paint, poor finishing of wall plaster, watermarks at the ceiling due to roof leakage, poor installation of floor tiles, plaster peeling, and fungus on the wall. Peeling of paint on the wall was ranked as the most defective work, and plaster peeling and fungus on the wall had the fewest defects that occurred.

Doors and Fittings involve five types of defects. These are dirty and stain marks at the door, door leaf damaged, door frame damaged, poor fixing of the door and the door being difficult to open. Dirty and stain marks at the door are ranked as the most defective work, and doors that are difficult to open are ranked as the least defective.

Windows and Fittings involves three types of defects. These are poor fixing of the window, dirty and stain marks at the window, and hairline cracks. Poor window fixing is ranked as the most defective work, and hairline crack is the least defective work.

Sanitary Fittings, Fixtures and Toilet Cubicles involve three types of defects: loose fittings, incomplete installation of plug socket and dirty and stain marks. Loose fittings are ranked as the most defective work, and dirty and stain marks as the least defects occurred.

Roof and Staircase are the least defective elements identified in architectural works. The Roof involves only two types of defects, namely blockage of the gutter system and rainwater downpipe and missing roof

tiles. Blockage of the gutter system and rainwater downpipe is the least defective work recorded. Meanwhile, only peeling of paint defects occurred in the Staircase.

Table 4. Type of Architectural Defects and Its Frequent Defective Items

Element	Type of elemental defects	Frequent defective items
Roof	Blockage of gutter system and rainwater downpipe	Blockage of gutter system and rainwater downpipe
	Missing roof tiles	
Staircase	Peeling off paint	1.Peeling off paint 2.Peeling off paint at wall 3.Dirty & stain mark
Wall, Floor & Ceiling Finishes	Peeling of paint at wall	
	Dirty & stain mark	
	Plaster crack	
	Unevenness of paint	
	Poor installation of floor tiles	
	Poor installation of floor tiles	
	Fungus on the wall	
Windows & Fittings	Poor fixing of window	4.Poor fixing of window 5.Dirty & stain mark
	Dirty & Stain mark	
	Hairline crack	
Doors & Fittings	Dirty & Stain mark	6.Dirty & stain mark 7.Door leaf damaged
	Door leaf damaged	
	Door frame damaged	
	Poor fixing of door	
	Door leaf difficult to open	
Sanitary Fittings, Fixtures & Toilet Cubicles	Loose fittings / Improper installation of fittings	1.Loose fittings / Improper installation of fittings 2.Incomplete installation of plug
	Incomplete installation of plug	
	Dirty and stain mark	

Note: The element, type of elemental defects and frequent defective items are all in ranking order
Source: Authors' own research result, (2023)

Architectural works are highlighted as the most defective works in residential projects. There were seven elements involved in this work discipline, with Wall, Floor and Finishes being the most defective elements recorded. Meanwhile, the Staircase was identified as the least defective work.

Causes of Defects

Besides outlining the causes of defects, Table 5 highlights the frequent causes of elemental defects in the architectural work discipline.

Table 5. Causes of Architectural Defects and Its Frequent Causes

Element	Causes of defects	Frequent causes of defects
Wall, Floor and Finishes	Poor workmanship	1.Poor workmanship 2.Works not accordance to specification 3.Lack of supervision 4.Lack of protection 5.Inappropriate of door material
	Works not accordance to specification	
	Lack of protection	
Doors and Fittings	Poor workmanship	
	Works not accordance to specification	
	Lack of supervision	
	Inappropriate door material	
	Lack of protection	
	Exposed to weather	
	Wrong measurement of doors and doors margin	
Ceiling finishes	Poor workmanship	
	Works not accordance to specification	
	Lack of supervision	
	Roof leakage	
Windows and Fittings	Poor workmanship	
	Lack of protection	
	Works not accordance to specification	
	Lack of supervision	
	Different floor level	
Sanitary Fittings, Fixtures and Toilet Cubicles	Poor workmanship	
	Works not accordance to specification	
	Lack of supervision	
	Lack of protection	
Staircase	Lack of protection	
	Works not accordance to specification	
Roof	Poor workmanship	
	Works not accordance to specification	
	Lack of supervision	

Note: The element, type of elemental defects and frequent defective items are all in ranking order
Source: Authors' own research result, (2023)

Categories of Defects

In this section, the defects' causes in all work disciplines are further categorised into twelve main categories: design, documentation, materials, factory, workmanship, lack of protection, maintenance, nature, vandalism, mishandling by users, lack of supervision, and wear and tear. Following the defects are touched across project stages to identify at which stage the defects occurred.

Table 6. Categories of Architectural Defects and Its Stages of Occurrence

Element	Type of defects	Causes of defects	Categories	Project stage
Roof	Blockage of gutter system	Works not accordance to specification	Workmanship	Post contract
		Poor workmanship	Workmanship	Post contract
		Lack of supervision	Lack of supervision	Post contract
	Missing roof tiles	Works not accordance to specification	Workmanship	Post contract
		Poor workmanship	Workmanship	Post contract
		Lack of supervision	Lack of supervision	Post contract
Staircase	Peeling off paint	Works not accordance to specification	Workmanship	Post contract
Wall, Floor and Ceiling Finishes	Peeling of paint at wall	Works not accordance to specification	Workmanship	Post contract
		Lack of protection	Lack of protection	Post contract
	Dirty and stain mark	Poor workmanship	Workmanship	Post contract
		Lack of protection	Lack of protection	Post contract
	Plaster crack	Works not accordance to specification	Workmanship	Post contract
		Poor workmanship	Workmanship	Post contract
	Unevenness of paint	Works not accordance to specification	Workmanship	Post contract
		Poor workmanship	Workmanship	Post contract

	Poor finishes of wall plaster	Works not accordance to specification	Workmanship	Post contract
		Lack of protection	Lack of protection	Post contract
	Poor installation of floor tiles	Works not accordance to specification	Workmanship	Post contract
	Fungus on the wall	Lack of protection	Lack of protection	Post contract
	Dirty and stain mark	Lack of protection	Lack of protection	Post contract
Doors and Fittings	Door leaf damaged	Poor workmanship	Workmanship	Post contract
		Works not accordance to specification	Workmanship	Post contract
		Inappropriate door material	Factory	Pre-contract
		Lack of supervision	Lack of supervision	Post contract
		Exposed to weather	Nature	Post contract
		Lack of protection	Lack of protection	Post contract
	Door frame damaged	Poor workmanship	Workmanship	Post contract
		Works not accordance to specification	Workmanship	Post contract
		Inappropriate door material	Factory	Pre-contract
		Exposed to weather	Nature	Post contract
	Poor fixing of door	Poor workmanship	Workmanship	Post contract
		Lack of supervision	Lack of supervision	Post contract
		Works not accordance to specification	Workmanship	Post contract
	Door leaf difficult to open	Wrong measurement of doors and doors margin	Design	Pre-contract

Sanitary Fittings, Fixtures and Toilet Cubicles	Loose fittings / Improper installation of fittings	Poor workmanship	Workmanship	Post contract
	Incomplete installation of plug	Poor workmanship	Workmanship	Post contract
	Dirty and stain mark	Lack of protection	Lack of protection	Post contract

Source: Authors' own research result, (2023)

Table 6 indicates that there are twelve categories of defects involved in architectural work. These are design, documentation, material, factory, workmanship, maintenance, lack of protection, maintenance, nature, vandalism, mishandling by users, lack of supervision and wear and tear. Workmanship was the main category for architectural defects, followed by lack of protection, lack of supervision, materials, design, and documentation. The factory and nature categories were recorded as having the fewest defects in this architectural defect. It is also found that most of the defects manifest during the post-contract stage compared to the pre-contract stage.

DISCUSSION ON THE FINDINGS

The construction industry in Malaysia continues to face significant challenges related to construction defects. As a developed nation expanding quickly, Malaysia's construction sector is familiar with building defects, according to Hassan et al. (2022). As such, this issue must be addressed to avoid casting a negative image on the industry's prospects. Plebankiewicz and Malara (2020) added that defects are a universal occurrence in the building sector worldwide. They should be given particular attention by contractors and investors alike since they can significantly influence the project's cost and resource requirements.

Similar to the findings in this article, Isa et al. (2016) discovered that the majority of the defects reported were in architectural works, followed by structural. Building cracks rate top among typical types of defects, according to a study by Hassan et al. (2022) and this paper, where they rank highest among defective defects in structural works.

The majority of the defects are primarily the result of poor workmanship. Hassan et al. (2022) concurred that the majority of the variables leading to the development of defects were poor workmanship. They also mentioned that the explanation for the defects in recently built residential structures was the contractor's or developer's poor job. The issue of inadequate communication, experience, and oversight at the building site. Without the contractor's supervision, inexperienced labour may build the construction project. Thus, contractors must oversee tasks like setting up formwork and pouring concrete at construction sites (Hassan et al., 2022). Plebankiewicz and Malara (2020) concurred that the majority of defects were caused by subpar workmanship.

The primary defect category is workmanship, followed by inadequate monitoring and protection. The least common kinds of defects in residential buildings are those resulting from design flaws. Both Hassan et al. (2011) and Isa et al. (2016) discovered that the primary categories of defects were related to workmanship.

Construction tracking is crucial, particularly for documenting defects and organizing them into organized groups. This is corroborated by Isa et al. (2016), who claimed that defect tracking and systematic category classification help determine the kind of defect, which defect is most likely caused by what, and which defects are most common. These are essential data that can help determine the cause of the issue. The majority of the defects are frequently connected. In terms of implications beyond the scope of current research, the study in this paper proves that the studies studied by previous researchers are in line with the findings in this paper. In addition, there are improvements in the research findings from this paper. The project teams must, however, be open-minded and supportive of the culture of continual learning in order to achieve this. In order to achieve zero defects in the following projects, they must view the system as a progressive and systematic strategy that can promote improved coordination and cooperation within the project team (Isa et al., 2016).

CONCLUSION

Tracking construction defects during the DLP in residential projects in

Malaysia highlights a significant concern for the construction sector. Various studies delve into the types, origins, and classifications of faults prevalent during this period, revealing that architectural works are particularly susceptible, followed by structural, electrical, and mechanical components. The common causes identified for these defects include substandard materials, poor workmanship, and insufficient supervision, collectively contributing to an elevated frequency of issues and indicating areas where procedural adjustments are needed.

The research aims to offer crucial insights into the landscape of construction defects during the DLP in Malaysian residential projects. By synthesizing data from previous studies, the report endeavours to draw significant conclusions that can inform the development of practical solutions for minimizing defects. Emphasizing the importance of construction defects management, the study underscores the need to address the root causes of these issues. The ultimate objective is to enhance the overall quality of construction in Malaysia. Practitioners, policymakers, and stakeholders are encouraged to utilize the findings and conclusions as a valuable foundation for implementing strategies that reduce the occurrence of faults, contributing to the long-term durability and reliability of residential constructions in the nation.

This research emphasises effective measures to reduce the occurrence of construction defects, particularly in residential projects. The project team, including developers and contractors, can reassess their processes, address issues promptly, and proactively prevent the repetition of the same errors in the future. Additionally, the research benefits homebuyers by providing substantial solutions that can be applied under the Housing Development Act (HDA). In cases where developers fail to fulfil promises, homebuyers can take legal action. Furthermore, the findings from this research can be utilized by homebuyers during the DLP to report any identified defects to developers.

The study aligns with ongoing efforts to elevate building standards and procedures, promoting a more robust and sustainable construction sector in Malaysia. It positions itself as a useful starting point for industry practitioners, policymakers, and stakeholders to implement methods that limit the occurrence of defects. By encouraging continuous improvement,

the research seeks to contribute to the overarching goal of fostering a construction environment that ensures lasting quality and resilience in residential construction across Malaysia.

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AUTHOR CONTRIBUTIONS

All authors contributed to the design of the research and the write-up. All authors have read and approved the final manuscript.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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