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# ARCHIVING TRADITIONAL HOUSES THROUGH DIGITAL SOCIAL MAPPING: AN INNOVATION APPROACH FOR LIVING HERITAGE CONSERVATION IN JAVA

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## ARCHIVING TRADITIONAL HOUSES THROUGH DIGITAL SOCIAL MAPPING: AN INNOVATION APPROACH FOR LIVING HERITAGE CONSERVATION IN JAVA

Atiek SUPRAPTI <sup>\*</sup>, Anang Wahyu SEJATI , Edward Endrianto PANDELAKI, Agung Budi SARDJONO

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Received 07 July 2021; accepted 14 February 2022

**Abstract.** Indonesia has various types of traditional houses, one of which is the most unique architectural work that is the Joglo Pencil (JP) house. It also has a meaning by reason of a symbol which defines as the development of culture and identity. The role of community in the conservation of cultural heritage buildings is very important. However, due to the pressure of urbanization, many heritage buildings transitioned into modern houses. The study area is the historic area of Kudus city, which previously had a significant influence on Islamic architecture due to its residential model. This study aims to provide a social mapping using GIS and primary survey involves community participation of living heritage. As a result, IT becomes the bridge between conservation needs and management patterns of structured organizations that connects all stakeholders. By innovation of digital social mapping, it will be a bridge for the participation of living heritage community with a more transparent and accountable conservation management. In this case, it is shown that Kudus has experienced cultural shifting and transition in traditional houses. The architectural design of the houses that was initially in JP has begun to disappear. The role of the community in social mapping is very decisive in providing data accuracy. Lacking in preservation and maintenance are the main factors, especially the minimum effort from local government. Therefore, active cooperation between cultural communities, communities, and the government is needed to be able to keep the existence of JP intact as a historical heritage building.

**Keywords:** traditional wooden house, living heritage, conservation, digital mapping.

### Introduction

Sustainability of cultural values in the era of urbanization is one of the world's critical issues. One of which is related to the impact of urbanization on cultural conservation and local wisdom (Lang et al., 2016). The issue spurred discussion on the development of world civilization, which was assessed from the cultural and historical value of a nation (Salamak & Fross, 2016). Urbanization that erodes local cultural values needs to be an essential note (Lang et al., 2016). As it is known that in 2050 the concentration of more than 60% of the world's population is in urban areas (Organisation for Economic Co-operation and Development, 2014), which is why cultural change in the form of physical space is very vulnerable to occur.

It is important to safeguard culture from the strong influence of urbanization. The real problem arises, which has been becoming a central issue in cultural architecture, namely the preservation of buildings that have historical and local values (Wikantari, 2001). This issue is strength-

ened to be an essential spotlight in the world such as the management of historic buildings in Lithuania and Cyprus (Seduikyte et al., 2018), traditional housing in Italy (Resuli & Dervishi, 2015), cultural building in China (Shao et al., 2019), and heritage settlement in Indonesia and South Korea (Suprati et al., 2018). The case is also a problem in Asia, especially for developing countries like Indonesia.

The change in architectural values from traditional to modern is an evident fact, especially in one of the influential cultures in Indonesia, namely Java. Javanese civilization is one of the older civilizations and plays an important role in Indonesian culture. One of the advantages and uniqueness of Javanese culture is the architectural product that has a unique characteristic, which is the Joglo building. Joglo building had developed in Java with a many of variations, one of which is Joglo Pencil (JP) in Kudus city. It has a knock-down wooden frame structure using wooden pegs and has been proven as an earthquake resistant building. The building philosophy is associated to the social strata.

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## EFFECTS OF SUNLIGHT AND SHADOW ON THE SURFACES OF PIGEON TOWERS IN CENTRAL ASIA: CASE STUDIES IN IRAN, QATAR, EGYPT AND SAUDI ARABIA

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**Abstract.** In many parts of the world, especially Central Asia, pigeon towers have been constructed as traditional buildings with different forms and types to keep pigeons. These buildings are cylindrical, cubic, dome-like and multi-cylinder in shape. This study was conducted to identify the effects of sunlight and shadow on the surfaces of pigeon towers in Iran, Qatar, Egypt, and Saudi Arabia with hot and dry or humid climates. Several pigeon towers with different types and structures in these countries were selected and modeled in detail in Rhino 5. Radiance and Ecotect were then employed to measure solar radiation and shadow on the surfaces of the pigeon towers on the hottest day of the year. According to the graphical and numerical results obtained, sunlight and shadow differently affected the surfaces of the different pigeon towers. The effect level of sunlight and shadow on the single-form pigeon towers was higher than on the vaults. In fact, solar radiation was lower and shadow was higher per square meter of the surfaces of the vaults constructed as pigeon towers in close proximity. These houses were therefore found to be the optimal type for the hot and dry or humid climate in Central Asia.

**Keywords:** pigeon tower, solar radiation, Radiance, Ecotect, shadow, Central Asia.

### Introduction

Ongoing research on thermal energy in old buildings aims at analyzing radiation and shadow on historical buildings, especially domes of mosques, reservoirs and markets (Sedighi et al., 2017; Shiri et al., 2021). In recent decades, a growing number of articles have been devoted to solar radiation on the outer surfaces of buildings in a way that outer surfaces and forms increase thermal comfort in spaces.

Certain strategies are commonly adopted to control the effect of sunlight on the surfaces of buildings based on the shape of their outer surfaces (Mohajeri et al., 2016).

A study examined the use of renewable energy sources and determined the effects of sunlight on the surfaces of buildings from physical, geographical, technical and socioeconomic perspectives. Global solar radiation on the selected buildings was also obtained by performing a solar radiation analysis (Montavon et al., 2004; Compagnon, 2004). Today, a large body of literature is assigned to building surfaces using solar radiation measurement

tools such as ArcGIS, Radiance, Ecotect, Lidar (Hachem et al., 2011; Urbanetz et al., 2011; Liu, 2014). The photovoltaic potential of Apeldoorn, (the Netherlands) was estimated at high resolution and feasible areas for photovoltaic installations and their power output were calculated (Kausika et al., 2015). Several studies also analyzed the potential of the outer surfaces of buildings for receiving sunlight (Košir et al., 2014). Moreover, numerous studies investigated the effects of sunlight on the outer curved surfaces of traditional buildings, including the domes of water reservoirs, mosques and bazaars. The effect of solar radiation on these surfaces was simulated in Radiance in dry and hot or cold climates (Shiri et al., 2019b; Shiri & Momeni, 2020; Shiri et al., 2019a). Building orientation, solar radiation, shading and natural ventilation were included in the study of thermal comfort in buildings by performing a weather data analysis in Ecotect (Haase & Amato, 2009; Petersen & Svendsen, 2010; Newell et al., 2012).

As the epitome of traditional architecture in Iran and Central Asia, pigeon towers were mainly built with curved

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## FOSTERING INTEGRATED DESIGN IN AN ACADEMIC ENVIRONMENT: PROCESS AND A METHOD

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**Abstract.** In conventional building design projects architects make pre-design and conceptual design decisions on buildings and hand these down to structural and building services engineers to follow up with design development. It is well known that the conceptual design stage of a project is the point where decisions make the most impact, and changes can be made at least cost. The sustainability and innovation aspects of projects often suffer in this respect. One way of addressing this is through Integrated Design Methods that set out mobilise the full potential of all design disciplines on a project by getting them to work effectively together. This method involves architect, engineers, contractors, and owners/clients in all design phases. The current literature reported fundamental principles and processes of Integrated Design however current industry practices do not fully embrace them. Introducing integrated design studios into university pedagogies is a key step in addressing this. Reports on methods of setting up integrated design studios in a university context are however rare. The aim of this article is to develop and document the underlying settings for such design studios. The principles and best practices for applying integrated design are identified. A specific framework of settings in university context is developed and the justifications presented. This article may be of value for the industry and universities to setup integrated design studios to better foster integrated design education.

**Keywords:** integrated design process, building design, design studio, sustainability, best practice.

### Introduction

Most buildings that perform poorly do so as a result of the subdivision of responsibility and accountability by time and by professional discipline (Rush, 1991). Most current design processes and design tools seem to be intended for individual designers with no attention for explicit teamwork embedded within them (Valkenburg, 1998). This is one of many significant cultural barriers to innovation for creating high performance buildings at the component level (where individual products are selected and combined to create the final design). Other reasons include the increasing segregation of the construction industry into more specialized consultants (Rush, 1991), lack of consultant fees/lack of value placed on the consultant's ability to innovate, poor communication, lack of competition, and different modes of thinking (convergent using logic, divergent using imagination, and lateral using both logic and imagination) between disciplines. The result is an inability to bring the engineering and architectural

disciplines together to effectively co-design high performance buildings.

It is well known that the conceptual design stage of a project is the point where decisions make the most impact, and changes can be made at least cost. The sustainability aspects of projects often suffer in this respect. For example, missed opportunities for renewable energy are typically locked in at the early stages of the design before Heating Ventilation and Air Conditioning (HVAC) engineers become involved. To address this cultural barrier and facilitate incorporation of these measures into design Integrative Design Process's (IDP's) have been developed and can be applied in project delivery (7group & Reed, 2009). IDP's enable co-creation of new ideas better integrating building components (e.g. building envelop, HVAC systems, energy generation, and energy storage) into architectural design. As a part of the process concept design reports and associated communications collateral convey the benefits of the resulting integrated design concepts and the indicative performance gained forming the

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