



## A SYSTEMATIC REVIEW ON SPATIAL-BASED VALUATION APPROACH FOR BUILT CULTURAL HERITAGE

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### ABSTRACT

This paper reviews previous research that has been carried out to assess the value of built cultural heritage based on spatial-based valuation approach. Built cultural heritage is classified as a special property and can be categorised under thin market due to limited transaction or being traded inactively in certain areas. It will age with time, which needs special attention by the local communities and authorities to sustain its cultural, historical and architectural values to be transmitted to future generations. A systematic review has been conducted to examine spatial characteristics that may affect the values of built cultural heritage, the spatial-based valuation approach and the impact of heritage properties on surrounding house prices located within specific radius or distance from the heritage properties. The finding shows that theoretical and empirical studies by the previous research have given some attention to address the concern regarding an effective method for assessing the values of built cultural heritage. It also suggests that there is lack of study on the spatial-based valuation approach for built cultural heritage and Spatial Hedonic Modelling (SHM) offers many opportunities for further investigation.

## 1.0 INTRODUCTION

House is a basic necessity for every individual. This paper presents the literature review and synthesizes the subject matter of the research areas that are being investigated. Accordingly, this paper is structured as follows. The first part is reserved for introduction; second part: a brief methodology; third part: literature review encompassed with the determinants of built cultural heritage for spatial and non-spatial-based valuation and supported by the valuation

approach for built cultural heritage; fourth part: an indication of result and discussion; and end with a summarization of conclusion.

Built cultural heritage can be defined as multifaceted and multidimensional cultural real estate property and an object of cultural value in the second half of the 20th century (Grazuleviciute *et al.*, 2011) and a part of the commonwealth of humans (Ai *et al.*, 2014). Despite of its hidden historical value, the assessor tends to observe an effective approach for valuing the built cultural heritage.

To date, there has been lack of rigorous study on spatial characteristics for assessing their values. Recent study by Normayuni *et al.* (2019) have investigated a list of spatial characteristics (i.e. locational, neighbourhood, and local amenities) but still lack of attention was given to spatial-based valuation approach for built cultural heritage.

On one hand, Junainah (2017) believed that non-spatial (attributes of the subject property) characteristics namely transaction-related, structural, locational, and historical are the factors affecting the heritage property values but she limits her scope of study on the Grade II of private heritage property which is inactively been traded whereby the thin market operates. Hence, this paper aims at filling this gap that concerning spatial characteristics of the built cultural heritage for both public (i.e. historical museum, places of worship, pre-war memorial, bridge, palace, train station) and private properties (i.e. pre-war shophouses, cultural houses).

This paper is organized into seven sections, namely introduction, methodology, literature review, logic model for the determinants of built cultural heritage values, logic model for the valuation approach for built cultural heritage, results and discussions, and conclusion.

## **2.0 METHODOLOGY**

Guided by Baron *et al.* (2014) who posited that stability, reproducibility, and accuracy are pillars of a good literature. Previous literature reviews were thoroughly analyzed and synthesized. A systematic review was conducted to investigate the possible spatial characteristics that may affect the values of built cultural heritage. It is a well-established methodology and suggests a clear-cut process that heavily relies on the researcher's judgment and decision-making (Phillips *et al.*, 2017).

Keele (2007) defined a systematic literature review as a way for identifying, studying, evaluate and interpret available research that is relevant to a topic area of interest. Generally, it aims to summarize the current and past literatures in respect of searching a keyword and identifying the gaps that exist for suggesting further research and providing a new framework (Azham *et al.*, 2015). The purpose of conducting this systematic

review has also been stressed by Waddington *et al.* (2014) that offers an exhaustive and systematic search with the mixed of comprehensive and unbiased synthesis of the existing evidence on that research.

This review involves studies on the topic published between 1915 and 2017 in online databases. This study used twelve primary sources of data as follows:

- (a) Web of Science,
- (b) Scopus,
- (c) IEEEExplore Digital Library,
- (d) Google Scholar,
- (e) Springer,
- (f) Jstor,
- (g) Science Direct or Elsevier,
- (h) Wiley,
- (i) MyCite or MyJurnal,
- (j) Directory of Open Access Journal (DOAJ),
- (k) Tandfonline, and
- (l) American Society of Civil Engineers (ASCE) Library.

The keywords used in searching the above-mentioned database include 'built cultural heritage', 'heritage property valuation', 'spatial valuation', and 'spatial hedonic modelling'.

## **3.0 LITERATURE REVIEW**

Basically, 'spatial' elements refer to the fixed and relative location (Follain & Jimenez, 1985; Orford, 1988; Dubin & Sung, 1990) or longitude and latitude coordinates (x, y) of the subject property (Nunns, 2015). On one hand, the term 'aspatial' is commonly used to define the distance variables (Fotheringham and Rogerson, 1993; Valente *et al.*, 2005). Another term called 'spatial-temporal' (Yao & Fotheringham, 2016) or 'spatiotemporal' is about time and space variables (Pace *et al.*, 1998; Adi Maimun, 2011). The authors opined that neighbourhood (i.e. socio-economic class, racial composition, aesthetic attributes, pollution levels, environmental quality, crime rate, poverty rate, traffic/ airport noise, toxic waste site, educational attainment, restoration of superfund sites, feng-shui beliefs); accessibility (i.e. proximity to main road, proximity to central business district

(CBD), proximity to local amenities, proximity to public transport, proximity to places of worship, proximity to shopping centres, proximity to educational facilities, proximity to trails); and buffering zone (i.e. heritage zone) variables could be also categorised as spatial elements. The reason is these surrogate measures have some influence on price.

The term “spatial-based valuation” is derived from an advanced method of property valuation namely Spatial Hedonic Modelling (SHM). Normally, we are familiar with the term “value-based management” (VBM) which is defined as a process of conserving the heritage building (Rafidee, 2014) that requires management plans (Altenburg, 2010) and involving systematic heritage conservation which is aimed to protect the significance of the heritage site (Mason *et al.*, 2003). In case of spatial-based valuation approach, one of the variables that need to be measured is spatial distance. Sander (2010) opined that spatial distance refers to a critical component of theories across the social, natural, and information sciences. It can be calculated in three ways. They are Euclidean distances, vector-based road network distances, and raster-based cost-weighted distances. These measures are frequently derived from hedonic pricing model (HPM).

Relatively speaking, the spatial-based valuation is guided by a dataset which is theorized to affect the property values and has been widely used by the previous researchers in order to develop an advanced method of Spatial Hedonic Modelling (SHM) and also known as Spatial Econometric Model (SEM) by Agudelo *et al.* (2011). The application of the SHM is lacking in developing countries, notably in Malaysia. Thus, the special measures must be taken into account in obtaining the reliable, valid, and effective approach for built cultural heritage valuation as been depicted in Figure 1.

Indeed, SHM could be a promising method in providing the real value for built cultural heritage since it was successfully and popularly being used for valuing the price of housing markets. It is pertinent to note that; built cultural

heritage is a unique property and will attract investment through tourist visits or funding project by the Federal government and private investors. Investment acts as an important source of capital formation and stimulates economic growth as well as to stabilize the values of built cultural heritage and reducing obsolesces of them (Fatin *et al.*, 2018). This will contribute to the sustainability of built cultural heritage in terms of sustaining its value or optimizing its transaction in property sub-market. In order to make this possible, the determinants of built cultural heritage values have to be examined has been explained as follows.

### **3.1 Logic Model for The Determinants of Built Cultural Heritage Values**

Figure 1 is a logic model for analyzing studies of factors affecting the built cultural heritage values. Proceeding from left to right in a series of boxes arranged in a flowchart, the figure begins at the determinants of built cultural heritage values. It moves to two boxes, spatial and non-spatial-based valuation. Spatial-based valuation proceeds to three boxes: spatial, aspatial, and spatial-temporal or spatiotemporal. The first three boxes are fixed location, relative location, and absolute location (longitude and latitude coordinates). The second three boxes are distance while the third boxes are time and space. These items are expanded into three boxes namely accessibility, neighbourhood, and buffering zone. The non-spatial-based valuation box includes four items: transaction-related, structural, locational, historical, cultural and traditional architecture. However, this paper will solely cover the spatial-based valuation approach since it is a new contribution from the researchers in the field of assessing the values of built cultural heritage. Indeed, apart of non-spatial based valuation has been revealed by Junainah (2017) using the method of Rank Transformation Regression (RTR) and Multiple Regression Analysis (MRA) in measuring the Grade II of pre-war shophouses in Kota Bharu, Kelantan.

### 3.2 Logic Model for the Valuation Approach for Built Cultural Heritage

Spatial-based valuation approach will take into account of spatial effects on built cultural heritage prices. In parallel to that, SHM could be a more suitable method for built cultural heritage analysis if spatial dependence is present in the

data. Indeed, SHM is a method that incorporates spatial dependence into a regression model (Boxall *et al.*, 2005; Kim, 2003) and it is an advanced multiple regression method (Suriatini *et al.*, 2008). It involves regressing all significant factors affecting prices that include spatial and non-spatial characteristics as been captured in Figure 1.

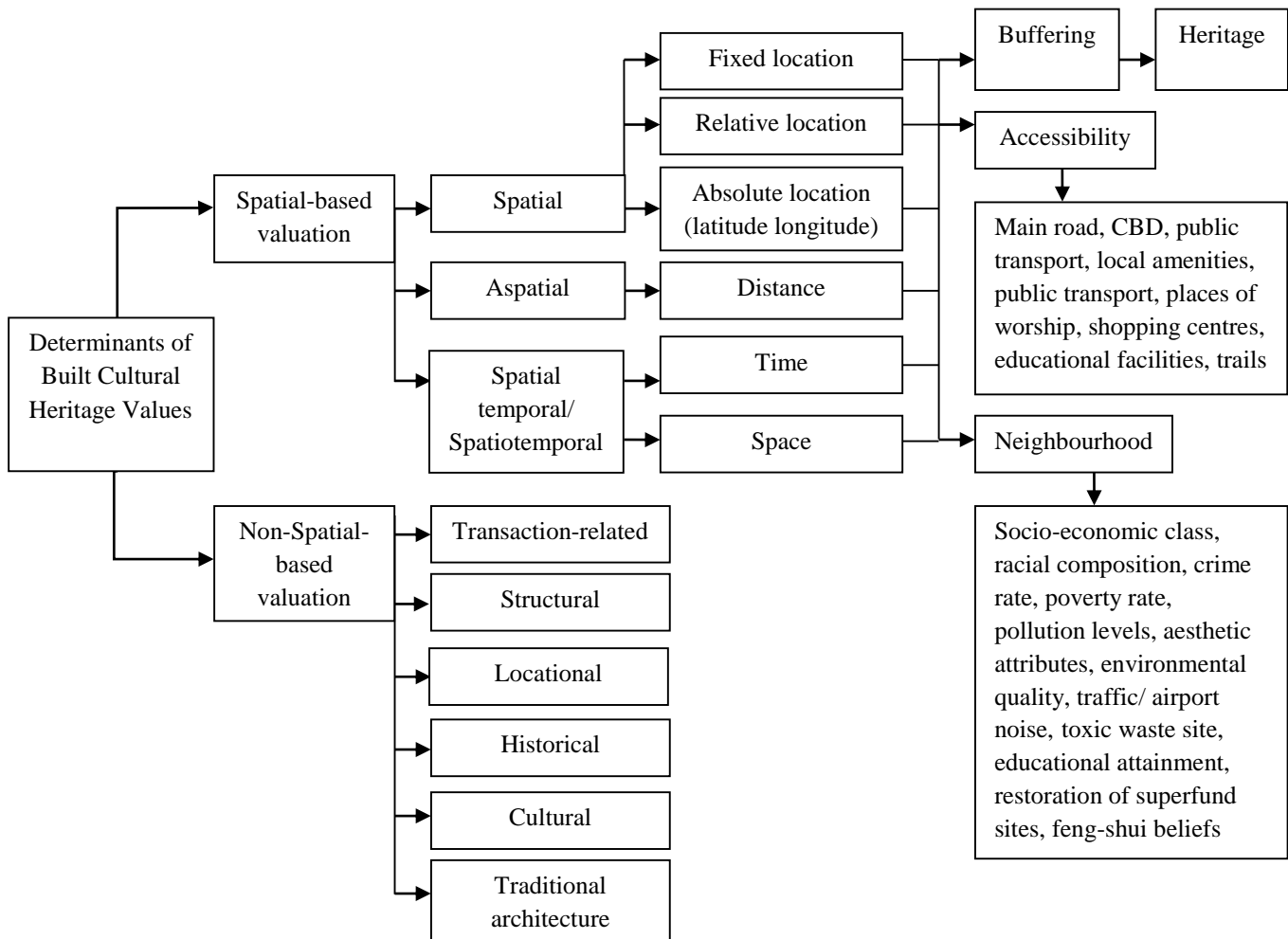


Figure 1: Logic Model for the Determinants of Built Cultural Heritage Values

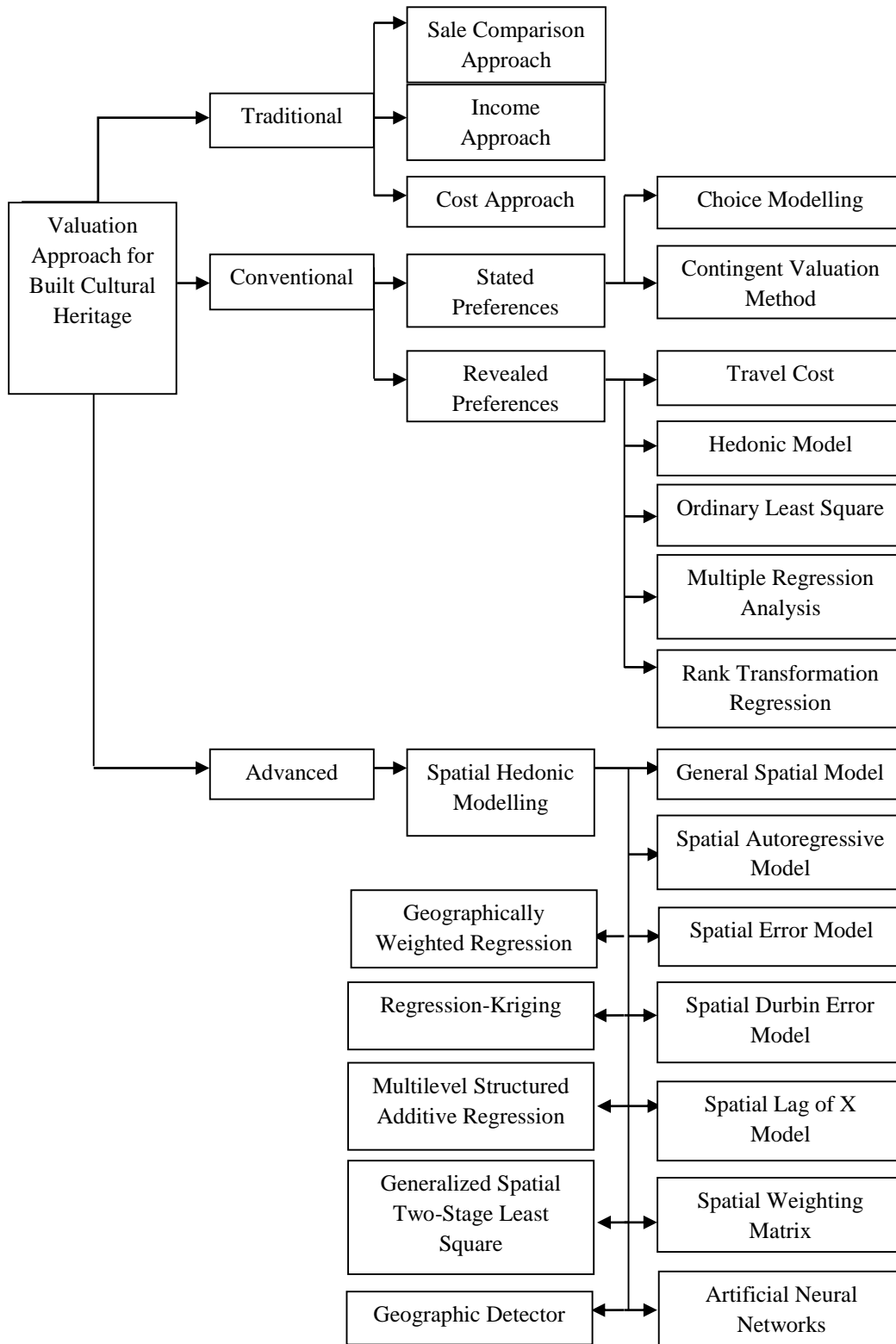


Figure 2: Logic Model for the Valuation Approach for Built Cultural Heritage

Once the list of spatial factors has been analysed, the next step that should be highlighted by the researchers is the spatial-based valuation approach for built cultural heritage. Based on Figure 2, valuation approach for built cultural heritage is divided into three categories: traditional, conventional, and advanced method. Starting from left to right in a series of boxes arranged in a flow chart, the traditional method extends into three boxes namely Sale Comparison, Income, and Cost Approach (Junainah, 2017).

The second box is conventional method which encompasses with Stated and Revealed Preferences Method. Choice modelling and Contingent Valuation Method are categorised under Stated Preferences Method while Revealed Preferences Method includes five items: Travel Cost, Hedonic Model, Ordinary Least Square, Multiple Regression Analysis, and Rank Transformation Regression (Mohamad *et al.*, 2017; Fatin & Suriatini, 2017). The advanced box is specifically referred to the Spatial Hedonic Modelling that includes twelve models: General Spatial Model, Spatial Autoregressive Model (Lazrak *et al.*, 2014), Spatial Error Model (Kim *et al.*, 2017; Suriatini *et al.*, 2008), Spatial Lag of X Model, Spatial Durbin Error Model (Hofe *et al.*, 2017), Geographically Weighted Regression (Peddy *et al.*, 2016; Yao & Fotheringham, 2016; Zhong & Li, 2016), Regression-Kriging (Bajat *et al.*, 2017), Multilevel Structured Additive Regression Model (Razen *et al.*, 2014) or Generalized Additive Regression Model (Olszewski *et al.*, 2017), Artificial Neural Networks (Feng & Jones, 2015), Spatial Weighting Matrix (Hui *et al.*, 2007), Generalized Spatial Two-Stage Least Square (Chen & Li, 2017), and Geographic Detector or Gravity Model (Wu *et al.*, 2017).

#### 4.0 RESULTS AND DISCUSSION

There were 3,721 papers returned by the query from the databases that were searched as illustrated in Figure 3. Over 3,721 article titles were reviewed in repositories and from those, 194 were found to be useful for this study. After the screening test, nine files were duplicated and have been removed. The remaining 185 articles were kept with six being studied for a more

thorough review using a systematic review process for assessing the eligibility. The eligibility of the papers was chosen based on the relevancy of the paper on the subject being studied in respect of spatial hedonic modeling and spatial-based valuation approach for cultural heritage property.

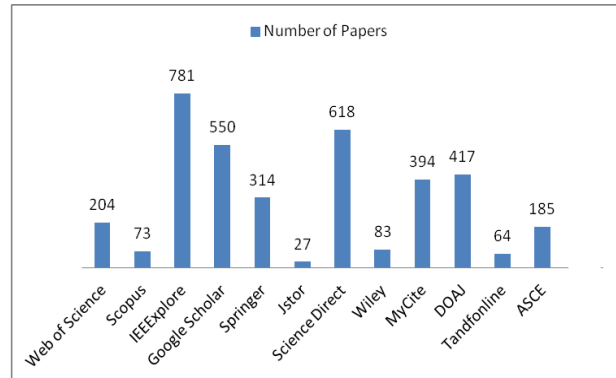


Figure 3: Papers Distribution Graph

Most of the papers returned applied Geographically Weighted Regression (GWR) for valuing the prices of houses and public amenities. In the case of assessing the values of built cultural heritage, the previous researchers applied Regression-Kriging (Tatt, 2010); Spatial Autoregressive Model (Lazrak *et al.*, 2014); Spatial Econometric Model (Lazrak *et al.*, 2011); Spatial Hedonic Approach (Nilsson, 2011); Spatial Autoregressive Model or Spatial Error Model (Ahlfeldt and Mastro, 2012); and Quantile Regression Model (Zahirovic-Herbert and Chatterjee, 2012) as been depicted in Table 1.

Table 1: A Systematic Review on Spatial-Based Valuation Approach for Built Cultural Heritage

No.	Spatial-Based Valuation Approach	Author(s), year	Main variables/ attributes	Sample (N)	Results and Discussions	Specific Measurement/ Radius from the Heritage Property/ Zone (m)
1.	Regression-Kriging (RK)	Tatt (2010)	<ul style="list-style-type: none"> <li>▪ Location</li> <li>▪ Neighbourhood</li> <li>▪ Local amenities</li> </ul>	<ul style="list-style-type: none"> <li>▪ 231 heritage property transactions</li> </ul>	The findings indicated that spatial factors namely location, neighbourhood, and local amenities have an influence on heritage property prices in Georgetown	Specific radius has not been revealed by the author.
2.	Spatial Autoregressive Model (SAM) (Spatial Durbin Model)	Lazrak <i>et al.</i> (2014)	<ul style="list-style-type: none"> <li>▪ Availability of listed heritage buildings status</li> <li>▪ Heritage density</li> </ul>	<ul style="list-style-type: none"> <li>▪ 51 listed heritage buildings (monument)</li> <li>▪ 90 houses sold in Zaanstad, Netherlands</li> </ul>	The results indicated that the impact of cultural heritage in particular (spillover effect), in purchasing a listed building and historic cultural sites, buyers are willing to pay an additional 26.9% while surrounding houses are worth an extra 0.28% for each additional listed building within a 50 metre radius. Besides, in the existence of historic ensemble effect, a premium of 26.4% would be gained by the landowner.	Property prices (houses value) associated with heritage property within 50 m radius with a price increase of 0.24-0.28% percent.
3.	Spatial Autoregressive Model (SAM) (spatial lag model and spatial error model)	Lazrak <i>et al.</i> (2011)	<ul style="list-style-type: none"> <li>▪ Availability of listed heritage buildings status</li> <li>▪ Heritage density</li> </ul>	<ul style="list-style-type: none"> <li>▪ 51 listed heritage buildings (monument)</li> <li>▪ 90 houses sold in Zaanstad, Netherlands</li> </ul>	The results demonstrated: (i) dwellings on a heritage list capture a positive premium for their own value, (ii) the heritage houses also generate positive premium effects for other dwellings in the 50 metre vicinity, and (iii) dwellings located in a historic-cultural ensemble also capture an additional property value.	Surrounding houses value increases as the listed heritage buildings increases in number (heritage density) within 50 m.

4.	Spatial Hedonic Approach	Nilsson (2011)	<ul style="list-style-type: none"> <li>▪ Distance to the listed heritage buildings</li> <li>▪ Distance to world heritage site</li> </ul>	<ul style="list-style-type: none"> <li>▪ 5000 housing transactions in south Sweden</li> </ul>	The results indicated that the percentage share of land devoted to preservation areas (cultural landscape and heritage) has a capitalization effect of 8.1% for properties located in the vicinity. The results also show the proximity to listed sites, measured in Euclidean distance has a capitalization effect of 4.4% on property prices.	Houses value increases as the distance to the listed heritage buildings and world heritage site decreases; however, specific radius has not been revealed by the author.
5.	Spatial Autoregressive Model (Spatial error model)	Ahlfeldt and Mastro (2012)	<ul style="list-style-type: none"> <li>▪ Availability of listed heritage buildings/distance to historic landmark</li> <li>▪ Iconic architectural design</li> </ul>	<ul style="list-style-type: none"> <li>▪ 3,334 homes in Oak Park, Illinois, Chicago</li> </ul>	Premium on the price paid per land unit is achieved of up 8.5% for homes within 50 m of a Wright home, and about 5% within 50-250 m. Beyond this threshold, evidence for positive effects is weak at best	Houses value increases within 50-100 m radius of the nearest Wright building (landmark).
6.	Quantile regression model	Zahirovic-Herbert and Chatterjee (2012)	<ul style="list-style-type: none"> <li>▪ Listed heritage density</li> <li>▪ Distance to historic landmark</li> </ul>	<ul style="list-style-type: none"> <li>▪ 28, 025 in Baton Rouge, Louisiana, USA</li> </ul>	Historic designation is associated with average property value increases ranging between 5% and 8% of mean house value. Designation of a neighbourhood as historic has positive spillover effects on property values for nearby residential properties.	Property values (residential properties) increases as the distance to the historic landmark decreases, however, specific radius has not been revealed by the authors.



Pertinent variables used to represent heritage properties/zone include availability of listed heritage buildings status, heritage density, distance to the listed heritage buildings, distance to world heritage site, distance to historic landmark, iconic architectural design, listed heritage density, and distance to historic landmark.

The impact of heritage properties/zone on surrounding house values as measured through accurate or radial distance demonstrates the evidence of spatial autocorrelation. Specifically, surrounding property values increase as the listed heritage buildings increase in number (heritage density) within 50-100 metres.

## 5.0 CONCLUSION

This paper has critically undertaken a systematic literature review on the selected six studies, out of 3,721 titles initially returned by the searches done on twelve online databases. The review has focused on studies of spatial characteristics and spatial valuation methods that were published in the years 2007 until 2017. Out of these, only six papers have studied the spatial effects on heritage property prices.

The findings of this study highlighted six advanced Spatial Hedonic Modelling namely the methods of Regression-Kriging (Tatt, 2010); Spatial Autoregressive Model (Lazrak *et al.*, 2014); Spatial Econometric Model (Lazrak *et al.*, 2011); Spatial Hedonic Approach (Nilsson, 2011); Spatial Autoregressive Model or Spatial Error Model (Ahlfeldt and Mastro, 2012); and Quantile Regression Model (Zahirovic-Herbert and Chatterjee, 2012) were used in examining the impact of heritage properties on surrounding house prices located within 50-100 metres of radius or distance from heritage properties.

The capability of SHM in quantifying the spatial effects of heritage properties on surrounding house values highlights the many opportunities of spatial valuation methods for further exploration. These would be interesting in pursuing the aspiration to establish effective methods of valuation for built cultural heritage. The main challenge of the advanced techniques seems to be the complication that relates to the advanced statistical knowledge required from the researchers.

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