

# The development of a construct in the heritage urban sustainability index

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**Keywords:** Cultural heritage; Exploration factor analysis, Heritage urban sustainability.

**Abstract.** *The UN Sustainable Development Goals (SDGs) have outlined that every country in the world needs to create sustainable cities for communities by 2030. The first thing to consider is how to identify sustainability indicators to be used as a guide in measuring the sustainability index. Therefore, this article aims to explore the formation of the heritage urban sustainability index construct in Malaysia using exploratory factor analysis (EFA). The respondents consisted of 100 residents in the heritage city of Kajang, Malaysia, who were selected using a simple random sampling technique. Likert scale questionnaires 1 to 5 were used to elicit feedback. The results showed that the items in each study construct achieved acceptable reliability with Cronbach's alpha values greater than 0.70 and met the normality test requirements. Data was processed using EFA for grouping items according to appropriate constructs. The results of the study from 154 items of the questionnaire have formed five main constructs of urban heritage sustainability in Malaysia, namely (1) economic prosperity, (2) social well-being, (3) environmental well-being, (4) cultural heritage, and (5) the role of government and community. The results of this study also meet the index value requirements set by Kaiser-Meyer-Olkin (KMO) and Bartlett's Test of Sphericity. Furthermore, the formation of the five constructs of this study directly demonstrates the relationship between items according to constructs. Indirectly, these findings help research on the sustainability of heritage cities in other areas as well.*

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## 1. Introduction

The UN Sustainable Development Goals (SDGs) target all countries globally with the aim of building sustainable cities and communities for all by 2030. The eleventh goal mentions the sustainability of cities and communities. It is detailed under Target 11.3 that by 2030 all countries need to improve inclusive and sustainable urbanisation for integrated and sustainable human settlement planning and management (UNDP, 2019). To achieve the SDGs' recommended

level of sustainability, a method or measurement must be applied systematically and holistically. To achieve this goal, a tool or benchmark must be created to assess each city's level of sustainability. Therefore, countries have been engaged in building their own measurement instruments to measure the sustainability of their respective cities, including Malaysia. The level of urban sustainability in Malaysia is measured by an instrument developed by the Federal Department of Town and Country Planning (Jabatan Perancangan Bandar dan Desa, 2019), the Malaysian Urban-Rural Sustainable Development Indicator Network (Murninet) 2.0, used from 2017 until the present day.

However, the constructs used in Murninet 2.0 do not include all elements, especially elements involving cultural heritage. Indeed, elements of cultural heritage are not included in Murninet 2.0 as a measurement construct. However, the cultural heritage element is element 11.4 in the SDGs, which sets the target that, by 2030, all countries need to strengthen efforts to preserve and protect the world's cultural heritage in urban development. This means that sustainable urban development should involve cultural heritage elements as one of the constructs in the measurement, especially for cities classified as heritage cities.

Many people are unaware that cultural heritage is one of the drivers of sustainable development in the Agenda 2030, especially in the context of urban development. Cultural heritage supports sustainable economic development, the formation of prosperous communities and the creation of a conducive environment. Cultural heritage is able to generate an economy based on heritage tourism, form a harmonious society by cultivating a sense of belonging as a result of the identification of origins and save the use of natural resources by reusing existing heritage elements. The values brought by cultural heritage cross borders and complement every existing dimension in sustainable urban development.

In Malaysia, there are 162 cities classified as heritage cities that existed before World War II (1941). Melaka and Georgetown have been listed in the World Heritage List as World Heritage Sites (UNESCO, 2019). Heritage cities have distinctive and unique features and elements that not found in ordinary cities (Keawsomnuk, 2021). For example, tangible and intangible cultural heritage such as the architectural design of buildings that orient the unique living culture of the local community, dialects used in daily speech, and lifestyle practices in certain ethnic and sub-ethnic cities (Baba Nyonya, Jawi Peranakan, Bugis, and others).

Therefore, the measurement of heritage urban sustainability should be identified in the context of Malaysia so that it can be used as a guide and indicator

in future studies and as a guide for external researchers. This study is in line with the view of Ban Ki-Moon that sustainable urban development does not marginalise elements of cultural heritage (Wiktor-Mach, 2019). Cultural heritage is already an integral part of the life of local communities. It been raised on a par with economic, social and environmental elements in measuring the level of sustainability (Appendino, 2017). Therefore, this article aims to explore and test cultural heritage constructs along with economic, social, environmental, governmental, and community roles in heritage cities in Malaysia.

## 2. Literature Review

In general, sustainable development has been defined as development that meets the demands of the present without compromising the ability of future generations to meet their needs. Sustainable development associates economic, societal, and environmental sustainability with poverty eradication and income distribution equity as important key goals (Chamhuri et al., 2014). The Limits to Growth (Meadows et al., 1972) was the catalyst, followed by the Brundtland Report (Brundtland, 1987), the Rio Summit (1992) (UNESCO, 2017), the Decade of Education for Sustainable Development (2004-2014) (UNESCO, 2017), and, most recently, the Sustainable Development Goals (SDGs) with 17 key goals that each country must act on (United Nations, 2019). Sustainable development in urbanisation has resulted in a number of global urbanisation agendas, including The Healthy Cities Movement, Local Agenda 21, and the most recent, the New Urban Agenda. A New Urban Agenda has goals for a enhance and more sustainable future (Satterthwaite, 2016; Habitat III, 2016). The New Urban Agenda was accepted at the United Nations Conference on Housing and Sustainable Urban Development in Quito on October 20, 2016 (Caprotti et al., 2017). One of the goals to be achieved in the New Urban Agenda is to create sustainable cities.

According to Fatimah et al. (2008) and Abdul Samad et al. (2004), sustainable urban development is a collaborative decision-making process involving stakeholders in urban planning such as local authorities, local business associations, non-governmental organisations, and consumers, to ensure that economic activities, population welfare (including health), and ecosystems are all given integrated consideration to ensure that current and future generations can meet their needs on an ongoing basis. An important criterion in the formation of a sustainable city is the environment, economy, society, and local authorities' ability to implement efforts to achieve the mission and vision of planned sustainable development.

When the New Urban Agenda is examined more closely, it can be seen that, in addition to the relationship between good urbanisation and job creation, livelihood opportunities, and revised quality of life, the natural and cultural heritage of cities is also a key component in urban planning, including rehabilitation and adaptation efforts, promotion and dissemination of knowledge regarding these issues (Habitat III, 2016). This shows that cultural heritage has been recognised as a key component in creating sustainable cities. This has led to debate between scholars such as Runnalls (2007), Tweed and Sutherland (2007), as well as Salvatore (2018), who place cultural heritage as the fourth dimension in sustainable development. Appendino (2017) has clearly shown a shift in the paradigm towards the foundation of sustainability when placing the element of heritage as one of the main pillars for sustainability achievers.

Each city has its own uniqueness. Whether big or small, a city has its uniqueness related to natural or cultural, tangible or intangible variables (Salvatore, 2018). According to Guzmán et al. (2014) and Abdul Rani (2018), cultural heritage not only transcends economic success and achieves policy-making attention but is also an urban uniqueness. According to Van Oers and Pereira Roders (2012), who studied the role of cultural heritage in sustainable urban development in Belfast, Ireland, cultural heritage has contributed to unique urban features and instilled a sense of belonging in residents of various generations, resulting in the development of a sustainable city. In most cases, heritage cities are often analysed in the context of tourism sustainability, as discussed by Coccossis (2008), Al-Hagla (2010) and Thorosby (2016). At the same time, the role of cultural heritage in contributing to sustainable cities has not been neglected (Thorosby, 2016; Kotradyova, 2019).

As Malaysia is committed to implementing the SDG agenda and adopting the New Urban Agenda, together with being a country rich in relics and uniqueness of its past, especially in cities, it needs to have an index to measure the sustainability of its heritage cities. The term sustainable heritage city does not apply only to UNESCO-recognized heritage cities but includes all cities with unique cultural characteristics. Some countries and cities have developed their own sustainability indexes, such as the Sustainable Cities Index (Australia), the Urban Sustainability Index (China), and the London Sustainable Development Indicator (United Kingdom), as well as Malaysia, which has developed Murninet 2.0, an instrument to measure urban sustainability (Mohamad et al. 2021). All of them view the city in general without placing the heritage element as one of the key domains for forming and calculating the index. This scenario is seen as marginalising the heritage that is the legacy of a city.

Questions concerning the sustainability of heritage cities in Malaysia can be addressed through the availability of instruments and indicators covering all sustainability components. Murninet 2.0 uses only three main constructs: economic, social, and environmental as introduced by Brundtland (1987). We propose that, by using the foundations of these three constructs, integrated by the cultural heritage constructs introduced by Appendino (2017) as well as the government and community role constructs introduced by Leus and Verhelst (2018) and Tan et al. (2018), an instrument with five complete constructs can be built and applied in Malaysia. Next, the details of each construct, sub-construct, and item can be based on the local environment of heritage cities in Malaysia by referring to various relevant sources such as UNESCO, New Urban Agenda, Healthy City Movement, Local Agenda 21, and others.

### 3. Methodology and Study Area

This study uses exploratory factor analysis (EFA) to identify a limited number of latent factors or constructs from a large number of observed constructs consisting of EFA. In this study, only EFA conducted to explore the heritage city sustainability index components in Malaysia. Pilot study data used to meet the requirements of EFA by using data and samples that were different from the actual study still had similar and almost identical characteristics to the actual study (Worthington and Whittaker, 2006).

#### 3.1 Study Area

The selected study area is the city of Kajang, located in the state of Selangor, Malaysia. Kajang is a city listed in the Malaysian Architectural Heritage Inventory report as a heritage city established before the Second World War (1941). Kajang still retains elements of its cultural heritage despite the expansion of Kuala Lumpur's development. Many elements of tangible cultural heritage buildings and shops built before the war are still preserved in this city and have an early transitional style and architectural design, with balustrades, domes on columns, attractive windows, various plaster decorations, patterns, and carvings that depict the culture of the loaves and fishes (Syed Zainol, 1992). In addition, an element of intangible cultural heritage is still intensely practised by the locals, including young people. In the city of Kajang, there are various elements of the intangible heritage of the cultural life of various ethnic and sub-ethnic groups, such as Javanese, Bugis, Malay, Chinese, and others who inhabit it. Among the popular intangible culture practised by Kajang's community is a Silat Sukmo Rogo performance, which takes place when there is a wedding ceremony (Hafez and

Aloysius, 2019). In addition to the preservation of cultural heritage, the city of Kajang is also competitive in economic growth, social development, and the environment, which makes it listed as one of the cities most chosen for livelihood and inhabited by residents (Abdul Samad et al., 2004). The characteristics of Kajang make it appropriate for selection as a pilot study area.

### 3.2 Population and Sample

This study set the total study sample at 100 residents aged 18 years and above, living in heritage urban areas. This is the initial sample for the verification process of instrument construction measurement using EFA. This population consists of locals and non-locals who migrated and settled in the city to work or study or for other reasons. The selection of respondents was with a simple random sampling technique. The number of samples is based on Leohlin (1992) and Kline (2005) in terms of the minimum number of samples recommended.

### 3.3 Instruments

The research instrument used was a questionnaire. This consists of six sections: sections A, B, C, D, E, and F (Table 1). Each section contains information related to the study constructs: Section A (economic prosperity), Section B (social well-being), Section C (environmental well-being), Section D (cultural heritage), Section E (role of government and community), and Section F (respondents' profile). Sections A, B, C, D and E are adaptations and modifications from the sustainability theory introduced over a period of time from Brundland Report (1987) to Appendino (2017). Table 2 shows in detail the constructs, items, and statements of this study.

**Table 1:** Questionnaire Information

Section	Constructs	Constructs Explanation	Items	Source
A	Economic Prosperity	Economic prosperity refers to human mobility, business/investment activities and economic growth contributing to employment opportunities, income, and human influx.	33	Adapted from Jabatan Perancangan Bandar dan Desa (2019) and Choon et al. (2011)
B	Social Well-Being	Community well-being refers to basic amenities, relationships/communications and utilities, safety and public order. Basic facilities lead to the infrastructure provided for all residents. Safety and public order are related to social problems in society and communication/utilities are related to transportation networks and domestic services such as water and electricity supply that lead to social well-being.	31	Adapted from United Nation Sustainable Development (1992) and Choon et al. (2011)

C	Environmental Well-Being	Environmental quality refers to physical health, namely air, sound, smell, congenital diseases and clean water supply. In addition, the land use that involves saturated built-up areas contributes to the quality of the environment.	20	Adapted from Takano (2003); O'neill and Simard (2006); Lafond and Heritage (2009)
D	Cultural Heritage	Cultural heritage refers to tangible culture that can clearly be seen and touched, such as buildings, monuments and other constructions, while intangible culture is a culture that cannot be seen and touched such as practices, customs, art, and so on, as well as the preservation and conservation of heritage that involves restoration, repainting, modification, and other activities that leading to the survival of cultural heritage	28	Adapted from Appendino (2017); Abdul Aziz (2011) and Syed Zainol (1992)
E	Role of Government and Community	The role of government and community refers to community involvement, environmental management, tourism and heritage management, and risk management, as efforts made to preserve cultural heritage	42	Adapted from United Nation Sustainable Development (1992) and Tan et al. (2018)
F	Respondent's Profile	Involves information on gender, race and population status	3	Built according to the needs of the study

**Table 2:** Constructs, Items, and Statements of Heritage City Sustainability

Constructs	Items	Statements
Economic Prosperity	a1	Many job opportunities are available in this area.
	a2	Side job opportunities abound in this area.
	a3	The price of essential goods is in accordance with the Ministry of Domestic Trade and Consumer Affairs (KPDNHEP) standards in this area.
	a4	The annual salary increase is inconsistent in this area.
	a5	Many people are unemployed in this area.
	a6	Many job opportunities are monopolized by foreign workers (non-citizens) in this area.
	a7	Many non-locals live in this area due to employment factors.
	a8	Many shops are empty and unused in the area.
	a9	Rental rates for shops or business premises are high in this area.
	a10	Service activities such as hotels/guest houses/motels are plentiful in this area.
	a11	Business activities are thriving/growing rapidly in this area.
	a12	The opportunity to run your own business is huge in this area.
	a13	All types of businesses can be found in this area.
	a14	There are certain business clusters (clothing, retail, furniture, restaurants etc) in this area.
	a15	Multi-National Companies (MNCs) (e.g. 7Eleven, KFC, McD) operate extensively in this area.
	a16	Small and Medium Enterprises (SMEs) (e.g. grocery stores, restaurants etc.) abound in this area.
	a17	Many companies or shops practice shifting hours in this area.
	a18	Business activities are active until night in the area.

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	a19	Non -locals run businesses around the area.
	a20	Traders around this area receive special assistance from the local/central government.
	a21	Enough space is provided for locals to do business in the area.
	a22	Land tax for business or commercial lots is adequate in this area.
	a23	This area is the focus of the public.
	a24	This area is the focus of foreign workers.
	a25	Every weekend many tourists come to this area.
	a26	Residents from this countryside often come to travel to this area.
	a27	This city is frequently visited seasonally (school holidays, convocations, etc.)
	a28	Every school holiday season many tourists come to this area.
	a29	Road congestion occurs during the holiday season due to the influx of many vehicles.
	a30	Tourists drive sales in this area.
	a31	The presence of tourists contributes to the development of this area.
	a32	The presence of tourists contributes to the economy of the area.
	a33	The presence of tourists increases the use of technology in this area.
Social Well-Being	b1	Wellness facilities are fully available in the area.
	b2	Hypermarket facilities are available nearby in the area.
	b3	Facilities such as schools, community colleges and institutes of higher education are adequate in this area.
	b4	Security facilities (e.g., Police Station, Fire Station) are fully available in this area.
	b5	Complex facilities and a cultural centre are fully available in the area.
	b6	Facilities for the disabled are fully available in this area.
	b7	Playground and field facilities for leisure and sports facilities are fully available in the area.
	b8	Pedestrian facilities are available throughout the area.
	b9	Safe cycling routes are available in the area.
	b10	Hygienic dining facilities are cleanly available in the area.
	b11	The assembly square facilities are sufficient to accommodate the residents in this area.
	b12	Hygienic public toilet facilities are available in the area.
	b13	Access to services and facilities (Hospitals, police stations, fire stations, post offices, government clinics, etc.) of the urban area is within a radius of less than 5 km.
	b14	Criminal cases (theft, snatching, robbery) are alarming in this area.
	b15	Symptoms of social malaise ("rempit" <sup>1</sup> , drugs, vice, etc.) among adolescents are alarming in this area.
	b16	Women are safe to walk in this area.
	b17	Children are safe to play in this area.
	b18	Public safety assurance is good and controlled in this area.
	b19	The police are constantly patrolling and inspecting the area.
	b20	The road infrastructure in this area is good and convenient to use.
	b21	Cases of premise or shop house fires are frequent in this area.

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<sup>1</sup> "ramp-(rev)-it" (ramp the throttle)

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	b22	Public transport such as buses and taxis are always available in the area.
	b23	E-hailing transport such as Grab and Mycar are easily available in the area.
	b24	Bus terminal facilities are fully available in the area.
	b25	A wide selection of bus ticket counters and kiosks are available in the area.
	b26	There are many bus stops in the area.
	b27	Many parking lots are available in the area.
	b28	Public transport services connect all places in the area.
	b29	Few water supply disruptions occur in this area.
	b30	Electricity supply is often cut off (blackout) in this area.
	b31	Telephone networks and maximum internet speed (4G) are available throughout the area.
Environmental Well-Being	c1	Air pollution is frequent in this area.
	c2	The temperature is at a comfortable level in this area.
	c3	Noise is frequent in this area.
	c4	Bad smells are common in this area.
	c5	Water-borne diseases (e.g., diarrhea) are common in this area.
	c6	Vector-borne diseases (e.g., dengue) are common in this area.
	c7	Domestic tap water supply is clean in this area.
	c8	Tap water needs to be filtered first before being used for cooking and drinking purposes.
	c9	Tap water is often cloudy and silty.
	c10	There is a lot of open space here.
	c11	Buildings in this area are built close together.
	c12	Buildings in this area are a built-in storey.
	c13	The local authority oversees well the physical construction of the building.
	c14	There is construction of buildings on an ad hoc (private) basis by landowners.
	c15	Property values in this area are very high.
	c16	Most of the soil surface has been completely cemented/asphalted in this area.
	c17	Flash floods often occur in this area.
	c18	This area lacks green vegetation cover.
	c19	There is a well-equipped public park in the area.
	c20	There is an open area such as a large football field in the area.
Cultural Heritage	d1	A heritage shop building still functions in the area.
	d2	Another type of heritage building still functions in this area.
	d3	Heritage buildings have their design features in the area.
	d4	Heritage buildings have their architectural features in the area.
	d5	Heritage buildings are the symbol of the community in this area.
	d6	Heritage buildings are the source of education in this area.
	d7	Heritage buildings can enhance the spirit of patriotism and love for the country.
	d8	Heritage buildings are still strong and intact in terms of structure in this area.
	d9	Heritage buildings still retain the originally built structures in the area.

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	d10	The walls of heritage buildings are not painted to maintain their originality.
	d11	The walls of heritage buildings in this area have cracks.
	d12	The walls of heritage buildings in this area have been sloping.
	d13	Cultural performing arts are often exhibited in this area.
	d14	The community in this area still listens to folk songs and traditional music.
	d15	Traditional games and folk sports are always played in this area.
	d16	Customs and rituals still practiced in this area.
	d17	Traditional businesses still abound and operate in the area.
	d18	Annual festivals and activities are often organised on a large scale in the area.
	d19	Festivals/ rituals/ crowds are celebrated every year in this area.
	d20	Preservation and conservation of heritage is done by the owner of the premises or local authority in this area.
	d21	Heritage buildings still function as originally in the area.
	d22	The structure of a heritage building has not altered to maintain its originality in the area.
	d23	Heritage tombs are still preserved and preserved in this area.
	d24	Preservation and conservation of heritage enhance the image of this area so that it becomes a visitor attraction.
	d25	Preservation and conservation of heritage increase the value of properties in the area.
	d26	Preservation and conservation of heritage attract many tourists to come to this area.
	d27	Preservation and conservation of heritage attract researchers to this area.
	d28	Preservation and conservation of heritage retain historical value.
Role of Government and Community	e1	Local authorities (PBT) put up posters and signboards promoting recycling practices in the area.
	e2	Local authorities hold recycling programs regularly to promote resident awareness in this area.
	e3	Local authorities provide recycling bins in every place to dispose of garbage in this area for the convenience of residents.
	e4	Local authorities always encourage residents to use public transport to reduce traffic congestion in this area.
	e5	Local authorities always hold environmental education programs for residents in this area.
	e6	Local authorities always carry out scheduled waste collection according to the regulations that have been made in this area.
	e7	Local authorities always clean the drains, drains, public toilets and road shoulders perfectly in this area.
	e8	Local authorities carry out greening (planting flowers) to cool the temperature in this area.
	e9	Local authorities always ensure that the landscape is maintained so that it looks neat in this area.
	e10	Local authorities impose compounds and fines on premises that do not manage solid waste properly in this area.
	e11	Local authorities impose compounds and fines on residents who dump garbage in public areas.
	e12	Heritage buildings are safe to use by the public in this area.
	e13	Road signs provided for the convenience of the public in the area.
	e14	Traffic lights work well for traffic convenience in this area.

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- e15 The disaster victim collection centre equipped with various facilities in the area.
  - e16 All accident risk areas are put up with signboards to warn the public in this area.
  - e17 Local authorities often conduct disaster drills for the public in this area.
  - e18 Authorities conduct regular inspections of heritage buildings to ensure the level of security in this area.
  - e19 The government recognizes this urban area as a heritage city.
  - e20 The government gazetted buildings and monuments as a national heritage to attract tourists to the area.
  - e21 The government always encourages conservation and preservation activities to be carried out in this area.
  - e22 The government has always provided financial assistance for the conservation and preservation process in this area.
  - e23 The government is constantly launching tourism campaigns to attract people to the area.
  - e24 The government has made the uniqueness of the cultural heritage a key asset for the promotion of tourism in the area.
  - e25 The government always holds annual festivals or activities in the city to attract tourists to the area.
  - e26 The government provides assistance and incentives to traditional business activities to drive the economy in the area.
  - e27 The government supports the movement of associations/NGOs that campaigns for the survival of heritage in this area.
  - e28 The government provides a comprehensive cultural centre in the area.
  - e29 The government provides a comprehensive heritage and tourism information centre in the area.
  - e30 The government has prepared a comprehensive cultural heritage preservation and conservation plan in the area.
  - e31 Care of the traditional premises of the heritage city is the responsibility of the local government.
  - e32 Care of the traditional premises of the heritage city is the responsibility of the owner of the premises.
  - e33 Many groups/clubs that campaign for cultural heritage for the future have been established in this area.
  - e34 Many groups/clubs that carry out preservation and conservation for future survival have been established in this area.
  - e35 Heritage groups/clubs often hold community activities to cultivate a love of history in this area.
  - e36 Heritage groups/clubs often conduct community-based programs for the preservation and conservation of heritage in this area.
  - e37 Heritage groups/clubs often hold cultural programs with the community to attract young people to this area.
  - e38 Heritage groups/clubs often run campaigns to attract tourists to this area.
  - e39 Heritage groups/clubs often hold seminars or cultural classes to teach young people in this area.
  - e40 Heritage groups/clubs often hold cultural performances to the community for entertainment in the area.
  - e41 The local community joins heritage groups/clubs to fight for the customs in the area.
  - e42 Young people join heritage groups/clubs to avoid the extinction of ancestral traditions in the area.
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### 3.4 Instrument Reliability

Table 3 shows the reliability of heritage urban sustainability constructs with Cronbach's alpha values for measuring the internal consistency level of the constructs. The Cronbach's alpha value is based on the reliability index analysis: 0.90-1.00 (very high), 0.70-0.89 (high), 0.30-0.69 (moderate), and 0.00-0.30 (low) (Babbie, 1992). Therefore, good reliability values are 0.70 and above (Mohamad et al., 2015). The analysis results showed that Cronbach's alpha value is between 0.70-0.95, within a range between high and very high. Therefore, the instrument used in this investigation demonstrates a high level of dependability (Babbie, 1992).

**Table 3:** Pilot Study Findings

Constructs	Items	$\alpha$ Coefficient value
Economic Prosperity	33	.878
Social Well-Being	31	.898
Environmental Well-Being	20	.745
Cultural Heritage	28	.914
Role of Government and Community	42	.974

### 3.5 Data Analysis Method

The data analysis method used was exploratory factor analysis (EFA). More specifically, the EFA procedure proposed by Hair et al. (2010) and Chua (2014) was used. Among the procedures are:

- (i) Correlation matrix values for items less than 0.5 dropped.
- (ii) Items that do not belong to any of the factors eliminated.
- (iii) Items that include more than one factor not accepted and dropped.
- (iv) Items with a loading factor value greater than or equal to 0.50 retained in their respective components.
- (v) The Keizer-Meyer-Olkin sample adequacy test must be 0.60 or more.
- (vi) At least three items must be available for each component.

## 4. Findings

The study's findings will touch on two main outcomes: the profile of respondents and the analysis of exploratory factors for each construct of the Malaysian heritage city sustainability index.

### 4.1 Respondents' Background

Table 4 shows 100 respondents living in the Kajang area. The analysis results found that 27 people were male and 73 people were female. 96 people were Malays and four were Chinese. 87 people were locals, born and raised in the city, and the remaining 13 were non-locals who came to live in the area for work, study, and other reasons.

**Table 4:** Respondents' Background

Respondent Background		Frequency	Percentage (%)
Gender	Male	27	27.0
	Female	73	73.0
Ethnicity	Malay	96	96.0
	Chinese	4	4.0
Population Status	Local Resident	87	87.0
	Non-Local Residents	13	13.0

### 4.2 Exploratory Factor Analysis Constructs of Economic Prosperity

The EFA results on the economic prosperity construct measuring tool explained the anti-image correlation analysis procedure, showing that the correlation coefficient value was more than 0.5. This meant that the factor analysis could continue. The Kaiser-Meyer-Olkin sampling adequacy measures and Bartlett's Test of Sphericity obtained showed a KMO value of 0.768. In contrast, Bartlett's Test of Sphericity was significant with a chi-squared value of 2326.386 at 528 degrees of freedom (**Table 5**).

**Table 5:** Suitability Test for the Use of Factor Analysis and Uniformity of KMO Items and Bartlett's Test on Economic Prosperity Constructs

<b>Kaiser-Meyer-Olkin</b>	<b>Measure of Sampling Adequacy</b>	<b>0.768</b>
Bartlett's Test of Sphericity	Approx. Chi-Square Sphericity	2326.386
	df	528
	Sig.	.000

The number of components to be separated in the factor analysis was set at three as categorised in the questionnaire. The component matrix with varimax rotation is shown in Table 6. The varimax rotation method was chosen because it can decrease complex variables and improve projected results. As a result, it found that the values of a7, a9, a19, a25, a26, a27, a28, a29, a30, a31, a32, and a33 belong to component 1, human mobility; a3, a6, a11, a12, a13, a14, a16, a18, a20, a21, and a22 belong to component 2, business and investment activities; and a1, a4, a10, a15, a17, and a24 belong to component 3, economic growth. Items that are not specified were dropped because they did not meet the set standards. The coefficients or loading factors for each item that tend to each cumulative factor are shown in Table 6. This number reflects the relationship between the item and the factors that have been formed. Therefore, it is important to know what type of factors have been formed.

**Table 6:** Component Matrix with Varimax Round Constructs Economic Prosperity

<b>Component</b>					
<b>Human Mobility</b>		<b>Business/Investment Activities</b>		<b>Economic Growth</b>	
Item	Factor loading	Item	Factor loading	Item	Factor loading
a7	.647	a3	.567	a1	.576
a9	.544	a6	.555	a4	.514
a19	.560	a11	.623	a10	.585
a25	.780	a12	.699	a15	.593
a26	.649	a13	.705	a17	.573
a27	.605	a14	.681	a24	.547
a28	.791	a16	.687		
a29	.668	a18	.503		
a30	.684	a20	.657		
a31	.683	a21	.693		
a32	.709	a22	.516		
a33	.702				

#### 4.3 Exploratory Factor Analysis of Social Well-Being Constructs

The anti-image correlation analysis technique was described through the EFA results on the social well-being measure, which showed that the correlation coefficient value was greater than 0.5, indicating that the factor analysis can continue. Furthermore, the Kaiser-Meyer-Olkin sampling adequacy measures and Bartlett's Test of Sphericity were conducted, with a KMO value of 0.741 and a chi-squared value of 2359.493 at 465 degrees of freedom, respectively (Table 7).

**Table 7:** Suitability Test for the Use of Factor Analysis and Uniformity of KMO Items and Bartlett's Test on Social Well-Being Constructs

<b>Kaiser-Meyer-Olkin</b>	<b>Measure of Sampling Adequacy</b>	<b>0.741</b>
Bartlett's Test of Sphericity	Approx. Chi-Square Sphericity	2359.493
	df	465
	Sig.	.000

The number of factors to be separated in the factor analysis was set at three in accordance with the questionnaire's categorisation. The component matrix with varimax rotation is shown in Table 8. As a result, it was found that the values of b1, b2, b3, b7, b11, b13, b20, b21, b26, and b29 belong to component 1, public facilities; b4, b5, b6, b8, b9, b12, b19, b21, b23, b24, b25, and b27 belong to component 2, communication and utilities; b10, b14, b16, b17, b18, and b31 belong to component 3, public safety and order. Items not specified were dropped from the questionnaire instrument. The values shown in Table 8 are the coefficients or loading factors for each item that tends to each accumulated factor.

**Table 8:** Component Matrix with Varimax Round Constructs of Social Well-Being

<b>Component</b>					
<b>Public Facilities</b>		<b>Utilities and Communication</b>		<b>Public Safety and Order</b>	
Item	Factor loading	Item	Factor loading	Item	Factor loading
b1	.747	b4	.541	b10	.531
b2	.614	b5	.791	b14	.644
b3	.663	b6	.708	b16	.764
b7	.667	b8	.723	b17	.842
b11	.704	b9	.647	b18	.844
b13	.755	b12	.634	b31	.610
b20	.550	b19	.554		
b22	.723	b21	.645		
b26	.783	b23	.556		
b29	.561	b24	.720		
		b25	.775		
		b27	.550		

#### 4.4 Exploratory Factor Analysis of Environmental Well-Being Constructs

The EFA results on the environmental well-being construct measuring instrument explained the anti-image correlation analysis procedure, showing the correlation coefficient value as more than 0.5, thereby indicating that the factor analysis could be continued. In addition, the Kaiser-Meyer-Olkin sampling adequacy measures and Bartlett's Test of Sphericity obtained showed a KMO value of 0.750, while Bartlett's Test of Sphericity was significant with a chi-squared value of 1038.175 at 190 degrees of freedom (Table 9).

**Table 9:** Suitability Test for the Use of Factor Analysis and Uniformity of KMO Items and Bartlett's Test on Environmental Well-Being Constructs

<b>Kaiser-Meyer-Olkin</b>	<b>Measure of Sampling Adequacy</b>	<b>0.750</b>
Bartlett's Test of Sphericity	Approx. Chi-Square Sphericity	1038.175
	df	190
	Sig.	.000

The number of components to be separated in the factor analysis was set at two in accordance with the questionnaire's categorisation. The component matrix with varimax rotation is shown in Table 10. Because it can decrease complex variables and improve predicted results, the varimax rotation method is used. As a result, it was found that the values of c3, c4, c5, c7, c8, c9, c10, c17, c18, and c20 belong to component 1, which is environmental health; c11, c12, c13, c15, c16, and c19 belong to component 2, land use. Unnamed items are items that do not meet the set standards and are dropped. The coefficients or loading factors that tend to each cumulative factor for each item are provided in Table 10.

**Table 10:** Component Matrix with Round Varimax Environmental Wellness Constructs

<b>Component</b>			
<b>Environmental Health</b>		<b>Land Use</b>	
Item	Factor loading	Item	Factor loading
c3	.692	c11	.749
c4	.510	c12	.803
c5	.856	c13	.732
c7	.560	c15	.643
c8	.600	c16	.510
c9	.691	c19	.719
c10	.569		
c17	.725		
c18	.847		
c20	.662		

#### *4.5 Exploratory Factor Analysis of Cultural Heritage Constructs*

The EFA results on the cultural heritage construct measuring instrument explain the anti-image correlation analysis procedure. The correlation coefficient value is more than 0.5, indicating that the factor analysis can be continued. The Kaiser-Meyer-Olkin sampling adequacy measures and Bartlett's Test of Sphericity obtained showed a KMO value of 0.834, while Bartlett's Test of Sphericity was significant with a chi-square value of 2576.052 at 378 degrees of freedom (Table 11).

**Table 11:** Suitability Test for the Use of Factor Analysis and Uniformity of KMO Items and Bartlett's Test on Cultural Heritage Constructs

<b>Kaiser-Meyer-Olkin</b>	<b>Measure of Sampling Adequacy</b>	<b>0.834</b>
Bartlett's Test of Sphericity	Approx. Chi-Square Sphericity	2576.052
	df	378
	Sig.	.000

Factor analysis was conducted by setting the number of factors to be separated at two as categorised in the questionnaire. Table 12 shows the component matrix with varimax rotation. As a result, it found that the values of d2, d3, d4, d5, d6, d7, d8, d9, d21, d22, d23, d24, d25, d26, d27, and d28 belong to component 1, tangible culture; d13, d14, d15, d16, d17, d18 and d20 belong to component 2, intangible cultures; the rest are dropped. The values shown in Table 12 are the coefficients or loading factors for each item that tends to each of the accumulated factors.

**Table 12:** Component Matrix with Varimax Rotation of Cultural Heritage Construct

<b>Component</b>			
<b>Tangible Culture</b>		<b>Intangible Culture</b>	
Item	Factor loading	Item	Factor loading
d2	.733	d13	.652
d3	.754	d14	.666
d4	.749	d15	.618
d5	.588	d16	.624
d6	.542	d17	.671
d7	.713	d18	.706
d8	.789	d20	.546
d9	.757		
d21	.685		
d22	.675		
d23	.784		
d24	.717		
d25	.605		
d26	.653		
d27	.749		
d28	.784		

#### 4.6 Exploratory Factor Analysis Constructs the Role of Government and Community

The EFA results on the government and community role construct measure explained the anti-image correlation analysis procedure, showing that the correlation coefficient value was more than 0.5, indicating that factor analysis could be continued. In addition, the Kaiser-Meyer-Olkin sampling adequacy measures and Bartlett's Test of Sphericity obtained showed a KMO value of 0.860, while Bartlett's Test of Sphericity was significant with a chi-square value of 4330.186 at 861 degrees of freedom (Table 13).

**Table 13:** Suitability Test for the Use of Factor Analysis and Uniformity of KMO Items and Bartlett's Test on Government and Community Role Constructs

<b>Kaiser-Meyer-Olkin</b>	<b>Measure of Sampling Adequacy</b>	<b>0.860</b>
Bartlett's Test of Sphericity	Approx. Chi-Square Sphericity	4330.186
	df	861
	Sig.	.000

Factor analysis was done by setting the number of factors to be separated at four as categorised in the questionnaire. Table 14 shows the component matrix with varimax rotation. As a result, it was found that the values of e4, e28, e33, e34, e35, e36, e37, e38, e39, e40, e41, and e42 belong to component 1, namely, community involvement; e2, e3, e5, e6, e7, e8, e9, e10, and e11 belong to component 2, environmental management; e18, e20, e21, e22, e23, e24, e25, e27, and e29 are in component 3, tourism and heritage management; e12, e13, e14, e19, e26, e31, and e32 are in group 4, risk management. The unspecified items are dropped for not complying with the set conditions. The values shown in Table 14 are the coefficients or loading factors for each item that tends to each of the accumulated factors.

**Table 14:** Component Matrix with Varimax Rotation Government and Community Role Constructs

<b>Component</b>							
<b>Community Involvement</b>		<b>Environmental Management</b>		<b>Tourism and Heritage Management</b>		<b>Risk Management</b>	
Item	Factor loading	Item	Factor loading	Item	Factor loading	Item	Factor loading
e4	.556	e2	.575	e18	.698	e12	.725
e28	.578	e3	.601	e20	.707	e13	.754
e33	.641	e5	.625	e21	.763	e14	.750
e34	.788	e6	.748	e22	.672	e19	.629
e35	.818	e7	.693	e23	.704	e26	.667
e36	.763	e8	.667	e24	.663	e31	.768
e37	.817	e9	.681	e25	.600	e32	.769
e38	.825	e10	.645	e27	.574		
e39	.722	e11	.631	e29	.564		
e40	.597						
e41	.771						
e42	.809						

## 5. Discussion

There are five main constructs in measuring the sustainability index of heritage cities in Malaysia that need to be adhered to. The questionnaire constructed and tested in the Kajang heritage city area consists of five constructs with 154 items. After the field test and EFA analysis were performed, only 134 items were accepted, and 20 items were dropped for not meeting the conditions and procedures proposed by Hair et al. (2010) and Chua, (2014). The KMO values obtained for each construct were above 0.6 and Bartlett's Test of Sphericity also showed significant values. This indicates that the findings of this exploratory factor

analysis meet the requirements of the set index value. Thus, a total of 134 items with five constructs can be used as instruments in the study of the construction of the heritage city sustainability index in Malaysia.

After the EFA analysis was performed, there was a change in the order of the items and the number of items in the instrument. For the economic prosperity construct, there are three components, or sub-constructs identified: (1) human mobility, (2) business and investment activities, and (3) economic growth. The social well-being construct also has three components: (1) public facilities, (2) communication and utilities, and (3) public safety and order. The environmental well-being construct has only two components: (1) environmental health and (2) land use. The cultural heritage construct also has two main components: (1) tangible culture and (2) intangible culture. Finally, for the role of government and community construct, there are four components: (1) community involvement, (2) environmental management, (3) tourism and heritage management, and (4) risk management.

The results of the EFA analysis show that the constructs suggested by Appendino (2017) and Brundtland (1987) – economic, social, environmental, cultural heritage, government, and community roles are suitable for use in the context of heritage cities in Malaysia. This finding is also a new perspective in Malaysia because the urban sustainability index measurement instrument used by Murninet 2.0 (Jabatan Perancangan Bandar dan Desa, 2019), does not involve cultural heritage constructs. However, the results of the EFA analysis indicate that cultural heritage constructs are appropriate and should be used as key constructs in the construction of the heritage urban sustainability index. Thus, it can be concluded that there are five constructs with 134 items that need to be used to construct Malaysia's heritage city sustainability index.

## 6. Conclusion

In conclusion, to identify the main constructs and components of each one of these in the heritage city sustainability index in Malaysia, EFA analysis was used. This is one of the essential methods in each initial study in the production of a research instrument. Results from the EFA indicate that centralised validity and discriminant validity can be achieved in this study. The findings show that there are five main constructs: economic prosperity, social well-being, environmental well-being, cultural heritage, and the role of government and community. The components of each construct or sub-constructs is 14, with 134 items adopted from the original 154 items. This means that as many as 20 items have been

discarded for not meeting the set procedures. Therefore, this EFA can be used as a new questionnaire instrument to be distributed to respondents for the actual study of heritage urban sustainability index measurement in Malaysia and can be used as a guide to researchers in the field of heritage urban sustainability development. However, in the future these indicators need to be further diversified, especially in the context of intangible cultural heritage so that its importance can be highlighted more deeply in the dynamics of heritage cities. For example, the role of traditional lifestyles, customs, taboos are aspects that shape the economic and social environment of an important heritage city. The uniqueness of the economic and social environment in the heritage city is the result of the composition of such elements that are not found in other areas. Therefore, future researchers can consider more indicators that are relevant and appropriate to intangible heritage in particular or cultural heritage in general in contributing to the development of sustainable heritage cities in line with the Agenda 2030.

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## Competing Interests

The authors declared that no competing interests exist.



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