

Architecture Marketplace System with Artificial Intelligence

Samuel Yudhatama^{1,*} Johan Agung¹

¹ Department of Architecture, Universitas Atma Jaya Yogyakarta, Yogyakarta, Indonesia

*Corresponding author. Email: samuelyudhatama@gmail.com

ABSTRACT

The lack of attention to the importance of architectural service in Indonesia worries the quality and advancement of the architecture sector in Indonesia. The established building often didn't meet the requirements needed and architectural service in Indonesia is also limited. Addressing the lack of people's attention to architectural service and limited human resources, a marketplace system was developed, equipped with artificial intelligence. The marketplace was developed by the research using theories according to people's willingness to use and a questionnaire using summative scale. The result stated that Indonesian people are interested in using an architectural application, therefore a marketplace system was developed. The marketplace functions as a bridge between people and architects, as a design assistant, and also providing an architectural insight to the people of Indonesia.

Keywords: Architecture, Marketplace, AI

1. INTRODUCTION

In 2016, the number of architectural practitioners was around 15,000 or about 1:83,000 when compared to the ratio of the population of the Indonesian people which in 2016 was 261.6 million based on statistical data. This is very interesting when compared to the data which states that there is a lack of architectural services in Indonesia. There is also a lack of attention to the importance of architectural service, reinforced by the news that states that buildings in Indonesia often do not meet the standards and requirements regarding development. On the other hand, IAI's basic rules point 2 regarding obligations to the community, in particular, point 2.2 concerning services for the benefit of the general public published by IAI in the Architect's Code of Ethics so far have not been properly facilitated, so that the services of architects are rarely used by middle to lower-income people. In addition, problems also arise from the phenomenon of non-engineered houses circulating in Indonesian society and affecting the quality of the structure and construction and the quality of building space, this can be seen from the number of unhealthy houses in Indonesia.

In recent years, there has been a hot issue discussed in the community, namely about architecture. The cause of this issue cannot be separated from the appearance of buildings that attract the public's eye, giving character to

a particular location and architecture that can change the city's economy. People whose economic level is middle to upper are starting to realize how important it is to find an architect to design their dream home. In 2017, the Creative Economy Agency of the Republic of Indonesia issued a discourse that architecture is one of the creative economies with the highest growth rate of 6.62%. This has become a prestige for architectural practitioners. However, this is inversely proportional to the development of the number of architectural practitioners in Indonesia. According to data from the Indonesian Architectural Association (IAI) in 2016, the number of registered architectural practitioners in Indonesia was around 15,000 people or about 1:83,000 when compared to the ratio of the Indonesian people. This figure is very far compared to China which has a ratio of 1: 40,000 with a population of 1.5 billion people. And from other countries such as Italy and Japan with a ratio of 1: 400. It can be seen that Indonesia is a country with low architectural practitioners when compared to other countries. The economic development sector in Indonesia is a promising market, this can be seen from the land area of Indonesia, which is 1,922,570 km² and with a population of around 250 million Indonesians who need space to live. One of the Indonesian architects, Endy Soebijono, said that 70% of projects in Indonesia are construction projects, but the irony is that there are few architects involved in the project. He said

that it happened because of the lack of architects who dared to open a bureau and were able to open up their job opportunities by opening an architecture bureau. According to former Minister of Finance Chatib Basri, in 2050 Indonesia will become the fourth-largest economy in the world, this is interesting because more and more Indonesians need a place to live, the more people need the services of architects. This discourse is also reinforced by Bekraf data which states that Indonesia is currently in the fourth level with the largest middle-class population in the world

In the current era, there are already several architects who have developed the world of architecture through the marketplace. Some examples include the blueprint which was founded by Ricky Cahyadi, Martin Samroni, and Andrew Wibowo in 2016. Then there is DEUFS which was founded by Mandre Austriono, Anindito Bayu, and Almaviva Landjanum in 2014. So DEUFS is the one who initiated the establishment of an architectural marketplace in Indonesia.

In addition, the purpose of forming Bluprin by Ricky Cahyadi, Martin Samroni, and Andrew Wibowo on the basis that currently finding the right professionals to build a house or just renovate a house is sometimes difficult. This is because generally professional architectural services are only obtained based on word-of-mouth recommendations. That's why they initiated the Bluprin marketplace. Keep in mind that this Bluprin marketplace is a directory site for architecture, interior design, and contractors in Indonesia and they can register themselves and showcase their portfolio as a showcase or work and then sell it to potential clients and Bluprin is a promotional medium for architectural professionals to the public so that the level of Public awareness of architectural services is increasing.

Since the 21st century, the world of architecture and the construction industry has received assistance from artificial intelligence technology. This has made many changes in several sectors, including Planning, Administrative Aspects, Step Determination, Technology After Construction, Building Information Modeling, and Virtual Assistant. The development of an advanced e-commerce system in Indonesia and

accompanied by the development of artificial intelligence can help make people aware of the importance of architect services in Indonesia. For now, several e-commerce sites can help with this, for example, arsitag.com and archify.com. The two websites provide things related to the work of architects, including architect consulting, design services, contractor services, and other things.

Artificial Intelligence or AI, is a term for a machine or computer that imitates human cognitive abilities about the human mind, such as learning and solving problems. The ability of a machine to complete a task does not always belong to the AI class, as the development of an AI, a technology that used to be called Artificial Intelligence is no longer recognized as real intelligence. A machine can be classified as AI if it can reason, represent intelligence, plan, learn, process natural language, and have perception, for example, a machine that can beat a professional Go, player, AlphaGo.

Artificial Intelligence in the world of architecture has begun to develop, for example, BIM (Building Information Modeling) software, which is a digital representation that is used together to facilitate a design, has used Artificial Intelligence to increase effectiveness. Finch, a software developed to assist initial design through adaptive design, works as an extension or plugin to existing CAD/BIM software to give an architect the freedom to work on a particular program, said Jesper Walgreen, founder of Finch 3D.

Stanislas Chaillou in his thesis discusses the use of Generative Adversarial Neural Networks (GANs), artificial intelligence that can assist architects in designing a floor plan. GANs work by analyzing the image (image-based) and then projecting it into a new floor plan. GANs consist of a Generator and a Discriminator, where the Generator is in charge of replicating the floor plan based on the existing data, and the Discriminator is in charge of evaluating the image produced by the Generator whether the image is relevant or not based on the existing data. GANs can learn directly from existing models, which are then developed by an architect.

2. HYPOTHESES

2.1. Recent Findings

Table 1. Recent findings

Topic	Base Theory	Exogen variable	Intervensive Variable	Moerate Variable	Reference
Analyzing the ease of use of the Bluprin e-marketplace	Usability	Learnability. Efficiency. Memorability. Errors. Satisfaction.	-	Profession	[1]
Web-Based Home Interior and Exterior Design Order Information System	System Context Diagram and Data-Flow Diagram	Efficiency Memorability Accesibility Security	-	Profession	[2]
Switching Intention of the Indonesian people regarding the purchase of food ingredients based on gender differences	Covariance Based Structural Equation Modeling (CB-SEM)	Perceived channel risk Perceived. price-search intentions. Mobility. perceived difference in delivery time.	-	Gender	[3]
New communication for the architect bureau during the pandemic by implementing a new communication system in the form of an online-based third room	Postcolonial theory	Communication efficiency. Work efficiency. Flexibility. Operational costs. Motivation. Productivity.	Third Place and Hibridity	Profession	[4]

So far, no related research has been found on the development of the Architect's Hub & Marketplace application with Willingness to Use/Willingness to Pay basic research. This study focuses on what are the supporting and inhibiting indicators of the buyer's willingness to transact [5] using moderating variables determined based on level 4 Stages of Learning [6] (table 1).

2.2. Hypotheses

2.2.1. The Four Stages of Learning (Hypothesis 1)

4 Stages of Learning is a level that must be faced when learning something, popularized by Noel Burch in 1970. 4 Stages of Learning consists of Unconscious Incompetence, Conscious Incompetence, Conscious Competence, and Unconscious Competence. The use of this theory is often associated with learning but it is possible to apply this theory to the use of architectural services, especially in Indonesia. The following table 2

is the result of linking the theory of the 4 stages of learning with the interest of the Indonesian people to use the services of an architect. 4 Stages of Learning become the moderator variable in determining the background of the research correspondent, which will then be linked to the determining variable Willingness to Use. H1. 4 Stages of Learning is an indicator to determine the level of users of architectural services.

2.2.2. *Perceived Usability (Hypothesis 2)*

Perceived Usability is an indicator of determining the quality to be used. In addition, perceived usability is also a tool to evaluate how visual a website is. This is a major factor in developing a marketplace or website. H2. Perceived Usability is the main factor to determine the visual quality of a website as well as an evaluation medium in developing a marketplace or website.

2.2.3. *Perceived accessibility (Hypothesis 3)*

Perceived Accessibility is an ease in reaching various things, such as goods, services, activities and goals. H3. Perceived Accessibility becomes a basic reference to look for an obstacle or problem in the wider community related to websites or applications regarding architect services.

2.2.4. *Social Influence (Hypothesis 4)*

A study suggests that people are more likely to change their opinion when people close to them do the same [11]. Social Influence has even been used often, one of which is in spreading propaganda that manipulates or invites someone [12]. In this modern era, the influence of social media on one's decisions is very large, e-commerce sites often connect their website or application with social media to improve user experience [13]. H4. Social Influence influences the decision to use the services of an architect.

2.2.5. *Habit (Hypothesis 5)*

Habit is a tendency to use or do something. In this case, habit refers to how an individual uses social media [14]. According to data, internet or social media users in Indonesia reached 80%, so this is something interesting and a positive thing in various aspects. Examples that can be taken are the economic and business aspects online. H5. Habit is the tendency to use or do something, for that in this case habit is the main thing for consumers or clients in using certain social media or marketplaces.

2.2.6. *Cost (Hypothesis 6)*

Cost is the main thing in the transaction process for goods or services. According to data, the influence of

the price of each architect varies depending on the quality of the resulting design [15]. H6. Cost is the main thing what distinguishes one architect from another and what distinguishes one quality from another.

2.2.7. *Benefits (Hypothesis 7)*

Benefits or benefits are divided into 3 parts, namely financial benefits, social benefits, and structural benefits. This advantage is taken into consideration by the client or customer when choosing the goods or services that the customer will choose [16]. H7. The benefits that will be provided by the actors of the architectural profession vary, depending on the 3 things mentioned, namely financial benefits, social benefits, or structural benefits. But broadly speaking, the size of the benefits received will affect the customer in choosing the goods or services to be used.

Based on the formulation of the hypothesis, a research model diagram is obtained, which will be used as an indicator in strengthening the desire to transact (Willingness to Use/Willingness to Pay).

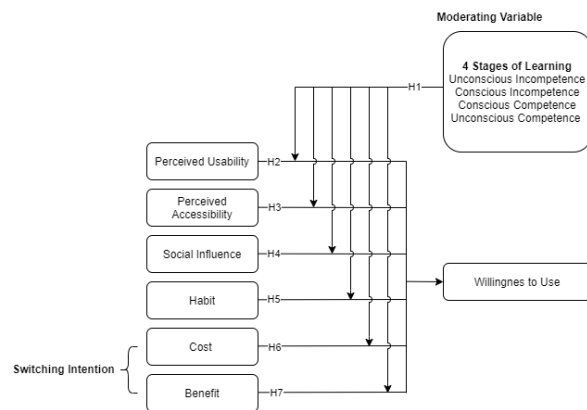


Figure 1 Research diagram.

Based on the figure 1 research diagram that has been developed through the hypothesis, questions were developed for data collection needs related to the desire to use the services of an architect and the desire to move.

3. METHODS

The method used in this preparation is the collection of public opinion with a questionnaire through the media google form. The literature review listed is related to the development of the marketplace and several existing marketplaces, and interviews via google form regarding the user's desire to use the services of an architect, and to use digital applications. How to present the questionnaire using the Summative Scale or commonly known as the Likert Scale. This method uses 2 poles as a measure between strongly disagree and strongly agree which is symbolized by the numbers 1 to 5 (table 2).

Table 2. Question list for survey

Variable (symbol)	Indicator	Measuring Instrument	Reference
4 Stages of Learning	SL1	I've used an architectural service before	[6]–[8]
	SL2	I'm interested in using an architectural service	
	SL3	I've known about an architectural service	
	SL4	I'm used to using an architectural service	
	SL5	I need an architectural service in design matter	
	SL6	I understand the importance of an architectural service on a matter of design	
Perceived Usability	U1	Seeing their portfolio, helps me decide a good architect for me	[9]
	U2	Seeing recent information about architecture inspired me	
	U3	I'm interested in using a website/application with pretty design	
Perceived Accessibility	PA1	I can find an architectural service just fine without using online platform	[10]
	PA2	Looking for an architect service online ease me	
	PA3	I need an online platform to find an architect service	
Social Influence	SI1	I'm interested in using an online platform according to my acquaintance's recommendation	[11-13]
	SI2	I'm interested in using an online platform according to its user count	
	SI3	I'm interested in using an online platform according to the advertisement I saw on social media	
	SI4	I'm interested in using an online platform according to my acquaintance's recommendation on social media	
Habit	H1	I often transact online	[14]
	H2	I felt comfortable by using an online transaction method	
	H3	I felt safe when using an online transaction method	
Perceived Cost	C1	I think the price to an architectural price is expensive	[15]
	C2	I'm willing to use an architectural service for a fair price	
	C3	I value price more than design quality	
Perceived Benefit	B1	I felt beneficial when using an architectural service	[16]

3. RESULTS AND DISCUSSION

Based on the data obtained through the questionnaire, it can be concluded that 53% of the respondents stated that they had used the services of an architect (SL1), and as many as 85% of the respondents had an interest in using the services of an architect (SL2). 95% of the total respondents were also aware of the existence of architectural services (SL3) and 65% of the total respondents were accustomed to using the services of architects related to design purposes (SL4). As many as 67% of the total respondents require the services of an architect for design purposes and have understood the importance of architectural services

related to design issues (SL5, SL6). By looking at an architect's portfolio, 83% of the total respondents can determine the expected architect's preferences (U1) and also 90% of the total respondents find it helpful in terms of inspiration when discussing with architects when viewing the latest information about the world of architecture (U2).

Regarding the application, 89% of the total respondents have an interest in using a website/application with an attractive appearance (U3). In using the website/application, 57% of the total respondents stated that they had an interest in using it if it was recommended by their closest people (SI1). 84%

of the total respondents also have an interest in using a website/application based on the total number of users (SI2). 72% of the total respondents tend to use a website/application based on the advertisements they encounter on social media (SI3) and as many as 89% of the total respondents are interested in using the website/application based on friends' recommendations through social media (SI4).

Regarding online transactions, 84% of the total respondents stated that they often transact online (H1), and online transactions are seen as more convenient (74%, H2) and safe (73%, H3) compared to traditional transactions. Regarding the price, respondents stated that the price of architect services was too expensive (63%, C1) and was more motivated to use the services of an architect if the service price was more affordable (83%, C2). It turns out that only 43% of the total respondents are concerned with price over design quality, meaning that the majority of architects are more concerned with design quality than price (C3). 84% of the total respondents stated that by using the services of an architect, they felt benefited (B1) (figure 2).

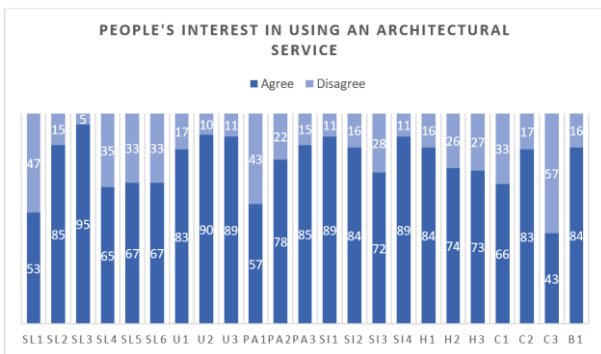


Figure 2 Survey result.

Regarding the topic that they want to discuss with architects, 52.3% of the respondents want to discuss the strength of the building and construction, and 59.2% of the total respondents want to discuss the ability of the building to meet the needs. Regarding the price, only 50% of the total respondents are interested in discussing the required costs. Topics that are popular and favored by respondents are related to aesthetics/beauty (69.2%) (figure 3).



Figure 3 Topic preference.

Regarding the making of architectural applications, the Indonesian people already have an interest in using the services of architects, and the Indonesian people are also familiar with digital technology such as websites/applications. The topics favored by the Indonesian people in the realm of architecture are related to the strength of the building, the function of the building, and aesthetics. Regarding the price, the Indonesian people expect that the cost required to consult an architect is not too high. With the use of digital technology, it is hoped that the gap between enthusiasts and dissenters can be closed.

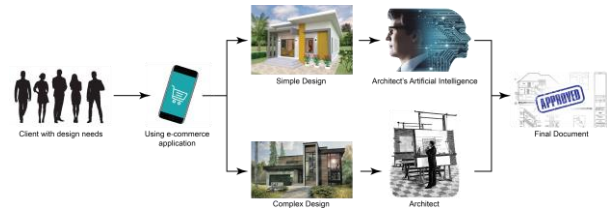


Figure 4 Application scheme.

The proposed application is a marketplace-based application equipped with Artificial Intelligence in its operation (figure 4). The scope of its activities is divided into 3 parts, namely the first part is the design consultation carried out by the client to the architect through the application platform that has been provided, then the second part is the realization of 2d drawings. In this section, the architectural drawing will be done by artificial intelligence, then the working drawing or Detail Engineering Design will be done by the architect himself. After the first and second parts are implemented, then the third or final part is the process of signing the price and the output that will be given to the client in the form of working drawings in accordance with applicable standards in Indonesia.

The design consultation process will be divided into 2 parts, namely simple designs and complex designs. The purpose of this simple design is how clients can get a direct user experience about a good home design process and in this process will work with RISHA which was developed by LITBANG PUPR so that the designs designed by clients can be in accordance with building standards and in accordance with the module structure. RISHA. The modules from RISHA itself are still in 3 modules, namely 3x3m2, 6x3m2 and 6x6m2. The role of artificial intelligence here is very necessary to create the user experience because we as a marketplace service provider must enter several standard parameters needed to design homes and include modules from RISHA to be designed by clients or users of the marketplace. And the role of artificial intelligence here will be to explore design problems and help find room zoning for clients or marketplace users.

For the second part, the complex design will directly communicate with the architects involved through the

live chat feature to help design the dream house of the client or marketplace user and for this complex design, we do not use the RISHA module because it is complex and the structure used does not depend on RISHA. The shape and embodiment will be explained in more detail in the mockup section.

4. CONCLUSION

People can design simple buildings independently (with the help of Artificial Intelligence) People can design complex buildings using the services of architects through e-commerce digital application intermediaries. Indonesian people indirectly learn about building standards. Indonesian people are indirectly encouraged to use the services of an architect because of the conveniences offered by digital applications. Human resources in the form of architects in Indonesia are helped by the existence of Artificial Intelligence that overcomes simple designs. And the target to be addressed is divided into 2 parts, the architect's target as a service provider and the client's target as the service user. For the architect target, it is hoped that young architects, final semester students and architecture students who have just graduated (fresh graduates) can gain experience from this application. Then the second target for clients is the lower middle class, so that the lower middle class can enjoy a healthy and comfortable home. This is based on some data which states that only the upper class can rely on architects to design their homes. For this reason, this application is made according to the intended target.

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