



## Recreating heritage in Bareleng zone, Indonesia

Sylvia Prisca Delima<sup>a,\*</sup>, Paulus Wirutomo<sup>b,†</sup>, Setyo Sarwanto Moersidik<sup>c,†</sup>, Abimanyu Takdir Alamsyah<sup>d,†</sup>

<sup>a</sup> School of Environmental Science, Universitas Indonesia, Jalan Salemba Raya 4, Jakarta 10430, Indonesia

<sup>b</sup> Department of Sociology, Faculty of Political and Social Sciences, Universitas Indonesia, Depok, Jawa Barat 16424, Indonesia

<sup>c</sup> Environmental Engineering Study Program, Department of Civil Engineering, Faculty of Engineering, Universitas Indonesia, Depok, Jawa Barat 16424, Indonesia

<sup>d</sup> Department of Architecture, Faculty of Engineering, Universitas Indonesia, Depok, Jawa Barat 16424, Indonesia

### Article Info

#### Article history:

Received 13 May 2019

Revised 29 November 2019

Accepted 4 December 2019

Available online 22 February 2021

#### Keywords:

developing open library,  
development model archives,  
heritage development,  
infrastructures as modern heritage,  
sustainable development

### Abstract

Bareleng zone, Indonesia, has been intended as a showcase of the physical and social development process as well as a modern heritage and archive site. This article employs a case study method to seek whether it has achieved its social function as a modern heritage site. The findings show that infrastructure development is considered as an effort to build future heritage where cultural transformation has deliberately taken the material culture into account; the preservation of socially perceived images and their creative use may lead to heritage creation, and it may give a boost towards a sense of national pride; it provides alternative sources of education materials and sustainable development archives. However, dynamic characteristics of ongoing progress, visual products, and their narratives attached to infrastructure as public spaces have not yet acted as archive sites that preserve knowledge and lessons learned that could be used for educational tools that benefit sustainable development.

© 2021 Kasetsart University.

### Introduction

Bareleng is a term that refers to a connection zone of Batam, Rempang, and Galang Islands located in the City of Batam, Riau Islands Province, Indonesia. These three islands are connected by a series of bridges that form the Trans-Bareleng road network (as shown by the line connecting islands in Figure 1). The development of the Bareleng zone has led to the social and cultural transformation in the area – a proof that we cannot separate the physical form and social form, or as Logan, Kockel, and Craith (2016) indicated, it should also cover “a significant portion of a mental contract

\* Corresponding author.

E-mail address: [prisca.d@gmail.com](mailto:prisca.d@gmail.com) (S. P. Delima).

† Co-first author.

E-mail address: [paulus\\_sosiologi@yahoo.com](mailto:paulus_sosiologi@yahoo.com) (P. Wirutomo).

E-mail address: [ssarwanto@eng.ui.ac.id](mailto:ssarwanto@eng.ui.ac.id) (S. S. Moersidik).

E-mail address: [abimanyu.takdir@gmail.com](mailto:abimanyu.takdir@gmail.com) (A. T. Alamsyah).

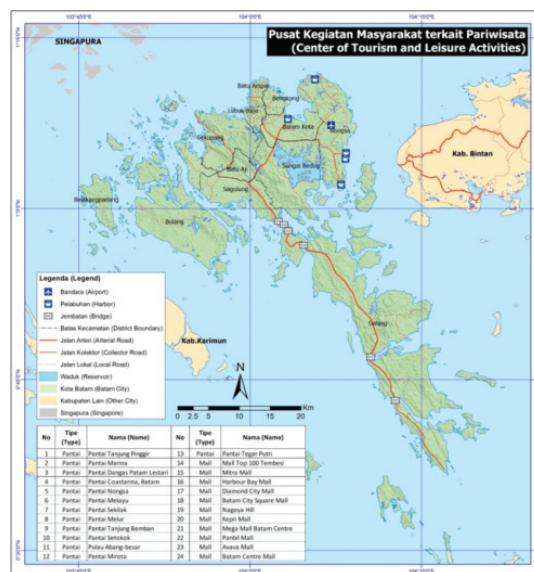


Figure 1 Centre of Tourism and Leisure Activities

*that attributes “significance” to certain places, artefacts and forms of behaviour from the past through processes that are essentially political, as a cultural practice and a form of cultural politics.”*

The Bareleng zone (Batam Indonesia Free Zone Authority [BIFZA], 2014) is the most developed land area in the region, despite the up-and-down development processes, as this area has been chosen as a pilot project for island development, as well as to act as a showcase of modern Indonesia. Building the island infrastructure from the very beginning on an almost empty island highlighted the nation's capability. In addition to that, the Bareleng area as Special Economic Zone or Free Trade Zone based on its location in the border area will create a chance to directly compete with other cities in nearby countries such as Singapore and Johor in Malaysia (Centre for Strategic and International Studies [CSIS], 2003). For that purpose, connectivity between Bareleng islands that provides a fast and reliable means to support transportation and movement of people and goods should be assured (BIFZA, 2014). In that spirit, a total of six Bareleng bridges (see Figure 1) that connect Batam, Tonton, Nipah, Setoko, Rempang, Galang and Galang Baru Islands have been realized, as well as an international airport and seaports for national and international logistics and transportation needs.

This article is based on an environmental science point of view (see Figure 2). It attempts to impart the importance of the physical environment in terms of modern infrastructures as visual products of development in the Bareleng zone and their roles within the social environment to create cultural transformation with visual narratives and images that the society wants to preserve. Their combination will create a built environment in the form of modern heritage and archive sites that function as an open library and archive display, national pride, and alternative sources of education materials and sustainable development archives.

## Literature Review

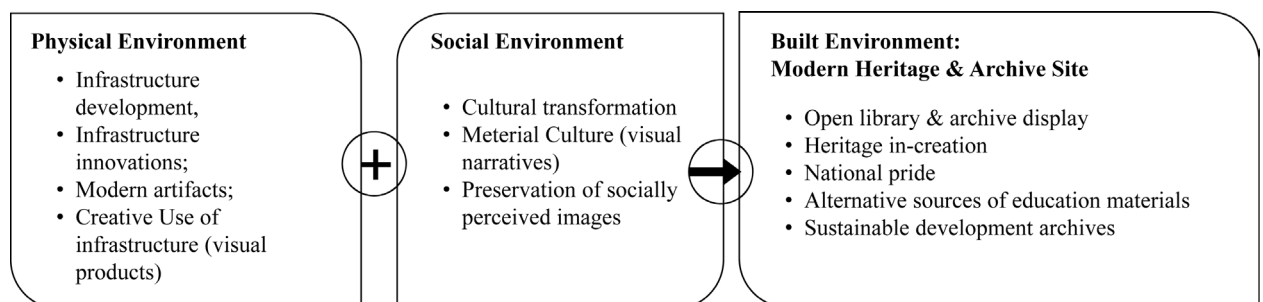
Creating heritage needs a physical form or a tangible form of the infrastructure that is inseparable from its social aspects or the human connectivity with the heritage in question. These two forms will create a fully functioning infrastructure. After a certain amount of time, the values created will end up as heritage.

Heritage is a broad field. This article is based on a description within the manifesto of the Association of Critical Heritage Studies (2012). It says that heritage is, as much as anything, a political act, and we must ask serious questions about the power relations that heritage has often been invoked to sustain, as well as on how heritage is used, defined, and managed. In reference to human connectivity and heritage, Riegl (1996) mentioned the modern cult of monuments that primarily served the specific purpose of keeping particular human deeds and destinies alive and present in future generations' consciousness. Logan et al., (2016) added that modern heritage enables monuments to act not primarily as a public commemoration in which the community exhibits a shared concern, but as having outstanding historical or artistic significance and values worthy of being handed down as an essential responsibility of the community. The idea of a living library is to provide the city's diverse community the opportunity to talk to others and learn from them. Places that act as living libraries may promote and lead to improved communication and understanding within the community (Kinsley, 2009), especially regarding their hopes.

Physical infrastructure has taken center stage as a country's icon of international competitiveness and national welfare. However, in urban areas, infrastructure becomes an essential part of the urban environment as they provide the framework for public life (Cilliers & Timmermans, 2016) and creates a new meaning (Giaccardi & Palen, 2008; see also Brod & Mazzarino, 2015). The significance of conserving heritage is due to this act reflecting and building local community identities, promoting sustainability and providing a sense of place (Halim & Ishak, 2017) and to ensure democratic access to information (Thompson, 2008) by providing access to information and a meeting place (Aabø & Audunson, 2012).

## Methodology

This article is based on a scoping study and a field study in the Bareleng zone. In the field study, data are gathered from 116 in-depth interviews of legal age, employed, and having at least high school educated city residents ranging from public to private sectors and having resided in the area for more than five years. These informants are representatives of twelve districts in the area. The number has been calculated proportionally based on the number of residents recognized or pinpointed by



**Figure 2** Conceptual Framework

the area's community. Twenty persons are government officials from various offices that deal with the development that has been assigned in the Bareleng zone for at least five years. In addition to that, we also observed the public hotspots in the Bareleng zone that can serve as modern heritage, library, human connectivity, infrastructure, and public space. Methodically, this paper is a case study of the Bareleng zone that attempts to make positivist assumptions (Yin, 2013) on public use of the Bareleng zone and social construction of reality over the area. The study was conducted at select points of interest in the Bareleng zone during short unscheduled visits to collect opinions on the Bareleng zone and its normative, economic, and cultural characteristics based on sociology and environmental science, particularly in memory (Riegl, 1996), community (Logan, Kockel, & Craith, 2016), public history (Salim & Negara, 2018), tourism (Blazeska, Strezovski, & Klimoska, 2018) and planning and development (Giaccardi & Palen, 2008).

## Results and Discussions

It is difficult to distinctively separate physical and social aspects. They were combined under the first part, i.e., Bareleng Zone and its product of development as the heritage, and continued on the built environment part, i.e., creating a heritage for sustainable development.

### *Bareleng Zone and Its Products of Development as the Heritage*

The Bareleng zone has changed substantially over time, from an almost deserted island in the 1970s to become a modern metropolis. It is fully equipped with high-technologies-based infrastructures that supply necessities and industrial needs, such as the Duriangkang estuary dam, whose desalination process has become the water sector's pride.

All informants agree that the Bareleng zone is intended to be an industrial area, but somehow economic developments have been pursued, disregarding the limitations of the island's natural environment and vision of the city. As a former government official harshly commented, "there is a lack to nurture the development vision or "follow the notion of forgetting to remember, or remembering to forget" (similar to Harrison, 2013). "It seems that the central government policymakers tend to disregard the history on the purpose of building this zone, and the local policymakers did nothing to counter that," as a lecturer of the local college commented on the current development vision. All of the informants seem to have a big question on the development targets and achievements and want their voice to be heard as well as have more engagement in the development process. An environmental activist said, "By recreating the values of modern heritage and treated products of development as artifacts, we try to regain their power to be involved and to voice our views on our city."

Development is an effort to build a modern heritage with ongoing creation and re-creation of meaning. While Harrison (2013) stated that "the cultural heritage of observations is an individual and collective memory, what a community chooses

to 'remember' depends on the accepted values that become sustained", the condition in the Bareleng zone shows that some of the sustained products of development may be treated as artifacts for their ongoing acceptable meanings. Such artifacts bear time marks of historical moments, generate an intellectual ecology, and can be regarded as an archival library for the sake of sustainable development. In the Bareleng zone, these development products are in the form of aqueducts, water reservoirs, memorial parks, refugees' barracks, and especially the bridges as the local icon.

This research's findings go along with Harrison (2013), who stated that heritage must be maintained and neither deaccessioned nor disposed of if heritage remains sustainable and upholds its claims to relevance in contemporary global societies. Our informants are very proud of the blend of technological-based development to tackle the environment limitation, especially the success of desalination in water management and toxic waste management, and frown on the old Malay kampongs' existence in the heritage list. The findings show that the residents of the Bareleng zone prefer to list the products of the modern development in the list of heritage, based on the fact that the ancient Malay Kingdom had never paid interest in these barren islands. The image of a modern bustling metropolis is within the collective of memory, as well as diversity and multicultural notions of the modern international port city. Notably, such conditions have been distinctly linked locally and perceived as local pride and identity, and according to 84 percent of informants, it is the uniqueness of the area that should be preserved and well-maintained as intangible heritage.

The tangible heritage, such as buildings, historical places, monuments, and artifacts, are considered worthy of preservation for the future, and these include objects significant to the archaeology, architecture, science, or technology of a specific culture. In addition to that, Radosavljević & Čulafić (2019) stressed the urban heritage integration in the local, sustainable development processes and place-branding strategies. It shows a greater appreciation of the spirit of the place and its intangible components, but it also serves to adapt it to local contexts with more participatory forms of heritage planning and educational purposes. The Bareleng zone, highlighted by its monumental bridges, provides a collection of development archives specific to various types of bridges (BIFZA, 2014). Photographs and manuscripts of development planning in the Bareleng zone can be observed in Public Works literature; however, the informants mention short social engagement regarding sustaining the bridges as public spaces. The suggestions that came out of the research are there should be a compilation of these data into well-managed archives that can be accessed by the public, not only for educational and learning purposes to create public awareness but also to keep the idea of having a development showcase on displays.

Tangible heritage may serve as a tool to increase a sense of national pride and a product of the social construction of a society that preserves its heritage for various reasons (Edson, 2004). Heritage is also notable as an image of human connection and human decency; therefore, tangible heritage increases sustainable development and provides an archive

library as tangible proof of development that may demonstrate best practices and lessons learned from public and private partnership (Espelt, 2015) and social engagement (Jones, 2016). The scenic Bareleng Bridges have proved themselves as national pride, along with the Duriangkang estuary dam, that is known as the biggest of its kind in the Southeast Asia region. However, limited information on these tangible heritages available to the public at the spots is the informants' concern. Even though The Bareleng Information Center has been slowly transformed into a tourist destination setting where discussions and everyday chat-regarding development can occur, providing a fine setting to nurture the collective memory, available information is not adequate. A local community leader reminds us that the function of these sites is as "meeting places where collections of archives and data of development should be available for public viewing, so the development process may not be forgotten." A youth representative also mentioned that "maintaining the modern heritage effort does not only increase national pride for the youth community but also boosts the creativity and spirit to create many kinds of products in the creative industry sector."

The informants mentioned that creating a recognizable modern Indonesian heritage is necessary to benefit the future generation. Generally, they believe that tangible heritage may increase a sense of national pride, national belonging, and local resilience. Therefore, handing down the values of development to the next generation in material form is essential. Nowadays, the recreating values can be seen in the Vietnam Village in Galang Island, where a Vietnamese Refugee Camp was built for the Vietnamese Boat People who escaped the Vietnam War (Sutrisno, 2010). Galang Island represents nostalgia (Tannock, 1995) on the war era in Vietnam, hope for a better future, and how humanitarian assistance should be managed. An appropriate representation of the past and present in the Vietnam Village should fulfill the current needs of well-being (Strangleman, 1999) and beyond.

#### *Creating Heritage for Sustainable Development*

In the Vietnam Village case in Galang Island, cultural heritage as a fundamental human right may pose difficult ethical issues. The Vietnam War and times of civil unrest led to large-scale displacement of people, and Galang Island has become a tangible heritage where artifacts and historical monuments and sites are preserved, revalidated, adapted, and repossessed through place-making (Giaccardi & Palen, 2008; Logan et al., 2016). The local people try to recreate the heritage site, not as a war memorial but as a universal peace pilgrimage site. The informants also want to raise awareness of the local crisis center's absence after the Vietnam Village has been abandoned by recreating it. In their opinion, the local crisis center is vital to give services to the residents during crises such as natural disasters or human-made disasters. The informants stated their disappointment with a frustrating question of whether there should be a crisis or disaster before the crisis center is revitalized.

Heritage is supposed to provide not only the essential relation between nostalgia and authenticity (Brembeck &

Sörum, 2017), but also symbolic national landscapes have become distinctive home places (Graham, Ashworth, & Tunbridge, 2016). The national landscape such as the Tengku Fisabilillah Bridge does not represent specific ethnicity but shows off the progress of modern eras as products of the cultural diversity of the society members who come from many other areas in Indonesia and overseas; thus, such diversity provides a sense of liberation from tradition by emerging modernity and interconnection. The bridges have also become a 'hegemonic landscape' or an image of the ideal place that has become a heartland of collective cultural consciousness (Johnson, 1993). With the transformation and adoption of new technology and social adaptation, the Bareleng zone has provided plenty of analytical thinking spaces that benefit others' development planning. Besides, the transformation of the Bareleng zone into tourism centers and recreational destinations provides continuity of development that the Bareleng society happily assented to.

Although the local authorities have understood the heritage values of the bridges and other island-related infrastructure development, and there is a trend towards inclusive decision-making, the Bareleng zone's recognition as modern Indonesian heritage has been sluggish. It is not inclusive, but it also happens in other places as well (Kryder-Reid, 2018). Creating modern heritage involves a more holistic view of the environment with a balanced approach to the new human intervention (Logan et al., 2016), and these efforts must be acknowledged with social engagement. This social engagement may be ascribed with additional purposes beyond the original *raison d'être*, to the extent that the engagement has become an integral part of the 'memory industry' (Smith, 2006). By connecting past and present, such sites also serve political functions (Logan et al., 2016). In the case of Bareleng, these sites serve as a modern Indonesian showcase. Based on our observation, we can see that suitable technology transfer and local capacity building will benefit society as tourism infrastructure and excellent tourism service performance.

Many development products can be treated as artifacts with a specific time indicating important events in history (Zukin, 2012). The findings show that any social and physical developments that left their marks should be recorded with time-series data for public awareness of development achievement dynamics. Our Information Technology sector informant argued that such data "will mark the beginning of a living library establishment and is a means to build modern Indonesian heritage in tangible and intangible form, the ups and downs of the community and the nation's struggles that one day will promote national pride, provide learning and education tools." It also implies, as a teacher mentioned, "The use of a living library for the sake of sustainable development reduced the possibility of mistakes that might have been costly or unsuitable for the local condition." Specifically, it refers to social development in terms of social and cultural transformation based on infrastructure and land development.

Modern heritage also demonstrates social dynamics and people's resilience in dynamic conditions. In front of the BIFZA building, the banyan trees show this kind of relationship



dynamics with the neighboring countries. On 29 November 1987, the former President of Indonesia Soeharto planted the banyan tree at the roundabout in front of the BIFZA building, with his colleague, the former Prime Minister of Singapore, Lee Kwan Yew. Banyan tree is a symbol of aegis, while the tree planting was a symbol of friendship. In 1991, the former Prime Minister of Malaysia, Mahathir Mohammad, also planted a banyan tree at the same location to represent the same symbols (Sutrisno, 2010). This occasion with the trees as living proof marked the era of friendship and cooperation between Batam, Singapore, and Malaysia. It was an accomplishment that may not have been imagined during the friction between Indonesia and Malaysia in the 1950s.

In this case, the past and heritage should not be viewed as static and bygone but connected to the present. As suggested by Harrison (2013), “the sustainability of cultural heritage means broadening the field to encompass a range of other social, political, economic and environmental concerns and the connections between them.” However, Halim and Ishak (2017) argued that only by engaging with the local community in heritage conservation, collaborative works with other stakeholders would become crucial, and these sites can fulfill their potential to transform values, practices, and overall behavior towards sustainability. Batam’s development is incomplete (Roeroe, 2013) without the sustainability of development and social engagement. Although the Bareleng zone’s existence in the vicinity of the border area is critical, establishing a well-managed and well-maintained site actively contributed to preserving the culture and sovereignty (Harto & Siam, 2012). Most importantly, this area and its artifacts have contributed to thoughts about better future development and lessons learned (Aritenang & Ardiantono, 2016) that benefit sustainable development. The physical environment and social engagement of the Bareleng zone as an action system will continuously complement each other; however, the specific zone with law enforcement should be established to support modern heritage development.

## Conclusion and Recommendation

Recreation of the Bareleng zone as modern heritage creates a visual image of modern-day Indonesia based on innovation and social-cultural transformation. It may strengthen the common ownership towards the Bareleng zone and increase a sense of national pride. The narratives attached to the products of development as tangible heritage may provide alternative sources of education materials and sustainable development archives that can benefit locally, nationally and globally. In a way, such widely available narratives will then improve the welfare and well-being of the people. In this case, the continual progress of the Bareleng zone will create symbols and material cultures that provide meaning and allow the re-creation of meanings that can be gathered in a collective memory of the local society by, preserving images of friendship, perseverance, humanity, and the spirit of sustainable development.

The democratization of Bareleng heritage that consciously rejects elite cultural narratives and embraces the people’s

heritage insights in terms of their communities and cultures is still in progress. Valuable knowledge and a memory collective have been created based on the products of development in the Bareleng zone, but they have not yet fully acted as archive sites that preserve knowledge and lessons learned. In creating the Bareleng zone as a heritage, it is recommended to utilize the invaluable tangible and intangible heritage as the showcase of the nation’s friendship and connectivity images, the dynamics of the area and its society, and progressing its function as a whole as library archives to provide educational materials for the benefit of sustainable development.

## Conflict of Interest

There is no conflict of interest.

## References

- Aabo, S., & Audunson, R. (2012). Use of library space and the library as place. *Library & Information Science Research*, 34, 138–149. doi: 10.1016/j.lisr.2011.06.002
- Aritenang, W., & Ardiantono, P. (2016). *Towards a magnificent Batam*. Jakarta, Indonesia: Khanata. [In Indonesian]
- Association of Critical Heritage Studies. (2012). *Critical heritage studies*. Retrieved from <http://www.criticalheritagestudies.org/history/>
- Batam Indonesia Free Zone Authority (BIFZA). (2014). *Revealing the facts of Batam’s development: B. J. Habibie Era*. Batam, Indonesia: Badan Pengusahaan Batam. [In Indonesian]
- Blazenska, D., Strezovski, Z., & Klimoska, A. M. (2018). The influence of tourist infrastructure on the tourist satisfaction in Ohrid. *UTMS Journal of Economics*, 9(1), 85–93.
- Brembeck, H., & Sörum, N. (2017). Assembling nostalgia: Devices for affective capitulation on the re:heritage market. *International Journal of Heritage Studies*, 23(6), 556–574. doi: 10.1080/13527258.2017.1300928
- Brod, R. D. A., & Mazzarino, J. M. (2015). Whatever stays, flows or talks: Identity places within the urban environment. *Ambiente & Sociedade*, 18(4), 55–74.
- Centre for Strategic and International Studies (CSIS). (2003). *Batam as the spearhead*. Jakarta, Indonesia: Centre for Strategic and International Studies. [In Indonesian]
- Cilliers, E. J., & Timmermans, W. (2016). Transforming spaces into lively public open places: Case studies of practical interventions. *Journal of Urban Design*, 21(6), 836–849. doi: 10.1080/13574809.2016.1234336
- Edson, G. (2004). Heritage: Pride or passion, product or service? *International Journal of Heritage Studies*, 10(4), 333–348. doi: 10.1080/1352725042000257366
- Espelt, R. (2015). *Lessons learned and best practices in public-private partnership projects*. Washington, DC: Public-Private-Partnership Legal Resource Center: Multilateral Investment Fund (MIF) of the Inter-American Development Bank.
- Giaccardi, E., & Palen, L. (2008). The social production of heritage through cross-media interaction: Making place for place-making. *International Journal of Heritage Studies*, 14(3), 281–297. doi: 10.1080/13527250801953827
- Graham, B., Ashworth, G. J., & Tunbridge, J. E. (2016). *A geography of heritage: Power, culture and economy*. New York, NY: Routledge.
- Halim, S. A., & Ishak, N. A. (2017). Examining community engagement in heritage conservation through geopark experiences from the Asia Pacific region. *Kajian Malaysia*, 35, 11–38. doi: 10.21315/KM2017.35.SUPP.1.2
- Harrison, R. (2013). Forgetting to remember, remembering to forget: Late modern heritage practices, sustainability and the ‘crisis’ of accumulation of the past. *International Journal of Heritage Studies*, 19(3), 579–595. doi: 10.1080/13527258.2012.678371
- Harto, Z. & Siam, N. U. (2012). *Batam: Eksistensi Kawasan Perbatasan [Batam: The existence of the border region]*. Tanjungpinang, Indonesia: The Ministry of Culture and Tourism, The Office of Historical and Traditional Values Preservation. [In Indonesian]

- Kinsley, L. (2009). Lismore's living library: Connecting communities through conversation. *Australasian Public Libraries and Information Services*, 22, 20–25.
- Kryder-Reid, E. (2018). Introduction: Tools for a critical heritage. *International Journal of Heritage Studies*, 24(7), 691–693. doi: 10.1080/13527258.2017.1413680
- Johnson, N. C. (1993). Building a nation: An examination of the Irish Gaeltacht commission report of 1926. *Journal of Historical Geography*, 19(2), 157–168. doi: 10.1006/jhge.1993.1011
- Jones, M. (2016). Archives alive: Expanding engagement with public library archives and special collections. *Archives and Manuscripts*, 44(1), 49–50. doi: 10.1080/01576895.2016.1135714
- Logan, W., Kockel, U., & Craith, M. N. (Eds.). (2016). *A companion to heritage studies*. West Sussex, UK: John Wiley & Sons, Inc.
- Radosavljević, U., & Čulafić, I. K. (2019). Use of cultural heritage for place branding in educational projects: The case of smederevo and golubac fortresses on the danube. *Sustainability*, 11(19), 5234. doi:10.3390/su11195234
- Riegl, A. (1996). The modern cult of monuments: Its essence and development. In N. Price, K. Talley, A. Vaccaro (Eds.), *Historical and philosophical issues in the conservation of cultural heritage* (pp. 69–93). Malibu, CA: Getty Publications.
- Roeroe, F. (Ed.). (2013). *Batam: A Half-hearted commitment*. Jakarta, Indonesia: Aksara Karuna. [In Indonesian]
- Salim, W., & Negara, S. D. (2018). Infrastructure development under the Jokowi administration. *Journal of Southeast Asian Economies*, 35(3), 386–401. Retrieved from <https://www.jstor.org/stable/26545320>
- Smith, L. (2006). *Uses of heritage*. Oxon, UK: Routledge.
- Strangleman, T. (1999). The nostalgia of organisations and the organisation of nostalgia: Past and present in the contemporary railway industry. *Sociology*, 33(4), 725–746. doi: 10.1177/S0038038599000462
- Sutrisno, E. (2010). *Batam—Past and Present*. Batam, Indonesia: Batam Link Publisher. [In Indonesian]
- Tannock, S. (1995). Nostalgia critique. *Cultural Studies*, 9(3), 453–464. doi: 10.1080/09502389500490511
- Thompson, K. M. (2008). The US information infrastructure and libraries: A case study in democracy. *Library Review*, 57(2), 96–106. doi: 10.1108/00242530810853982
- Yin, R. K. (2013). *Case study research: Design and methods*. Thousand Oaks, CA: SAGE Publications.
- Zukin, S. (2012). The social production of urban cultural heritage: Identity and ecosystem on an Amsterdam shopping street. *City, Culture and Society*, 3(4), 281–291. doi: 10.1016/j.ccs.2012.10.002