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Integration Factors of Design Participants in Performance-Based Building Design of Commercial Property

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Abstract: Design practice has shifted towards a performance approach that is based on an awareness of sustainability goals. Achieving this goal requires the integration of all participants through communication, collaboration, and knowledge-sharing (CCKs), specifically at the design stage. The participants are from different stages of the project which are design management (DM), project management (PM), and facility/property management (FM). The current research has not been able to clearly describe the practice in achieving design performance, especially involving the main three stakeholders (DM, PM, and FM). Thus, this study aims to fill the research gap by focusing on the influence of factors CCKs on the design performance of the commercial property, especially retail property. This will form a design, construction, and operational integration model to achieve the performance of retail properties in forming an optimal space. This study uses a method of quantitative study using a questionnaire survey. It was collected from 111 practitioners of the project participants (DM, PM, FM) in retail property development in Indonesia. There are different results in the correlation that the higher the factor value, the lower the space value performance. This correlation occurs in collaboration for PM, communication for DM, and knowledge-sharing for FM. This interesting finding can be explained empirically according to the preferences of each participant. This study contributes to knowledge about the influence of CCKs, which focus on the design of performance-based retail buildings to get the highest space value.

Keywords: communication; collaboration; knowledge-sharing; performative design

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1. Introduction

In Indonesia, retail buildings such as malls or shopping centers have a high occupancy rate (70–80%) [1], so it is important to improve their operational performance through good design. Research by Ha et al. [2] states that if a store in a shopping center has a higher number of visits, it can have implications for increased sales and high prices for the lease of the store. It means the value of the store will increase in line with the increase in visitor/consumer traffic. This has attracted the interest of researchers to investigate the importance of structuring rental spaces that are easily accessible by visitors. Thus, rental space or small shops in shopping centers have the same space value for tenants, so it has an impact on obtaining optimal profits for shopping centers [3,4]. Creating optimum value of space as design performance depends on the design of accessibility, and visibility. These two aspects can be optimal if they involve various expert professionals (multi-stakeholder) based on their roles and responsibilities in completing work from design to operation so that there is a chance for the success of the project [5].

Several studies have been conducted to support the improvement of design performance, for example, most recently, research developed by Ataman and Dino [6] seeks to understand design performance practices and strategies to achieve integrated design. This study reveals the importance of awareness that designers and clients have as a key driver of the shift from traditional design to performance-based design. There are three things highlighted to achieve design integration, namely the competence possessed by design

actors, support of interoperable design technology tools in the collaboration process, and direct and indirect stakeholder involvement. In contrast to the research conducted by Azari and Kim [7] that examined the relationship between design integration on green building projects, design integration is measured through processes of collaboration, leadership, and systems thinking. In particular, the study found that there was a positive relationship between design integration and project success. Study Maier et al. [8] identifies the factors that influence communication in design collaborations where the primary role of communication is to create shared understanding. The factors found are grouped based on information, representation, individuals, teams, and organizations that are believed can be drivers and obstacles in the design performance process. Other studies have also analyzed the improvement of shared understanding through knowledge-sharing practice [9]. The results of the study found differences in understanding or ideas, when translated into the design process, can improve design performance.

Based on previous research, design performance is closely related to design integration, where to achieve design performance it is necessary to integrate all interconnected project participants. The form of multi-stakeholder relationships can be achieved well if there is communication, collaboration, and knowledge-sharing (CCKs). The influence of CCKs on the success of multi-stakeholder relationships will ensure the achievement of retail property design performance, that is, optimal space value. However, the influence of CCKs is often studied separately, it is still rare that discuss their influence together on design performance. In addition, previous research has also been limited to design management stakeholders in the development of designs for space values of retail property. Therefore, there are still problems regarding the strategy for achieving the value of the retail design space that involves other stakeholders. The purpose of this study is to investigate the performance of retail property design in terms of achieving optimum space value through the influence of CCKs factors carried out by stakeholders of design management (DM), project management (PM), and facility management (FM). This research consists of: the first part is an introduction that discusses the background of the study; the second part is a literature review, which consists of an explanation of the retail sector in Indonesia, design performance, design performance on retail properties, and the importance of performance-based design practices, elaboration of the definition of CCKs, and conceptual development that discusses the effect of each CCKs factor on design performance; the third section is the research methodology, where this section describes the research process. The next section is the results and discussion that discusses the research findings. The last is the conclusion and direction for further research. This research contributes to the body of knowledge that examines the influence of CCKs on achieving optimal space value as a design performance in retail property development.

2. Literature Review

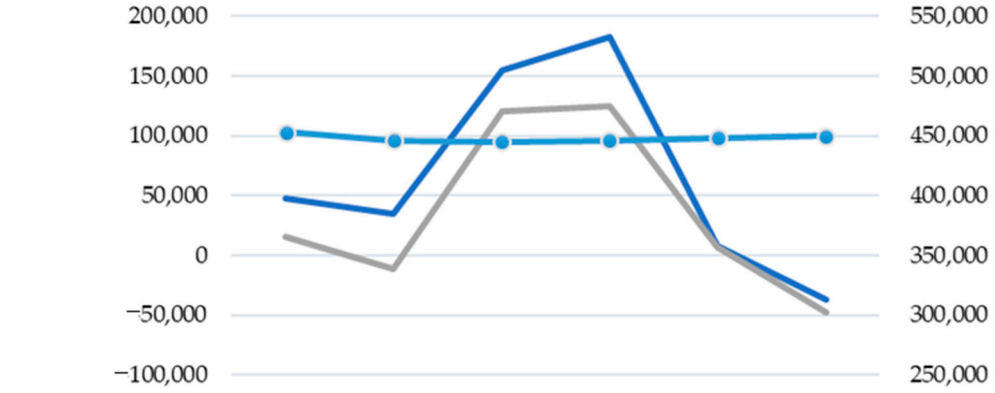
2.1. Sector of Retail Property in Indonesia

Indonesia is one of the countries in Southeast Asia which is known as an archipelagic country with a total of 17,504 islands. It has 37 provinces, and the national capital is located in Jakarta, which is also the largest city in Indonesia. In 2021, the total population of Indonesia reach 275.77 million people and become the country with the fourth largest population in the world.

The retail sector in Indonesia plays an important role in supporting national economic growth. In the last five years, there has been an increase in supply and demand starting from 2017 to 2019 on retail properties in Indonesia. However, in 2020 there was a very large decline due to abnormal conditions affecting the pandemic [10] as shown in Figure 1.

In the last three months since the pandemic, the number of transactions and visits to shopping centers has continued to increase, although currently, there is no addition to the supply of retail properties [1]. According to the 2020 Central Bureau of Statistics, Indonesia has 649-unit shopping centers spread across various provinces, such as West Java (118 units), Jakarta (96 units), East Java (77 units), Central Java and Banten (55 units,

and 43 units), North Sumatra (23 units), East Kalimantan, North Sulawesi, South Sulawesi (18 units), and Riau (16 units). Table 1 presents several shopping centers in Indonesia. Based on the data of the 2021 Global Retail Development Index (GRDI), Indonesia managed to rise one place and occupy the fourth position based on the development of retail markets around the world with a national retail sales number of US$ 407 Billion. This shows that the retail property sector continues to show good performance in line with the economic recovery process.



	2016	2017	2018	2019	1Q20	2Q20
Net Supply	48,000	35,000	155,000	183,000	7,800	−37,000
Net Demand	15,000	−11,900	120,000	125,000	6,350	−48,000
Avg. Rental	453,000	446,000	445,000	446,000	448,000	450,000

Figure 1. Supply and demand retail property development in Indonesia.

Table 1. Several shopping centers in Indonesia 2021.

No	Name (Location)	Number of tenants	Area (m^2)	Figure
1	AEON Mall BSD CITY, Tangerang	300	177,000	
2	Grand Indonesia Shopping Town, Jakarta	214	250,000	
3	Tunjungan Plaza, Surabaya	500+	150,000	
4	Pakuwon Mall Surabaya	300+	200,000	
5	Ciputra World, Surabaya	300+	150,000	

Table 1. *Cont.*

No	Name (Location)	Number of tenants	Area (m^2)	Figure
6	Plaza Senayan, Jakarta	250	130,500	
7	Nipah Mall, Makassar	125	121,426 + 25,000	
8	Sun Plaza Medan	351	107,373	
9	Central Park Mall, Jakarta	250	188,077	
10	Mall Taman Anggrek	528	110,000	

2.2. Performance Design

Design is a series of plans involving multilevel and hierarchical processes, where the processes can be partially carried out together, and in other cases, the activities cannot be carried out until other activities are completed [11]. In this case, the resulting design is often referred to as design performance; however, there are limitations of research that discusses design performance in construction projects. Research related to design performance is typically extended to other industries such as IT, manufacturing, and NPD with a concentration on measuring design performance. There are differences of opinion regarding the definition of design performance among researchers. For example, researchers Dubois et al. [12] look at design performance in two ways: process performance, which is determined based on considerations of time, cost, and quality; and product performance, which can provide user satisfaction. Another opinion expressed by researchers O'Donnell and Duffy [13] is that show design performance is a combination of design activities in terms of effectiveness and efficiency. Effectiveness refers to the success in the achievement of design goals, while efficiency is related to the comparison between the process of activity and the resources tused.

In the architecture, engineering, and construction (AEC) industry, design performance is understood as the result of a design that leads to sustainability goals [14], that is, buildings that encompass various requirements from several performance categories, among others: environmental performance, functional performance, social performance, process performance, etc. [15]. Ren et al. [16] mentions that design performance should be measured through a process and a product. For process-based design, the indicators consist of effectiveness, efficiency, learning, communication, collaboration, and design management. The indicators of product-based design are desire, ability to build, integration, usability, aesthetics, function, reliability, and building period. Brown [17] uses a different definition, where his research states that design performance consists of performance specifications, where during the process the design results will be measured using simulation techniques; design creativity as measured by the diversity of design outcomes, and the designer perceived utility. Achieving design performance is highly dependent on the characteristics

of communication in collaboration in the form of information, speech, and understanding that can affect individuals, teams, and project organizations [8].

2.3. Performance Design on the Retail Property and the Important of Performance-Based Building Design

Several studies show design performance as a sustainability goal. For example, researcher Fieldson [18] emphasizes the importance of developing a shopping center that affords adaptable. The ability to adapt to buildings is a change that cannot be avoided because it will continue to change according to the need of its users [19]. Fieldson [18] identified the adaptability of shopping centers on three aspects, that are first, allowing tenants to customize the appearance of their retail space to meet seasonal demands; second, ease of repair through simple re-branding; and third, the ability of retail buildings to change to different classes of use. The study Zhou and Liu [4] studied how to obtain the highest shopping center synergies by optimizing the layout of the shopping center. The research shows that the spatial arrangement of shopping centers in the design process is an important basis for the success of shopping centers. There are three components of spatial design, that are connection value, where many spaces are interconnected; intelligibility, related to the connection between local space and overall space; and integration, which refers to the ease of accessibility throughout the space. It was further stated, optimizing the spatial layout in a shopping center can increase the flow of consumers' feet and maximize the benefits of commercial space. The same thing was also completed by researchers Omer and Goldblatt [3], but used the flow pattern of visitor movement and its relationship with the space syntax during the design process. The thing that is highlighted in this research is to encourage the movement and distribution of visitors through the accessibility of physical, visual, and intelligibility.

Research [20] states that retail properties have four main stakeholders that can influence the design process, there are developers, facility management (FM), tenants, and consumers. To achieve design performance in retail property development, performance requirements are identified early in the design as a process for setting performance objectives. This is known as performance-based building design (PBBD). In other words, "performance-based design is an achievement for high-performance buildings" [6]. As a first step, establishing communication with all stakeholders involved is a key factor. This is very important, especially in making decisions related to achieving the optimum of valuable space in retail design development. Furthermore, the study by Ren et al. [16] mentions the main thing to achieve design performance is how the design team builds strength through collaboration, which leads to an understanding of performance requirements. On the other hand, it also requires multi-stakeholder collaboration because of the demands in providing retail buildings that are in accordance with end-user needs, and are responsible for the resulting environmental impact [21].

2.4. Communication in Design

Communication has been considered an important part of the construction design management process and a key factor of project success [22]. The term communication in the design process is widely discussed in the literature and can differ based on the context of the researcher. Chiu [23] defines communication in the design process as the transmission of new information between sender and receiver due to possible differences in cognition during design development. The term communication was also highlighted by researchers Otter and Emmitt [24] who gave a different definition, that communication consists of synchronous and asynchronous communication. Synchronous communication is the dissemination of information carried out by the sender to the recipient directly through face-to-face and telephone. On the other hand, asynchronous communication is the indirect dissemination of information the by the sender to the recipient via email, website projects, design documents, etc. Another definition is given by Norouzi et al. [25] which reveals communication in the design process can be understood based on three things, which are

function and behavior; communication as a process and as an interface. Communication as a function is focused on its function, which is to facilitate the achievement of common goals, and behavior that is interpreted as a social relationship in conveying meaning. Communication as a process is understood as a social process that leads to delivery, hearing, and response. While communication as an interface is everything related to the form of communication (meeting or using communication media).

The involvement of multiple multi-stakeholders in a project fosters a collaborative culture to work together in understanding client needs. In the design phase, most of the communication is completed to solve the problem, while others are to define the design problem [23]. According to Hölttä [26], quality communication is how information can be conveyed by the sender to the right recipient at the right time. However, information is not always available when required, therefore, it is essential to gather knowledge and ensure the availability of information so that it can be shared according to the needs of members of the team [8]. To facilitate the dissemination of information, it is significant to choose the right communication tool with the aim that the communication built can be more effective and efficient [27], as well as a technological system to support simple and easy-to-use design work [23]. ICT tools can facilitate easy coordination, manage information, and ensure the flow of information throughout project phases.

2.5. Collaboration Stakeholder in Design Stage

Generally, design collaboration has different definitions by researchers. The research of Jagtap [28] mentions collaboration in the design process is the involvement of designers who have the same understanding, to integrate their knowledge into a design object. Faris et al. [29] give a different definition, which is collaboration as a systematic process connected through communication between project members, and bound by contract to achieve a common goal. Rahmawati et al. [30] connect collaboration as a practice in terms of completing design work that is carried out together with her focus on achieving the best design. Another definition is mentioned in the study of Savolainen et al. [31] which describes collaboration as cooperation to achieve the highest level of quality related to client satisfaction. To achieve these results, four important indicators are needed, that is, communication to each stakeholder, communication between stakeholder groups, communication related to user value creation, and communication related to alternative solutions, where these indicators must be based on trust between collaborating stakeholders. The various definitions summarized illustrate collaboration as the completion of work carried out by various parties to obtain the expected results. In this case, the design process is an activity that involves joint efforts to complete complex design work based on relationships and commitments [23]. Kvan and Candy [32] mentioned problems that appear during the design collaboration process were resolved through negotiation and evaluation.

Collaboration is closely related to the participation of members from different backgrounds. Nguyen and Mougenot [33] identified the types of stakeholder groups that collaborate, that are multidisciplinary, interdisciplinary, and transdisciplinary. Multidisciplinary is joining disciplines to solve design problems and will separate when the work is complete. Interdisciplinary is combining scientific disciplines to form new knowledge to identify issues. Transdisciplinary is the highest level of collaboration outside interdisciplinary, which creates new understanding regarding the relationship between science and society. Some benefits of collaboration identified by researchers are, for example, a collaboration between designers and facility management during the design phase. The role of facility management can provide knowledge about building operations, thereby enabling increased building performance and reduced maintenance costs, minimizing design errors, and creating flexible designs where space in the building can adapt to various types of use [34]. Savolainen et al. [31] demonstrated that through trust, flexible workflows, and value strategies in collaboration can increase client satisfaction. Lundström et al. [35] emphasize the importance of collaboration as well as improving design and construction

management. This is because constructor involvement during the design process can create value for end users.

2.6. Knowledge-Sharing in Construction Project

Zhang et al. [36] classify knowledge as a source of explicit knowledge and a source of tacit knowledge. Explicit knowledge is a source of knowledge that is easy to codify and disseminate between individuals in the form of organized documentation, for example, standard specifications, and research reports [37]. While tacit knowledge is a source of knowledge developed by individuals based on years of work experience that can be explored through conversation or communication [38]. In general, Yang et al. [39] define knowledge-sharing as a process of exchanging knowledge and experience between individuals, so that individuals can complement and perfect each other's knowledge to achieve work goals. Knowledge-sharing is one part of the knowledge management process where its application can increase individual productivity and encourage innovation [40]. Addis [41] stated, in the construction industry, types of knowledge are propositional, experiential, performative, and epistemological where all these types of knowledge are true in their own way. However, most of this knowledge is tacit knowledge that must be documented and used to improve project performance. One strategy for capturing tacit knowledge is through social networks [42,43]. This provides opportunities for interpersonal communication, encouraging collaboration so that knowledge-sharing practices occur [43].

Several studies review the factors that can encourage knowledge-sharing practices in construction projects, such as research Saini et al. [44] which emphasizes organizational culture and trust are the main factors that can influence knowledge-sharing practices. Will [45] uses four factors that motivate the practice of knowledge-sharing in construction organizations, that are resources, intrinsic motivation, incentives, and social motivation. Studies by Zhang and Cheng [46] show that leadership roles can encourage more knowledge-sharing practices through social capital in terms of building social interactions and maintaining trust. The study of Arif et al. [43] highlights three factors that encourage knowledge-sharing, including trust factors, environmental factors, and communication factors are important factors that can motivate members to share knowledge. Additionally, researchers Idris et al. [40] confirmed that environmental factors related to managerial leadership, organizational strategy, and organizational culture play an important role in influencing knowledge-sharing practices. The various driving factors proposed can be a strategy for the organization to facilitate its members regarding the success in implementing knowledge-sharing practices in construction organizations.

3. Conceptual Model Development

3.1. The Influence of Communication on Design Performance

Along with the complexity of design and multi-stakeholder participation, three important factors identified in the literature review are communication, collaboration, and knowledge-sharing. Several studies have analyzed the importance of communication that supports the success of the design and projects, such as research by Norouzi et al. [25] which investigates the relationship between the designer with the client through the point of view of communication. Elmustapha et al. [47] mention that the client is an individual or organization that gives tasks about the building, thus playing an important role in coordinating activities with various stakeholders involved in the project. The contribution of a client is their active involvement during the design process and design meetings [22]. Based on research by Norouzi et al. [25], three important factors can improve design practice through the relationship between the designer and the client, that is, the use of appropriate communication tools, characteristics of information, and characteristics of the relationship.

Studies by Hosseini et al. [48] show that the success of the design depends on the use of proper information technology (IT). The use of IT for integration is the support of information technology that makes it easy for designers to exchange data at the same time interval, and the existence of communication protocols that include capturing, organizing,

and storing information that makes it easier for designers to access or reuse related information of design [49]. This is also highlighted in research by Milat et al. [50] on the importance of proper use of IT having a positive influence on achieving project objectives. Researcher Luck [51] studied how multidisciplinary teams manage design work. In particular, this study shows that social interaction through the presence of design team members in design team meetings affects project success. The function of the meeting is to monitor the progress of work. In this case, routine meeting activities are the basis of the project, where deadlines will be set for the completion of work, coordination of tasks, and plans for further activities. Furthermore, this meeting activity also explains design issues and discussions that led to the negotiated solutions to design problems [51,52].

Researchers Kania et al. [52] analyzed the importance of communication and information flow in construction projects. According to Maier et al. [8], information is one of the problems that often arise during the design process. This is because the information is often not available, or there is excess information and inaccurate information, and even not getting to the right place. Overcoming these issues, the team can act to leverage the knowledge gathered, and manage the availability of information, to suit the needs of the design team members. Transparency or availability of required design information contributes to project success [52]. Researchers Knotten et al. [22] explore the key success factors of building design management (BDM). BDM is concerned with organizing people and managing the design process to achieve design performance through increased productivity and design quality. The results showed that communication is the most important success factor. Based on this context, the proposed hypothesis is:

Hypothesis 1. *There is a positive influence between communication and improved design performance.*

3.2. The Influence of Design Collaboration on Design Performance

The involvement of a specialized multidisciplinary design team results in a high degree of fragmentation throughout the design process. Collaboration practices were believed to increase the integration of participants throughout the project life cycle [7]. Various studies show the importance of collaboration that supports the achievement of design success, such as research by Lundström et al. [35], which has studied how to understand user needs for space design through collaboration practices, to obtain high-quality designs. There are three collaborative practices identified to achieve design success, which is: (1) the use of participatory design (PD) in the concept design phase aimed at maximizing value through the involvement of building end users. (2) In the technical design phase, design integration (ID) is used to obtain information between multidisciplinary design teams, and find solutions to meet end-user needs; and three, the use of concurrent engineering (CE) involves collaboration between designers and builders to obtain design solutions that can save costs during construction. According to Savolainen et al. [31], collaboration should provide benefits for all participants involved.

Researchers Rahmawati et al. [30] conducted an exploratory study on the achievement of the best design. The results of the study show that there are three aspects to support design collaboration, that are the technical aspect which refers to the integration of design objects based on a common understanding; the social aspect relates to the integration of participants to achieve the best design, and the physical aspect refers to the integration of designs that are separated by geographic location. Carcamo et al. [53] mention that these three aspects require system capabilities that can support, create, and manage more effective collaborative design work practices.

A study conducted by Feast [54] analyzed the importance of collaboration during the design phase. The research underlines several things. First, collaboration can create innovative designs through the integration of perspectives, designer skills, and knowledge of the multi-stakeholders involved. Second, collaboration during the design process can create social networks through the roles, responsibilities, and relationships of participants in a team. Third, collaboration can build creativity and understanding of design through the

distribution of information among multi-stakeholders; and fourth, contribute to producing high-level designs. Therefore, the research hypothesis is:

Hypothesis 2. *There is a positive influence between design collaboration on the achievement of design performance*.

3.3. The Influence of Knowledge-Sharing on Design Performance

In a hierarchical structure, Ruan et al. [55] classify the knowledge process at the highest level and the data at the lowest level. Data are collected and converted into information. Information needs to be analyzed, to generate knowledge. Thus, knowledge comes from interpreted information. In the design process, the design team consists of experienced professionals, and often their knowledge is required in a problem-solving process. In a study by Knotten et al. [22] they stated that creating a knowledge-sharing culture is an important factor, where knowledge-sharing is carried out to prevent multiple interpretations due to differences in knowledge from each of the designers involved [56], as well as being useful in minimizing design errors [34,42].

According to Kalantari et al. [34], the complexity of the design process requires the sharing of knowledge between multi-stakeholders during the design process. This can be the basis for the integration of participants in all stages of the project. As it is understood that the design phase is the stage of a construction project that is dominated by tacit knowledge, where this type of knowledge is often difficult to share [57]. Research conducted by Pourzolfaghar et al. [58] has investigated the importance of knowledge-capture techniques during the design phase. The results show that capturing tacit knowledge from expert practitioners, which is then shared during the design phase, can reduce the cost and time of design work, and improve design quality.

The importance of knowledge-sharing is also demonstrated in research Obeidat et al. [59] which found that knowledge-sharing affects innovation. According to Elmualim and Gilder [60], innovation is a creative solution that combines knowledge from various domains and is implemented into products that lead to success. Research by Obeidat et al. [59] found that when knowledge dissemination occurs, it contributes to generating new ideas, can increase brainstorming, and avoid adverse risks during the design process. Researchers Wang et al. [61] have investigated the role of knowledge-sharing in construction and facility management during the design phase. In this case, the involvement of contractors since the design phase can contribute to the provision of solutions related to the estimated schedule, budget, and construction strategy. Meanwhile, the involvement of facility management during the design stage aims to estimate potential problems that may occur at the operational stage. This is because facility management has knowledge of operations and maintenance (O&M), and end-user needs as business objectives [62]. Based on this, the next hypothesis is:

Hypothesis 3. *Knowledge-sharing has a positive effect on improving design performance*.

Figure 2 presents the model of the three hypotheses in the form of the influence of communication, collaboration, and knowledge-sharing on design performance, either individually or together.

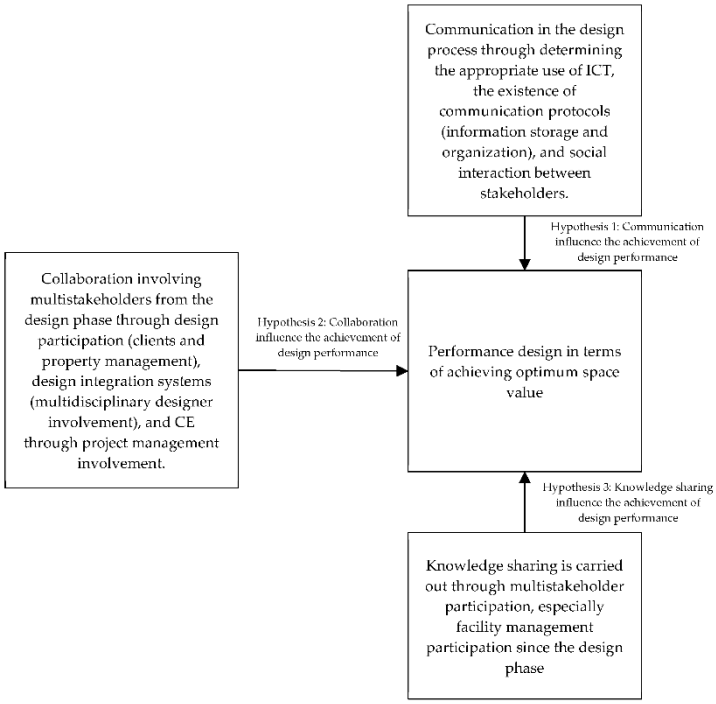


Figure 2. The conceptual model of performance design.

4. Research Methods

4.1. Sampling and Data Collection

This study aims to determine the influence of CCKs on design performance. To build a conceptual model, first, this research uses a literature review related to design performance in the construction industry. Next, this study uses a questionnaire survey as a data collection tool. The questionnaire was chosen because it is a fast process to collect data and is an appropriate tool for empirical research and is useful for generalizing findings through hypothesis testing. The questionnaire used is in the form of an online questionnaire that is distributed to stakeholders in the field of the construction project, including the designer, project management representing the contractor, and stakeholder facility management. Before sending the questionnaire, the researcher first contacted the respondents, regarding their willingness to participate in the research. Questionnaires were then sent to 111 practitioners via email and messaging applications. Figure 3 and Table 2 present survey respondent information.

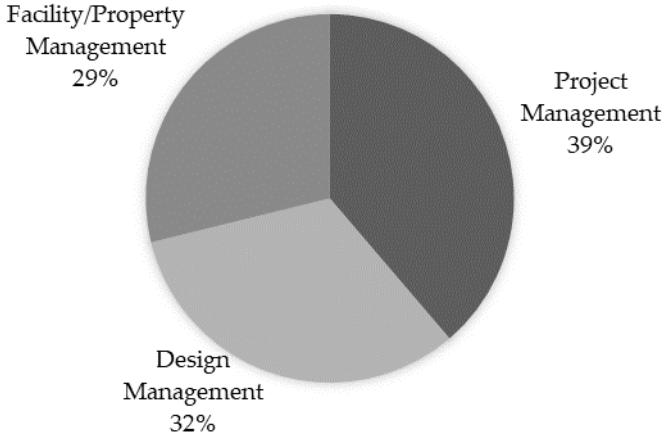


Figure 3. Information of respondents.

Table 2. Organization of respondents.

Stakeholder	Organization	N
Design management	Private developer	6
	Consultant (architect and engineer)	30
Project Management	Private developer	28
	Consultant (architect and engineer)	8
	Government	7
Facility Management	Private developer	32

Based on Figure 3, the respondents involved in this study are from design management as much as 32%, project management 39%, and facility management 29%. Table 2 shows the organization of respondents, that is, from private developers, consultants, and the government.

4.2. Analysis of Data

This study uses two separate methods in the data analysis process. First of all, using a descriptive approach through direct interpretation based on the mean and standard deviation of the survey results. Second, using analysis of influence to predict between the independent variable with the dependent variable. In this case, the independent variable is communication (X1), collaboration (X2), and knowledge-sharing (X3), while the dependent variable is design performance (Y). The form of the equation of the influence of the variable is as follows:

$$Y = \alpha + \beta_1 X + \beta_2 X_2 + \beta_3 X_3 + \ldots + \beta_N X_N + \varepsilon \quad (1)$$

The equation indicates that Y is the dependent variable that is design performance, α is the constant value and the intercept on the y-axis. β_1, β_2 ... to β_N is the coefficient estimated. The values of X_1, X_2 ... to X_N are the values of the predictor or independent variables, then ε is the model term for error.

5. Results

To provide an overview of the response of respondents (Figure 3) to the questions in the questionnaire, an assessment was made based on the value of mean and standard deviation. The mean value is used to represent the data, or in other words, the value that represents the data as a whole, whereas the standard deviation is used to determine the distribution or variation of the data, and see how close the value standard deviation is to the mean value. Table 3 presents the results of the mean and standard deviation values based on stakeholders of design management, project management, and facility management. Table 4 shows the results value of mean and standard deviation for all stakeholders.

Table 3. Value of mean and standard deviation for the stakeholder design management, project management, and facility management.

Variable	Design Management			Project Management			Facility/Property Management		
	Mean	Std. Dev	Rank	Mean	Std. Dev	Rank	Mean	Std. Dev	Rank
Communication (X1)	2.777	0.897	3rd	2.790	0.860	3rd	3.718	0.728	2nd
Collaboration (X2)	3.055	0.790	1st	3.186	1.006	1st	4.031	0.782	1st
Knowledge-sharing (X3)	2.833	0.654	2nd	3.139	0.965	2nd	3.500	0.803	3rd

Table 4. Result of the overall value of mean and standard deviation for all stakeholders.

Variable	Mean	Std. Deviation	Rank
Communication (X1)	3.054	0.932	3nd
Collaboration (X2)	3.387	0.964	1st
Knowledge-sharing (X3)	3.144	0.861	2rd

Table 3 shows the mean and standard deviation of each group stakeholder of design management, project management, and facility management. Based on the table of the overall factor results, there are different perceptions regarding the importance of factor CCKs based on mean and standard deviation values. In the stakeholder of design management and project management group, collaboration is the most important factor, followed by knowledge-sharing, and the last is communication. While in the stakeholder of facility management, the most important factor is collaboration, communication, and knowledge-sharing. Furthermore, Table 4 summarizes the overall results of all stakeholders combined. Based on Table 4, if sorted, the first rank is a collaboration (M = 3.387), followed by knowledge-sharing (M = 3.144), and the last is communication (M = 3.054) which is considered important by all stakeholders in support of achieving design performance on the retail property development Indonesia.

Next, is to analyze the effect of the CCKs on design performance. First, the value of the contribution variable in predicting is presented through the R-square value. Based on the results of the analysis the R^2 value obtained for stakeholders of design management is 0.669, meaning that three factors have contributed to the design performance of 66.9%, while the remaining percentage is influenced by other factors not included in this study. For project management stakeholders, the contribution value of all variables in predicting is 78.3%, and for facility management stakeholders, the variable contribution value is 73.2%. In general, for all stakeholders, the value of the variable contribution in predicting is 43.9%. Table 5 shows the summary results of the measure of the influence on design performance to form the optimal space value.

Table 5. The influence on design performance in forming optimum space value.

	B (Constant)	Communication	Collaboration	Share Knowledge
Design management	0.688	−0.101	0.213	0.342
Project management	1.103	0.611	−0.074	0.270
Facility/Property management	3.620	0.376	0.152	−0.484
All stakeholders	0.837	0.476	0.388	−0.317

Based on the table above, the following is the result of the equation obtained:

Design management

$$Y = 0.688 - 0.101X_1 + 0.213X_2 + 0.342X_3 \quad (2)$$

Project management

$$Y = 1.103 + 0.611X_1 - 0.074X_2 + 0.270X_3 \quad (3)$$

Facility/property management

$$Y = 3.620 + 0.376X_1 + 0.152X_2 - 0.484X_3 \quad (4)$$

All stakeholders

$$Y = 0.837 + 0.476X_1 + 0.388X_2 + 0.377X_3 \quad (5)$$

The equation shows that there are differences between each stakeholder in assessing the influence of CCKs on design performance. As shown in the stakeholders of design management who always focus on collaboration (0.213) and knowledge-sharing (0.342) with a direct positive relationship, while communication has a negative influence (−0.101). This is because DM stakeholders have the distinctive characteristic of being a multidisciplinary group, and they have different contractual relationships. Although these results contradict research by Ruan et al. [55] where communication can encourage collaboration and knowledge-sharing, stakeholders of DM perceive that too much communication, such as information overload, can degrade their design performance. Another case for PM stakeholders is where collaboration (−0.074) practices are avoided, because the project organization in this position tends to be hierarchical (contract-based), thus minimizing collaboration. Coordination is a process carried out to improve design performance. Communication (0.611) and knowledge-sharing (0.270) have a positive influence. These results confirm research by Kania et al. [52] that PM stakeholders require an optimal flow of information during the construction phase between project participants. This is because most of the communication problems arise in the early stages of construction work, during the construction process, and during the handover phase. Therefore, managing the communication network in the project life cycle is a major concern. Optimizing the flow of information, for example in the form of effective communication through IT systems, and support tools. IT system support can manage information between participants, manage tasks, and knowledge-sharing, so that communication becomes optimal throughout the project network. Meanwhile, stakeholders of FM assess that communication (0.376) and collaboration (0.152) have a positive influence, but this does not apply to knowledge-sharing practice (−0.484), where FM avoids knowledge-sharing. This is because they are in an operational position and business performance. The knowledge of FM is stored as part of the strategy organization. The results found underline the research Kalantari et al. [34], which shows that this can happen because of the reciprocal relationship felt by the FM organization with other stakeholders, for example, stakeholders of DM. The importance of incorporating FM knowledge into the design process is critical, especially with regard to the operational phase. However, unfortunately, DM is often not interested in the practice of KS with FM because DM stakeholders prioritize innovation through experiments, this causes FM organizations to also be reluctant to share knowledge.

Furthermore, for all stakeholders, it shows that the CCKs factor has a positive influence on design performance. It means this variable will always change in the same direction. From the results of these equations, it can be understood that if the communication factor (X1) increases, with the assumption that collaboration (X2) and knowledge-sharing (X3) remain, the design performance (Y) will also increase. In addition, if the collaboration factor increases, assuming the communication and knowledge-sharing factors have a fixed value, it can improve design performance. Finally, if the knowledge-sharing factor increases, and it is assumed that the communication and collaboration factors have a fixed value, the design performance will also increase.

6. Discussion

6.1. Achievements Design Performance Retail Property in Increasing Commercial Space Value

This study aims to investigate the influence of CCKs on design performance in terms of achieving optimum space value in retail property development. Based on this, this study highlights the results obtained regarding the direction of a positive influence, that is, the increased value of communication, collaboration, and knowledge-sharing will improve design performance.

Based on Figure 4, positive influence occurs in communication between project management and property management, the collaboration between project management and design management, and knowledge-sharing between project management and design management. Meanwhile, the negative effect indicates that the higher the CCKs value, the

lower the design performance. Figure 5 shows that communication for design management, collaboration for project management, and knowledge-sharing for facility management.

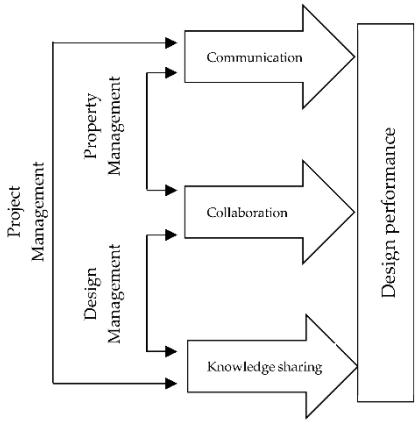


Figure 4. Positive relationship of factors to design performance according to each stakeholder.

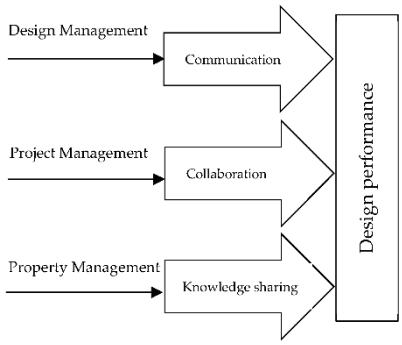


Figure 5. Negative relationship of factors to design performance according to each stakeholder.

Nevertheless, the result analysis of all stakeholders reveals factors of CCKs positively influence design performance. These results are in line with research [52] that shows that communication is an important factor underlying success during the design process. Increased design activity demands a seamless distribution of information. This means that each stage of the design requires the right information to meet the requirements or requests of the client. Communication requires designers to interact and discuss design issues, transparently exchange information, and synergize experience and knowledge so that an opportunity for design success. On the other hand, the increasing advancement of information and communication technology (ICT) helps the fast of distribution information among the participants involved. This makes it easier for the design process to exchange data or information between separate geographical participants. However, basically, developing a communication protocol is important, so that team performance becomes more efficient [49]. The approach through a combination of people management with information management during the design process can ensure the design results appropriate to expectations and objectives.

In addition to communication, the collaboration also has a positive influence on design. These results also confirm research [54] that states that the design process requires many perspectives that cannot be handled by one individual, so through collaborative practice, there is a use of knowledge from design specialists. In retail property development, the design process is an interaction between a network of interrelated multidisciplinary and multi-stakeholder collaborators, and the completion of design tasks is carried out jointly. This is a high-level collaboration that combines design with a business perspective. Collaboration is not only about the integration of the multi-stakeholder, but also about the integration of the technological tools used to achieve high-performance design results.

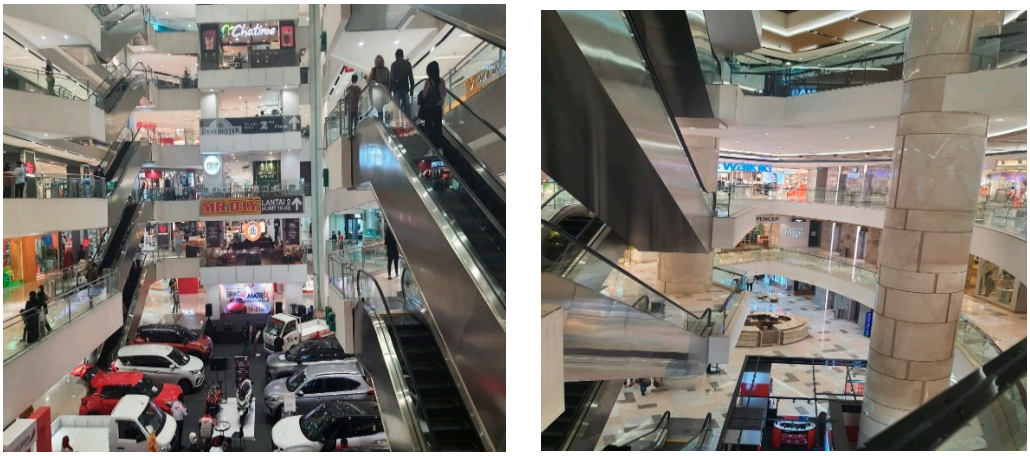
As it is understood, the designer spends most of his time exchanging data/information regarding the design. The existence of a user-friendly system or facility that is easy to use, and interoperable with other design technologies can support seamless collaboration and co-creation [50].

Next is the positive influence between knowledge-sharing and performance design. The study confirms the research by [42] which states building a culture of knowledge where social networks are formed can positively increase the innovation ability, knowledge, and skills design practice of designers. Knowledge-sharing in the design process is very important, especially when considering sustainability goals. For example, the involvement of facilities management during the design process can prevent problems during retail property operations through knowledge-sharing between designers and FM. The input of FM is an important resource during the design phase [34]. Furthermore, FM is the most responsible stakeholder for building operations. In this case, the knowledge possessed by FM can affect the profitability of retail properties [20].

Until now, the development of research involving multi-stakeholders continues to be studied. The goal is to increase integration across project implementation. Multi-stakeholder involvement at the design stage, for example, is often performed indirectly or through design automation systems. This ultimately further increases the activity of CCKs during the process. At this stage, the designer will utilize the knowledge system stored by other stakeholders to support his design work. This is where the important role of knowledge-sharing is needed that can improve project performance through the storage of knowledge shared on a project network. The main concern is to provide a system that can not only store, and be compatible with the technology tools used simultaneously, but also related to the acceptance of each stakeholder. The existence of different goals is often a big problem, so further attention is on technology support where there is a system that can assist in decision making. Decision making is based on the limits of acceptance and rejection of each stakeholder.

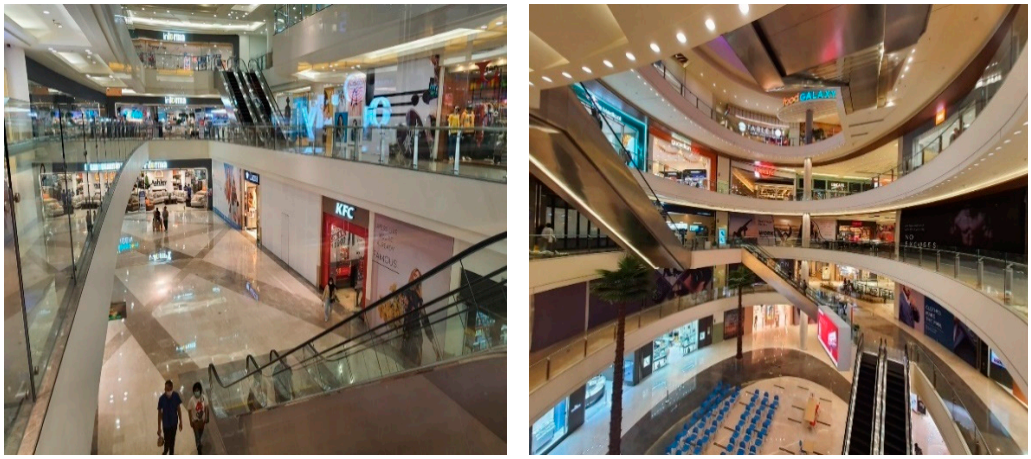
6.2. Implications of Design Performance in Shopping Center Buildings

Achievement of design performance through communication, collaboration, and knowledge-sharing is the basis of multi-stakeholder integration in all project stages that can ensure the achievement of design goals in shopping centers that are achieving the optimum value space. This study presents an example of the design differences that are applied in the building of shopping centers, it is shown in Figures 6 and 7.



(**a**) (**b**)

Figure 6. Comparison of shopping center GM 1 (**a**) and GM 3 (**b**).



(**a**) (**b**)

Figure 7. Comparison of shopping center TP 1 (**a**) and TP 5 (**b**).

Figures 6 and 7 are two of the shopping centers in Indonesia located in Surabaya, province of East Java. Figure 6a is GM 1 a shopping center that was built in the first phase, and started operating in 1996. Figure 7a is TP 1 shopping center which started operating in 1986. At that time, the developer did not have sufficient experience in mall development even though he used a design consultant. The involvement of facility management is not yet dominant so each stage of the project is still fragmented. In this case, the design of the shopping center experienced a shift in accessibility and (visual) visibility, where the division and determination of space value adhered to the principle of "all small shops must be passed by visitors". This has implications for the placement of a large tenant/anchor store in the farthest position. Thus, the anchor store serves as an attraction for visitors to pass through small shops. This focus is usually due to the main consideration of capital expenditure. In addition, this also affects the placement of vertical transportation as an important attribute of shopping centers. In this case, vertical transport cannot be accessed directly between floors. Visitors must pass through other areas to be able to use vertical transportation to reach the desired location.

Figure 6b is GM 3, the last stage of the development of this shopping center. It was built in 2016, and began operating in 2019. Figure 7b is TP 5, which started operating in 2015. In the development process, the owner or developer has experience in managing at the previous stage, so in the design process, the involvement of the facility manager is very dominant along with the designer. The involvement of facility management has implications for the focus of operational expenditure, where the comfort and accessibility of visitors is a priority. In this case, the vertical transportation attachment is carried out continuously, making it easier to reach without requiring visitors to pass through all the small shops. To increase the flow of visitors and create value in space, this shopping center uses spatial integration factors through visuals. As mentioned in the research of Omer and Goldblatt [3], to increase the flow of visitors and the externality of small tenants, the shopping center design considers the spatial integration factor through visuals, and the level of intelligibility through connectivity between spaces (corridors, floors, and the entire building) within the shopping center. In addition, the circular atrium also supports a line of sight that allows unobstructed views of visitors and can reach wider.

It is different if it involves FM from the early design stage, then this understanding may change with a focus on operational expenditure, where the comfort and accessibility of visitors is a priority. As mentioned in the study [4], accessibility has an influence on the vitality of the space and is a predictive factor in the flow of visitors in reaching the target location easily. This also relates to an important attribute of a shopping center, which is the location of vertical transportation that will be continuous, making it easier to reach without requiring visitors to pass through all the small shops. To increase the flow of visitors and

the externality of small tenants, the shopping center design considers the spatial integration factor through visuals, and the level of intelligibility through connectivity between spaces (corridors, floors, and the entire building) within the shopping center [3]. The circular atrium also supports a line of sight that allows unobstructed views of visitors and can reach wider.

Indeed, FM is often not involved in the design stage. It was also highlighted in the research [34] that there is still a collaboration gap between facility management and designers. Whereas it is very important to obtain input from the involvement of facility management during the design stage because facility management contributes to the business strategy of shopping center performance requirements, including class and consumer segmentation [62]. On the other hand, the design of a shopping center also depends on the client and all his decisions determine the success of the design. The challenge is if the client does not have enough knowledge about the critical role of facility management in the design process, it becomes an obstacle to collaboration. It is different if facility management is in-house, and the client is the end user of the building. This condition allows for greater collaboration [34]. Research [61] affirms, that although FM is rarely directly involved in the design stage, this can be overcome by the use of automation support systems, where knowledge from FM can be collected, managed, and shared, thereby improving project performance. System support that facilitates a knowledge database from FM is very important and is useful for identifying operational and maintenance problems from the design stage.

As previously mentioned, the development of shopping centers is very complex, where there are demands to design shopping centers with three main objectives, that are having aesthetic value as an attraction, having a commercial value which refers to increasing the profitability of tenants, and having residual value through the use of construction materials [18]. In the design process, performance specifications will be made as detailed as possible by the owner or developer, and then the design team will review, and propose various design alternatives. Communication continues to build mutual understanding between participants. In this case, a negotiation process occurs because of disagreements over the flow of ideas that freely continue to develop, so that the design development process occurs repeatedly until an agreed agreement is obtained.

The involvement of various multidisciplinary design teams and multi-stakeholders that collaborate creates many conflicts of interest. This is because individual goals and shared goals must be met so as to provide satisfaction to all collaborating parties. Still, there is a need for the use of systems from advanced technology that makes it possible for multi-stakeholder to collaborate using the automation system. Automation technology support that is equipped with an optimum payoff system is needed, where in these systems each stakeholder can make limits on the receipt and rejection of other stakeholders. This is useful in making decisions to obtain the best results.

7. Conclusions

This research has presented the effect of communication, collaboration, and knowledge-sharing in improving design performance, that is achieving optimum space value in Indonesian retail property development. This research is based on an empirical study through a questionnaire survey as a data collection tool involving expert respondents including stakeholders of design management, project management, and facility management. The descriptive results show that collaboration is the most important factor according to respondents. The results found that the optimum space value in the development of shopping centers can be achieved through communication, collaboration, and knowledge-sharing with a positive relationship direction. This study was limited to the three factors of CCKs investigated, and only conducted in Indonesia, so it cannot be generalized. Further suggestions could add another factor with a different location. The managerial implication of this research is the value of space as a retail property design performance will increase if positive conditions occur and negative conditions are reduced. This research paved the way for further research of this kind in different country locations.

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