




DATA LANDSCAPE AS THE REPRESENTATION OF NIGHTTIME URBAN DYNAMICS

 Ruth Kartika Purnasasmita,  Yandi Andri Yatmo*,
 Paramita Atmodiwirjo

Department of Architecture, Faculty of Engineering, Universitas Indonesia, Depok, Indonesia

Abstract. This paper explores the data landscape as the representation of the network of entities that construct the nighttime urban environment. The utilization of data landscape is understood as the collective reading of nighttime place dynamics which could unfold the complex narratives of urban context. It reveals two main elements involved in the emergence of the nighttime environment: what constructs urban nighttime and how it is captured. The mapping of data from social media was conducted using Instagram posts that contain the hashtag #pasarmalam, which indicates the representation of the night market as an element of the urban nighttime environment in the context of Indonesian cities. Analysis was conducted by identifying the network of relations that emerged from the hashtags. The findings from the study indicate the emergence of data landscape as the network of entities related to elements of events, food, entertainment and experience that construct nighttime urban places. It also reveals how nighttime is represented through various methods, tools and techniques for capturing nighttime. The study suggests the critical role of data landscape in understanding the construction of nighttime urban environment as the basis of data-driven urban placemaking that can capture the dynamics and complexities of nighttime urban elements.

Keywords: *Nighttime, urban, night market, data landscape, elements, representation.*

***Corresponding Author:** *Yandi Andri Yatmo, Department of Architecture, Faculty of Engineering, Universitas Indonesia, Depok, Indonesia, Tel.: +62217863512, e-mail: yandiay@eng.ui.ac.id*

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1. Introduction

1.1. *Nighttime Urban in Enhancing the City's Dynamic*

Discussion on nighttime urban architecture has emerged along with the idea of a 24-hour city as an approach to establish a dynamic urban environment at night time. The concept of a 24-hour city was established for purposes related to the evening economy, city image and safer city experience at night time (Heath, 1998). Urban places are constructed by various social and spatial qualities (Haas & Mehaffy, 2019), which may vary at different times and contexts. The construction of urban places at night might be unique compared to daytime urban places, which often become the subject of inquiry in urban design studies. It offers the perceptual experience, place meaning and spatial practices that differ from what usually occurs during daytime (van Liempt *et al.*, 2014; Yatmo, 2009). This concept suggests the importance of promoting

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dynamic urban life at night, creating an evening experience that generates livability in the city (Hadfield, 2015; Yeo & Heng, 2014).

Ensuring sociability, accessibility and community-building during the nighttime is necessary to improve city life at night. Kramer and Whittman (2022) see nightlife as a “counterspace” that could generate social encounters and foster social well-being (p. 1). Local culture plays an important role in building such a liveability experience in the nighttime environment, for example, through the local events and cultural activities in the city (Lee *et al.*, 2018; Johansson & Kociatkiewicz, 2011), which allows for interactions between groups of people (Rowe & Bavinton, 2011). It transforms the city outside the everyday realm into an “experiencescape” that redefines and reconfigures the city (Johansson & Kociatkiewicz, 2011). In promoting the nighttime dynamics, it is important that such elements and activities are considered not as separate entities, but integrated with the context, celebrating the richness of the city's locality and nightlife culture.

However, there has been a shift in nighttime cities, where “consumption-based leisure activity is increasingly clustered” and social dining has become the most popular activity (Rowe & Bavinton, 2011). Both the residents and tourists look for the ‘uniqueness’ in the nighttime environment. From the tourists’ perspective, the uniqueness of the city can be seen through the atmospheric streetscapes, bringing forth the authenticity of the local culture in the city (Li *et al.*, 2021). Meanwhile, from the residents’ perspective, they prefer to have a safe and convenient nighttime environment (Lee *et al.*, 2008). The night market offers such a dynamic experience of the nighttime environment. It stimulates nostalgia for both the tourists and residents, in which they can revisit their prior experiences regarding the night market entities (Li *et al.*, 2021). It also acts as a public space that transgresses the city’s urbanized landscapes (Tan & Chan, 2021). Therefore, the inquiry towards the elements of the night market is necessary as it can unfold the city's cultural aspects.

1.2. Multiple Elements in the Nighttime Urban

Various studies have highlighted several prominent elements when discussing urban nighttime. For example, lighting becomes one of the critical elements required for nighttime urban activities to provide safety (Ferreira & Paraiza, 2022; van Rijswijk & Haans, 2018) and to provide a night city image (Shi & Chung, 2021). Nighttime urban places are also associated with the presence of elements that are part of the nighttime economy, such as commercial and entertainment activities (Roberts & Turner, 2005), nighttime festivals (Foster, 2022), nighttime food street and street vendors (Yatmo, 2009) or other elements related to night urban culture. Beyond those elements of the nighttime economy, nighttime places are also constructed by the affective atmosphere representing the specific spatial practices occurring at nighttime (Shaw, 2014). These elements might be considered as aspects that construct nighttime urban experiences.

This study explores how data landscape reveals the multiplicity of urban narratives. Driven by the emergence of inter-relational networks and clusters, the utilization of data allows for such urban complexities to be mapped and traced collectively, bringing closer relations between people, the urban environment and cultures (Artopoulos & Costa, 2019). Studies have attempted to map the construction of urban places as a dynamic network of actors, space, time and experiences. The mapping of urban experiences by urban actors indicates the continuity of experiences happening

in the network of urban places (Atmodiwirjo *et al.*, 2019). Cities are also emerging as layers of elements that are interconnected to one another (Kempf, 2009). Various urban places, including mundane places, could be mapped as a network of elements that define the character of the places (Johanes *et al.*, 2017). Through reading such collective information and engagements of the urban environment, this study unfolds some possible networks of the urban environment which address the unique and dynamic entities of the urban, particularly the nighttime.

The nighttime elements play an important role in constructing the nighttime dynamics of the urban environment; however, this paper argues that the nighttime urban environment is not constructed by those elements as separate entities. Urban places always emerge as complex systems involving various entities (Haas & Mehaffy, 2019). Nevertheless, compared to various attempts to understand urban places as a dynamic network of entities, the emergence of a dynamic network that constructs urban nighttime is less explored. This study intends to explore the emergence of urban nighttime through inquiry into the nighttime landscape generated by social media data. The inquiry into the nighttime data landscape becomes an attempt to reveal the dynamic relationship between elements of urban nighttime.

2. Data Landscape in Revealing Nighttime Urban

This study focuses on data-driven mapping in capturing and representing the urban condition. Previous studies have attempted to represent urban characters collectively through data mapping. People could co-create and co-manage large collections of data to facilitate users, giving easier access to interpret and manage public spaces (Artopoulos & Costa, 2019). Data mapping can reveal various urban patterns and entities, including hierarchy, land use, population distribution and public transportation network (Tunçer, 2020). Furthermore, data-driven mapping could reveal urban phenomena in a more intimate everyday neighborhood through an attempt to capture and map everyday and meaningful urban activities (Atmodiwirjo *et al.*, 2019). The inhabitants play a role as the main performers in a particular context, allowing mapping for both temporary and permanent events. The mapping process reveals an urban environment's hidden potentials that offer various possibilities (Corner, 1999). It uncovers some strategies and spatiality from the richness of the networks (Paramita *et al.*, 2021). This paper argues that the data-driven mapping process could expand the possibilities for revealing the complexities of urban places and experiences.

The utilization of data has the potential to unfold urban narratives and their complexities. It does not simply record events and uncertain contexts (Kim, 2020) but also reveals operations and techniques for further retelling. The operations may include moving and crossing time, playing with multi-time data (Tunçer, 2020), looking at particular and general elements (Atmodiwirjo *et al.*, 2019) or utilizing geographical information. It captures the information of particular contexts from multiple perspectives, demonstrating multi-level narratives (Atmodiwirjo *et al.*, 2019). To reveal such narratives, photography, alongside social media texts, could become a data source to depict personal experiences and awareness towards certain places (Kaur *et al.*, 2022; Qian, 2022). Various settings and photography techniques are utilized for more “tellable and legible” (Kaur *et al.*, 2022) information and meanings. Understanding broader forms of representation in urban conditions, particularly in urban nighttime becomes necessary to reveal the hidden narratives.

Nighttime is often understood as an ambiguous context (Kim, 2020) that needs further control and management. The common problems related to nighttime in urban areas are mainly related to transportation (Plyushteva, 2019), safety (Chew, 2009) and the spatio-temporal concentrations and segmentations due to the closing hours (Rowe & Bavinton, 2011; Tiesdell & Slater, 2006). However, the understanding of nighttime should be seen beyond the formal way, which does not only relate to accessibility and daytime activities. The nighttime contains informal and spontaneous events that make the city livable (Yeo & Heng, 2014) through various forms of cultural exchange (Hadfield, 2015). These show how nighttime is constructed of multiple temporal events and elements, which lie within social, political, economic and spatial aspects. It is through the data that the urban nighttime reveals such a multiplicity of elements within the landscape. However, there is a lack of research that attempts to reveal the urban nighttime phenomenon based on data mapping.

This study focuses on revealing the nighttime data landscape by utilizing social media, particularly Instagram, as a data source. Instagram is a visual media platform which presents the richness of data through images and texts based on the algorithms. The algorithm shapes certain behaviors that influence the users to engage with other users and the content immediately. Instagram captures and promotes the current trends (Rogers, 2021), expanding visual vocabulary related to the posts (Bimbao & Navarra, 2023). Such vocabularies mediate emotion and thoughts between users (Meric *et al.*, 2023). It emphasizes users' perspectives and identities as well as represents a particular place, city or even country (Budge, 2020) to become publicly recognized. Furthermore, Instagram captures both the tangible and intangible elements from particular contexts, creating "on-going networked conversations from those present to those not present" (Gibbs *et al.*, 2015). Such data richness enables immediate photos and video sharing. It becomes a creative platform which produces creative and productive content digitally allowing it to be remembered in the future (Budge, 2020a, 2020b), which then further leaves digital text and visual traces (Budge, 2020a).

3. Pasar Malam (Night Market) as a Nighttime Urban Environment

This study took the case of *pasar malam* (Indonesian language term for night market) as a starting point to investigate the nighttime data landscape. Night market is a form of nighttime entities emerged in many cities or regions in various countries as part of society's everyday life (Kalnaovakul & Promsivapallop, 2021; Li *et al.*, 2021; Paramita *et al.*, 2021). The emergence of the night market could be considered from social, cultural and economic perspectives that together indicate its important role in constructing an urban environment. Therefore, the inquiry into the case of the night market can become a way to study the elements that construct nighttime urban places.

The night market has been studied in various research as a generator of the nighttime economy. It emerges as a result of the co-creation process between vendors and visitors (Lee & Pearce, 2020), which involves various acts of bargaining, selling, choosing and purchasing products. The presence of the night market becomes an important aspect of stimulating the local economy by promoting local enterprises (Yeo & Heng, 2014) while at the same time providing a vibrant and lively atmosphere during nighttime (Klein *et al.*, 2021). The night market presents temporal dynamics with a multiplicity of events that involve a massive flow of actors, actions, objects and elements (Atmodiwirjo *et al.*, 2019).

Some night markets in various regional contexts are closely associated with food culture. Nighttime markets become the temporal entities celebrating food culture as strategies to restructure and regenerate urban life (Hulme, 2018). In many cities, a night market is utilized as an opportunity to offer a culinary experience. The experience of food in the night market becomes an indicator of urban qualities as part of a tourist destination (Kalnaovakul & Promsivapallop, 2021). As a generator of food culture, the night market could also offer the relationship between food and time and bring nostalgia (Li *et al.*, 2021) by providing a food experience from a particular time in the past.

Night market and its emergence in the urban environment highlight the society's socio-cultural exchange. Through the process of consumption, the night market becomes a setting for negotiating cultural differences and multicultural branding, eventually becoming a setting for celebrating authenticity (Pottie-Sherman & Hiebert, 2015). The construction of social and spatial relations that emerge in the night market suggests the dynamic nighttime urban life. The night market as an urban element plays a vital role in narrating the everyday and ordinary nighttime spatial practices (Atmodiwirjo *et al.*, 2019; Yeo & Heng, 2014). Night market becomes a unique form of place-making in a nighttime urban environment (Paramita *et al.*, 2021) and this study intends to expand the understanding of such nighttime place-making through the inquiry into the construction of socio-spatial dynamics involved in the emergence of the night market.

This study aims to reveal the data landscape that represents the construction of urban nighttime. Nighttime is seen as a landscape constructed by multiple elements, which differs from the discussion of 'day and night' in the urban environment. In particular, this study aims to reveal what constructs urban nighttime and how urban nighttime is represented. The investigation of what constructs urban nighttime will lead to understanding particular elements involved in the emergence of urban nighttime. Meanwhile, investigating how urban nighttime is constructed will lead to various ways of representing urban nighttime.

4. Methods

The study reveals the landscape of urban nighttime construction in Indonesia by utilizing the data from Instagram. It acquired 9,458 posts related to the night market by searching the hashtag #pasarmalam (*pasar malam* is an Indonesian term for night market). The search was conducted on 20 June 2023 at 9:57 PM from Instagram API using phantombuster, a digital platform that gathered the public Instagram data based on the algorithm. It collected information related to the #pasarmalam posts, including usernames, URLs (profile, post and image), text descriptions (including captions and hashtags), locations, likes and comments counts and the publication date. Due to the limitation of the data extraction method, the emojis within the posts that are presented as symbols are excluded and only the first photo from each post could be extracted in image format.

In total, 88,401 hashtags related to #pasarmalam were gathered from this process; they were extracted from posts referring to the night market in multiple countries. Since this study focuses on urban nighttime construction in Indonesia, the data were filtered by removing posts related to non-Indonesian countries, resulting in 6,948 excluded

posts. Further data cleaning was conducted by replacing the inconsistent typings of #pasarmalam and removing the symbols found in the hashtags.

This study intends to map the data on the night market as indicated by how the Instagram hashtags are connected to other related terms. Hashtags can build connections with other actors and promote conversations about the topic (Buente *et al.*, 2020). Instagram hashtags denote the users' value on how they want the posts to be remembered (Budge, 2020) and invite other users to participate collectively (Gibbs *et al.*, 2015). In this study, the #pasarmalam becomes a starting point, leading to other related hashtags.

Analysis was conducted to identify other hashtags that appear alongside #pasarmalam, resulting in the 26 most prominent hashtags based on the frequency of appearances on the posts. Some hashtags were merged because they have similar meanings but different pronunciations (#bazar and #bazaar were merged into #bazaar; #karnaval, #carnival and #carnaval were merged into #carnival; #komediputar and #komidiputar were merged into #komidiputar). This merging process resulted in the 22 most prominent hashtags which appear between 65 to 1,225 times in analyzed posts (Table 1). The hashtags with the most frequent occurrences were: #bazaar (1225), #kuliner or culinary (748), #umkm or small to medium enterprises or SMEs (397), #event (351), #festival (333), #streetphotography (325) and #carnival (322). Some hashtags appear less frequent, such as #pasar or market (135), #food (126), #korakora or a kind of amusement ride (103) and #travel (65); nevertheless, they indicate some potential elements or experiences that may contribute to the construction of night market as a nighttime event.

Table 1. The most prominent hashtags related to #pasarmalam

| No | Hashtag | Result | No | Hashtag | Result |
|----|--------------------|--------|----|-------------------|--------|
| 1 | #bazaar* | 1225 | 12 | #nightphotography | 200 |
| 2 | #kuliner | 748 | 13 | #bianglala | 183 |
| 3 | #umkm | 397 | 14 | #nightout | 175 |
| 4 | #event | 351 | 15 | #nightview | 175 |
| 5 | #festival | 333 | 16 | #nightlights | 169 |
| 6 | #streetphotography | 325 | 17 | #kuliner Malam | 159 |
| 7 | #carnival** | 322 | 18 | #komidiputar*** | 155 |
| 8 | #tamanria | 296 | 19 | #pasar | 135 |
| 9 | #expo | 248 | 20 | #food | 126 |
| 10 | #carousel | 242 | 21 | #korakora | 103 |
| 11 | #streetfood | 212 | 22 | #travel | 65 |

Note: *merged with #bazar;

**merged with #karnaval and #carnaval;

***merged with #komediputar

The analysis to reveal the distribution of hashtags related to #pasarmalam was conducted by creating a word cloud using Orange data mining software. The word cloud was then used to help define the categories. Further analysis was conducted by classifying the prominent hashtags into five categories that indicate what elements construct the urban nighttime and how to represent the nighttime. The mapping of the

network of #pasarmalam was conducted using CorText Manager to visualize the co-occurrence of the hashtags with the related queries. The networks were generated automatically as the network of clusters for each category. Finally, the interpretation was made toward the clusters that emerged in each category to conclude the elements that construct the urban nighttime data landscape and how they are connected within the network.

5. Result and Discussion

5.1. Night Market as an Element of Urban Nighttime

The distribution of posts with hashtag #pasarmalam reveals the variety of regions where the night market is represented. These regions can be seen from the co-occurring hashtags that mention certain locations. The data indicates the representation of the night market in Indonesia that spans from Sumatra (Aceh and North Sumatra), Java (Banten, Jakarta, Central Java, West Java, Yogyakarta Special Region, East Java), Bali, to Kalimantan (West Kalimantan). Many posts captured the night market in Java, as indicated by hashtags mentioning #semarang, #semarangexplore, or #semaranghits, highlighting Semarang city in Central Java. The data also reveals that the night market is captured from smaller regions without mentioning particular regencies or provinces. For example, #subah and #limpung captured the night market in Batang, Central Java, while #infobinjai and #kulinerbinjai highlighted Binjai, a city in Deli Serdang, North Sumatra. These examples suggest that the hashtags could clearly indicate the broader or specific location of the night market without tagging the location in the Instagram post.

The data on the co-occurrence of hashtags related to #pasarmalam reveals 22 prominent hashtags that were classified into five categories related to event, food, experience, entertainment and representation (Table 2). The event-related category contains hashtags related to the occurring events in the night market, including those related to the economic aspect. The food-related category contains hashtags capturing the food culture happening in the night market. The entertainment-related category includes the hashtags containing the amusement rides in the night market. The experience-related category contains hashtags that emphasize the experience or atmosphere of the night market. Meanwhile, the representation-related category highlights the role of photography in capturing the nighttime event.

Table 2. Hashtag categories related to #pasarmalam

| | Event | Food | Entertainment | Experience | Representation |
|----------------|-----------|----------------|---------------|--------------|--------------------|
| Categories | #pasar | #kuliner | #carousel | #nightout | #streetphotography |
| | #bazaar | #kuliner malam | #bianglala | #nightview | #nightphotography |
| | #expo | #streetfood | #korakora | #travel | |
| | #event | #food | #komidiputar | #nightlights | |
| | #carnival | | #tamanria | | |
| | #umkm | | | | |
| | #festival | | | | |
| Total Posts | 1,599 | 1,054 | 667 | 248 | 462 |
| Total Hashtags | 23,263 | 23,380 | 13,311 | 4,949 | 8,272 |

Each category indicates the range of elements and representation techniques of the night market as an entity of urban nighttime. For further analysis of how these elements construct and capture urban nighttime, the maps of networks were generated for each category using CorText Manager. The network mappings reveal the relationships among hashtags, which generate a series of clusters that represent the more specific categories of elements that construct #pasarmalam as a nighttime phenomenon, which will be described in more detail in the following sections.

5.2. Nighttime Data Landscape: What Constructs Urban Nighttime

The first four network maps were generated based on hashtags related to #pasarmalam, which illustrate the elements that construct the night market as a nighttime urban event in relation to four categories: events, food, entertainment and experience. Each network mapping demonstrates several clusters that suggest the interrelated elements in constructing urban nighttime.

Event-related network mapping demonstrates how the urban nighttime is constructed from various activities, celebrations and occasions, as indicated by clusters A1 to A11 in Figure 1. Some clusters highlight the economic aspect, particularly regarding trading activities which include renting and selling goods, such as #serba10ribu (everything ten thousand), #bajumurah (cheap clothes), #murahbanget (very cheap), #sewamesincapitboneka (claw machine toy rent), or #prelovedbranded (A3, A7). Cluster A5 reveals the tools and objects related to the trading activities, such as #cup, #stempelgelas, #stempelcup (cup stamp) and #cupplastik (plastic cup), while another cluster promotes the economic value of the night market related to the bazaar and tenants, such as #callingtenant and #opentenant (A4, A8, A9). These network clusters demonstrate how the promotion of the night market appears prominently in the hashtags in this category. Besides, this network also highlights the role of various actors, particularly those related to the occupation of the night market. For example, cluster A1 mentions event organizers and planners such as #eventorganizerbatang, #eo and #eventplanner, while cluster A3 mentions #pedagangkakilima (street vendors).

This event-related network also contains hashtags related to promoting certain places or locations. It can be seen in three clusters which include #amazingtegal, #tegalkekinian (trendy Tegal), #slawihits (A10); #pemalangkeren (great Pemalang), #pemalangkuliner (Pemalang culinary), #pemalangupdate, (A11); #aslisuroboyo (original Surabaya), #pasarmalamjogja, #pasarmalambalikpapan (A3). These clusters promote both the places and their particular culture, such as local food. Another cluster highlights the specific types of events such as entertainment, competition and performance; the hashtags #lombafashionshow and #fashioncompetition appear in a cluster (A4), which is directly connected to another cluster highlighting experiences such as #seru (fun), #seruseruan, #bianglala (Ferris wheel) and #mainananak (kids' game) (A2). There is also a cluster promoting the celebrations that are specifically commemorated in the nighttime, like #pekanraya (fair), #maulud (religious celebration) and #kemerdekaan (Independence Day) (A9).

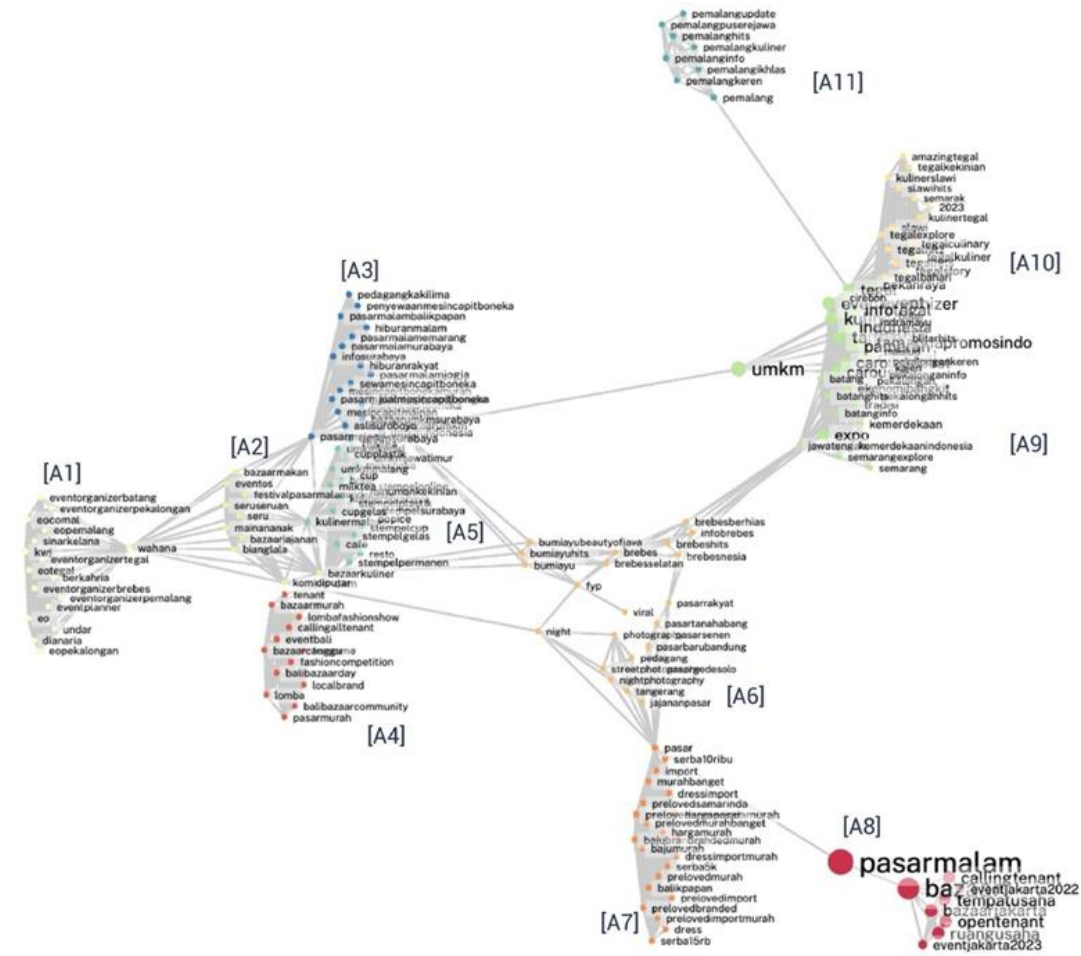


Figure 1. The event-related network mapping



Figure 2. Sample Instagram posts related to nighttime event

The food-related network incorporates eight clusters labeled as B1 to B8 (Figure 3). The mapping reveals the menus or brands sold at the night market, such as #boba, #milkshake, #milktea, #popice and #minumankekinian (trendy drink) (B5); #bahanmakanan (food ingredients), #makananindonesia (Indonesian food), #jajananpasar (market snack), #sateyayam (chicken satay) (B6). The cluster also indicates various tools and objects that signify a certain brand's identity, like #stempelpermanen (permanent stamp) and #stempelgelas (cup stamp) (B5), similar to

those in the event-related network. The network also presents various local and international events closely related to food consumption. Cluster with hashtags #fifaworldcup2022, #nobarpialaduniamalang (watching together world cup in Malang) and #harijadikabupatenmalang (Malang anniversary), (B8) indicates how food caters for various celebrations, while cluster with hashtags #festivalkemayoran, #jakartafair2022, #jakartafairkemayoran, #festivalmakanan (food festival) (B1) indicate the occurrence of food festivals to celebrate certain events.

The clusters in the food-related network map also include various places and locations where the food-related events occur. It can be seen from hashtags such as #viralmedan, #deliserdang, #cafejatim, #cafemalanghits (B8); #pemalangikhlas, #kulinerslawi, #brebeshits (B4); #sidoarjo (B3); #ceritamedan (Medan story), #promomedan, #binjaikuliner (Binjai culinary), #pasarmalambinjai (Binjai night market), #medaneating (B2). These hashtags show the prominence of food elements in the night markets in Medan (North Sumatra), Central Java and East Java. Similar to the event-related networks, some clusters also reveal actors which highlight certain occupations and hobbies that are closely related to food, such as #foodblogger and #bintarofoodies (B6, B7) or actors which emphasize the pride of the region, marking the specific identity of the place, such as #anakbinjai (Binjai kids) (B2).



Figure 3. The food-related network mapping

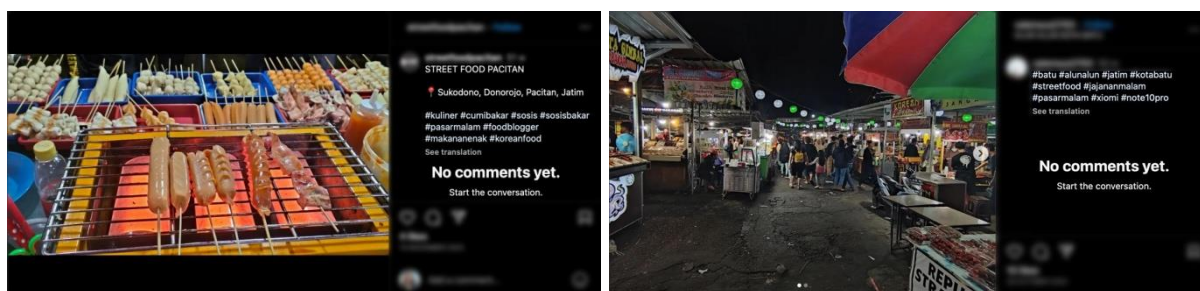


Figure 4. Sample of Instagram posts related to food

Another network map presents how promotion becomes the most prominent element among 11 clusters that represent entertainment-related elements at nighttime (Figure 5). It is demonstrated in eight clusters, which span from promoting Indonesia, specific locations and places to promoting the food culture in particular regions (C1-C3, C7-C11). The network also depicts various entertaining activities in the form of playgrounds and events. For example, #keretamini (mini train), #keretalantai (floortrain) (C4); #odongodong (car ride) #tamanhiburan (amusement park) (C5); #mainananak (kids' game), #wahanapermainan (game ride), #wahana (ride), #bazaarmakan (eating bazaar) (C3); #kincirangin (windmill), #ferriswheel, #hiburanmalam (night entertainment) (C6) and #pameran (exhibition), #ekonomibangkit (rising economy) (C8). The entertainment-related networks also present the role of photography in capturing and defining such a phenomenon. It is represented in the hashtags #travelphotography, #urbanphotography and #photooftheday (C6). In addition, this network also demonstrates how some actors (both individuals and groups) are also involved in relation to entertainment, such as event organizers and photographers (C2, C6). It also demonstrates certain religious celebrations, such as #lebaran and #maulud (C8, C10).

The experience-related network mapping indicates eight clusters labelled as D2 to D8 (Figure 7). Some of these clusters suggest that nighttime construction related to experience highlights how 'travelling' in the night market expands the richness of experiencing the nighttime. It can be seen from #travel in cluster D1, which is directly connected to other clusters (D2, D3, D4) that relate to places, photography and social media terms. The hashtags #wisatadago (Dago tourism), #mountain, #staycation, #nusapenida and #dagodreampark (D1) indicate how the nighttime experience is related to travelling destinations in various landscapes, including beach, mountain and adventure park. The experience is also emphasized and captured through photography, as can be seen in three different clusters: #portrait, #sonyalpha, #nature, (D2); #urbanphotography, #potopotokota (urban photo taking), #capturestreets, #lensculturestreets, #instastreet, (D3) and #canonphoto, #humaninterestphotography, #tegalstory, #instamood (D5). This network map also shows that cluster D5 is directly connected with #streetfood (D6). Besides, the food events also appeared in cluster D8, as indicated by #pasarmalamfood.

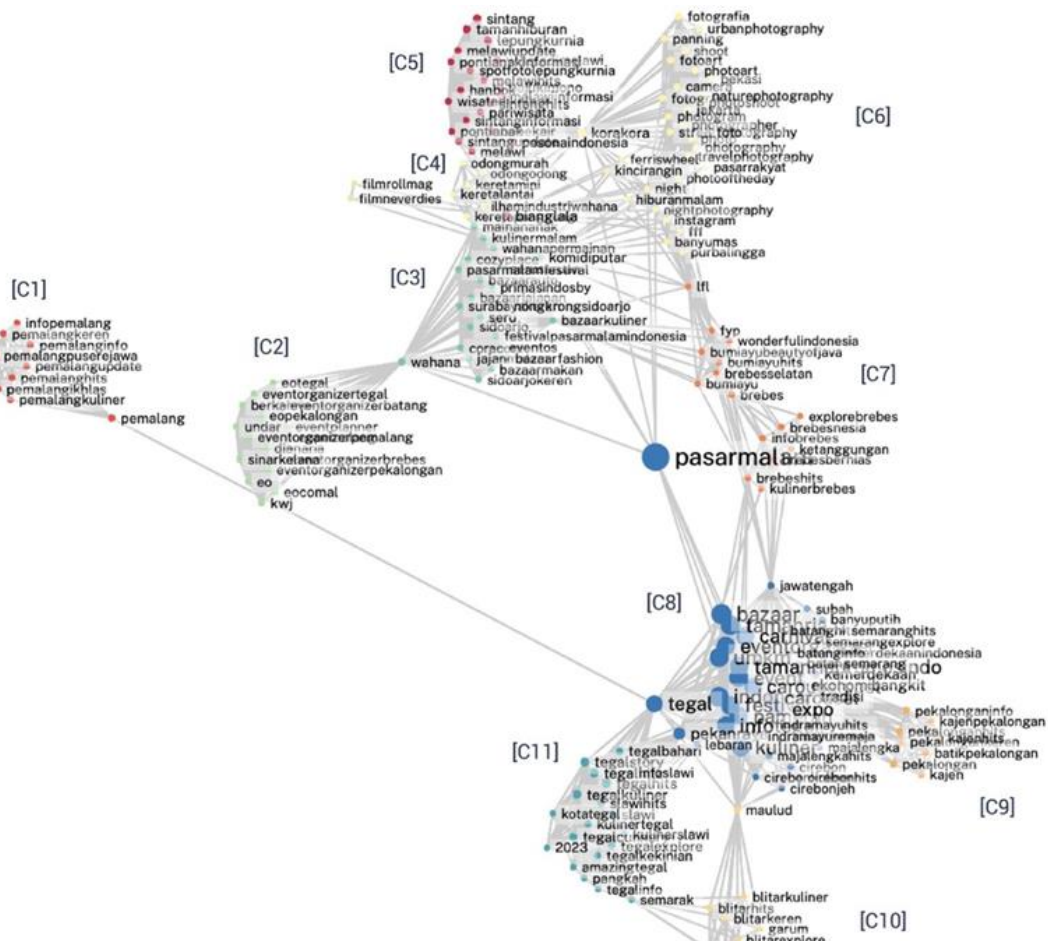


Figure 5. The entertainment-related network mapping

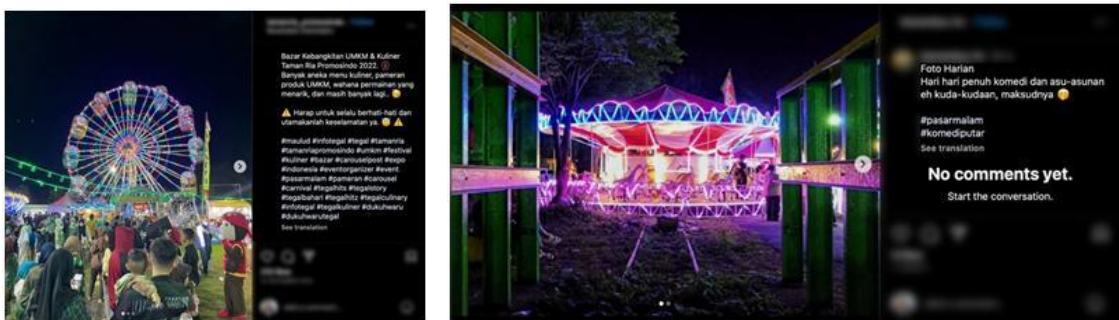


Figure 6. Sample of Instagram posts related to the nighttime environment

The elements of travelling experiences are also represented in the mention of various social media terms such as #picoftheday, #like, #love, #instalike, #follow, #happy, #followforfollowback and #likeforlike (D4). The use of such terms suggests some narratives of nighttime experiences driven by the need to promote the posts for public exposure and recognition. The network also show that the nighttime experience is related to the promotion of events and actors in a specific place, representing the sense of belonging to the place (D6, D7). For example, #binjaieksis, #livemusic, #liveband, #binjaikotaku (my city Binjai), #binjaipunya (belongs to Binjai) and

#anakbinjai are the hashtags representing the Binjai events and actors. Furthermore, the experience-related network also portrays the nighttime atmosphere, highlighting the nighttime qualities as indicated by the hashtags #nightview, #night, #nightout and #nightlights (D8).

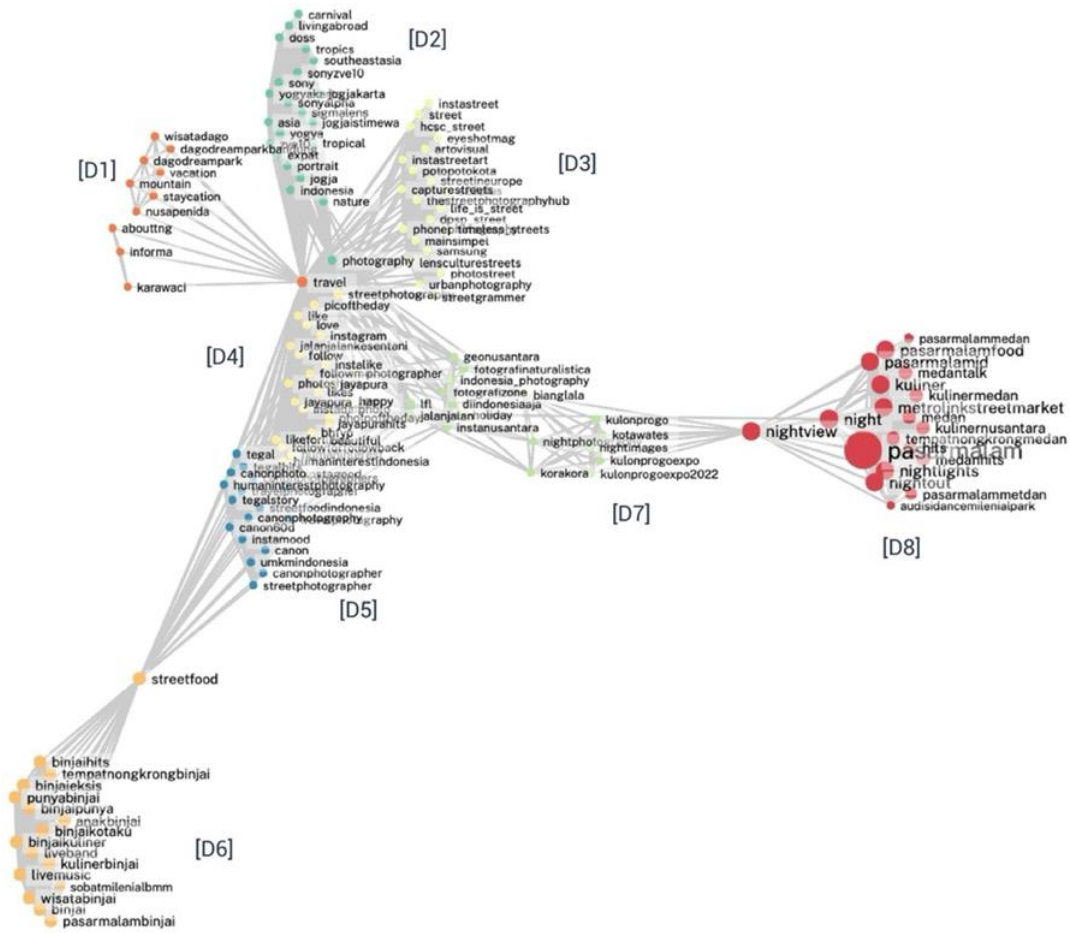


Figure 7. The experience-related network mapping

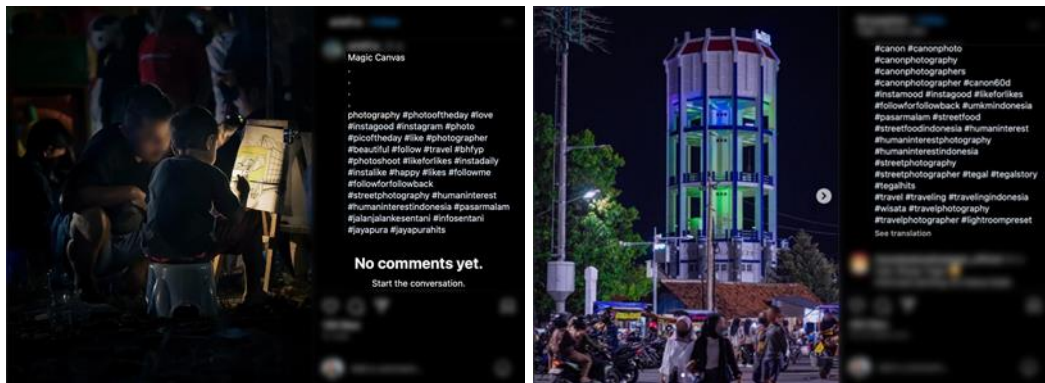


Figure 8. Sample of Instagram posts illustrating the nighttime experience

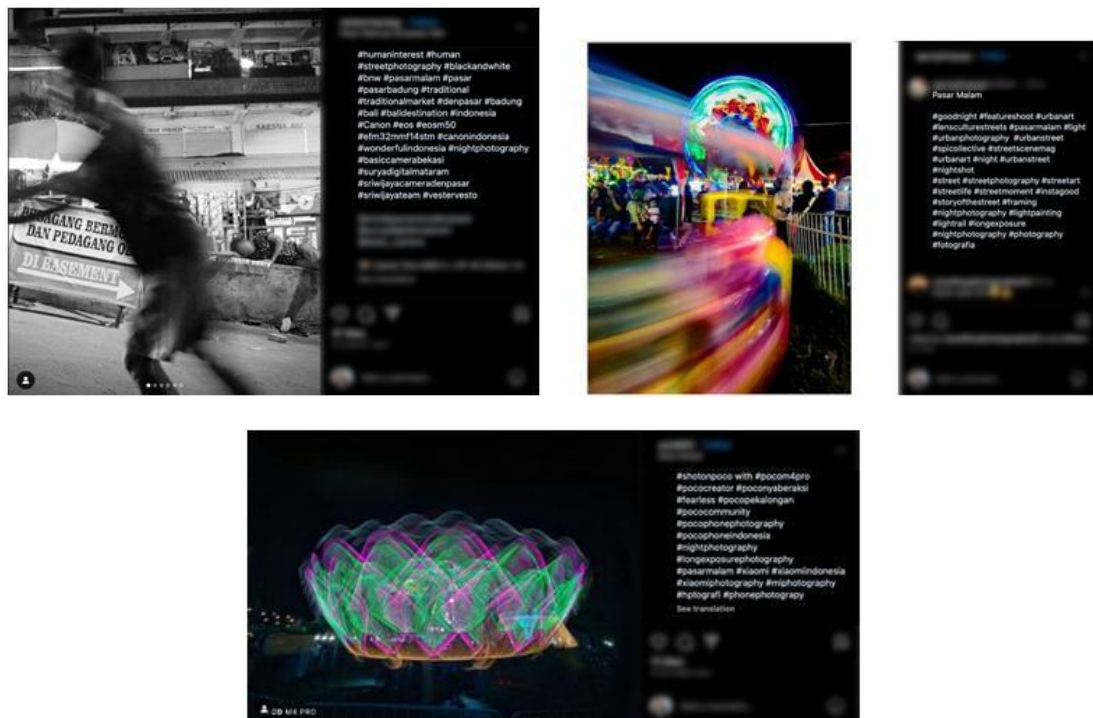


Figure 10. Sample of Instagram posts illustrating nighttime representation

The network map also indicates other strategies for capturing nighttime through narratives. One cluster highlights the nighttime stories through hashtags #ourstreets, #ceritajalan (street story), #jalankubercerita (my street story) and #streetsstorytelling (E1), while another cluster demonstrates the creative act of narrating the nighttime such as #lightpainting and #streetart (E7).

Figure 10 illustrates examples of how drawing the nighttime not only captures the events, people and landscapes but also narrates and interprets the environment and personal experiences through stories and paintings. The stories are narrated using terms that elaborate and express the meanings of the images, for example, the expression of greeting through the hashtag #goodnight or the user's mesmerized impressions towards nighttime through the hashtag #wonderfulindonesia. Meanwhile, the painting as a form of representation visualizes the quality of the nighttime, particularly by capturing the night lights and applying the photography techniques that emphasize the dynamics of the nighttime landscapes.

5.4. Nighttime Data Landscape: Network of Urban Entities

The result of mapping the elements based on Instagram hashtags related to #pasarmalam reveals the presence of various elements that construct the night market as a form of urban nighttime entity. The emerging networks around the key categories of events, food, entertainment and experience illustrate various clusters of elements that represent the complexities in the construction of nighttime urban places and experiences.

Table 3 summarizes the clusters that emerged from the network mapping of hashtags in the four categories. It shows that some clusters suggest the prominent physical elements such as trading activities, tools, objects, bazaars and tenants in event-related mapping; menu, brand, tools and objects in food-related mapping and

playground or rides in entertainment-related categories. These clusters show some elements that have been identified by previous studies to play an essential role as the generator of the nighttime economy (Roberts & Turner, 2005; Yeo & Heng, 2014), including the elements that construct the urban food landscape (Hulme, 2018; Li *et al.*, 2021). Meanwhile, based on experience-related mapping, some elements can be non-physical but more related to the act of experiencing, such as traveling, social media acts and atmosphere. The mapping demonstrates the role of the nighttime atmosphere as a key element that constructs nighttime urban places (Klein *et al.*, 2021; Shaw, 2014). This finding suggests that the urban place at nighttime can be constructed not only by physical elements or objects but also by various experiencing acts and experienced conditions.

Table 3. Summary of clusters in each category

| Event | Food | Entertainment | Experience | Photography |
|--|---|---|--|---|
| Trading (A3, A7) Tools, objects (A5) Bazaars, tenants (A4, A8, A9) | Menu, brand (B5, B6) Tools, objects (B5) | Playground, rides (C3, C4, C5, C6) | Travel (D1) Social media (D4) Atmosphere (D8) | Tools (E1, E2, E3, E4, E5, E7) Techniques (E3, E4, E7) |
| Place: promotion (A3, A10, A11) | Place: food culture (B2, B3, B4, B8) | Place: promotion (C1, C2, C3, C7, C8, C9, C10, C11) | Place: destination (D1) | |
| Actor: occupation (A1, A3) | Actor: food-related (B2, B6, B7) | Actor: organizer (C2, C6) | Actors: local identity (D6, D7) | |
| Event: various types (A4, A9) Experience (A2) | Event: food-related (B1, B8) | Event: celebration (C8, C10) Photography (C6) | Event: food-related (D6) Photography (D2, D3, D5) | Narrative (E1, E7) |

In addition to those prominent elements, all the mappings in the four categories indicate the promotion of place, location or region as another prominent aspect of the night market. Actors also appear as important elements of the night market; however, the types of actors in each category seem to vary. In event-related, food-related and entertainment-related network maps, the actors are those with related occupations or roles, such as street vendors, food vendors and event organizers. Meanwhile, in the experience-related network map, the actors appear as the local identity of the region, suggesting belonging to the place locality. This finding suggests that the construction of the night market as a nighttime phenomenon is closely attached to the locality of the place and the role of actors that operate in the setting. The emergence of the data landscape of urban nighttime confirms that locality plays a vital role in constructing the cultural uniqueness and authenticity of the nighttime urban environment (Pottie-Sherman & Hiebert, 2015) as an important asset for promoting local cultural uniqueness. It should be noted here that the social media data is generated by the people participating in night market, however, it is not possible to distinguish whether they are local residents or visitors from elsewhere and their particular reasons for visiting.

Table 3 also illustrates that each category contains clusters that refer to other categories. Event-related mapping contains clusters that refer to the idea of entertainment and experience, while food-related mapping contains clusters of events but focuses on events closely related to food consumption. Entertainment-related mapping contains clusters of events and celebrations, while experience-related mapping contains clusters of food events. This finding confirms that the elements that construct a nighttime urban environment cannot be considered as separate entities but complementary to one another, constructing the complexity of nighttime urban places and experiences. Network mapping emerges as a form of data landscape that can depict the multiplicity of narratives in a particular urban place (Atmodiwirjo *et al.*, 2019; Haas & Mehaffy, 2019; Tunçer, 2020). In this study, such multiplicity is captured through the collection of images and texts representing the multiplicity of experiences from various urban actors.

Finally, the summary of clusters in Table 3 also shows that the clusters related to photography emerge in the two other mapping categories, the entertainment-related and experience-related mappings. These emerging clusters also contain hashtags that refer to tools, techniques and methods of capturing nighttime. This finding suggests that there might be an interrelationship between the elements that construct nighttime and how nighttime is drawn or represented.

In particular, the clusters containing photography aspects seem quite prominent in experience-related mapping, suggesting the critical role of nighttime representation techniques and methods in highlighting nighttime experiences. The data landscape of urban nighttime generated from social media data contains strategies on how the image, experience and atmosphere of nighttime (Shaw, 2014) could be captured, represented and interpreted.

5.5. Hidden Complexities in the Urban Nighttime

This study reveals the urban nighttime elements situated in the night market through data landscape. The data is gathered from social media, representing the perspectives of people visiting the night market. Due to the quantity and complexity of the data, there is another dimension of nightlife that cannot be captured through social media, which is the local residents' perspectives. The data mapping did not indicate specifically who the visitors are. However, the mapping clearly showed the deep sense of belonging to the city of those participating in the night market, as indicated by the hashtags representing the identity of the nighttime city, regardless of whether they are visitors or local residents. Both actors have prominent roles in enlivening nightlife through their sense of belonging to the city, the region or the night market itself, as mentioned in the hashtags.

It should be noted that the mapping of the data landscape could not reveal the invisible elements of the nighttime urban environment, such as the negative impacts of inhabiting the nighttime environment. For example, the vibrant and colorful lights in the night market might lead to the emergence of light pollution in the city, causing disturbance for some of the nearby residents. For example, the residents might suffer from circadian-rhythm-related problems such as vision problems and difficulty of sleeping at night (Nguyen & Peña-García, 2019). On the contrary, the relations between light, sound and people break the loneliness of the city, which conveys a great sense of energy that affects the visitors' emotions (Cortés & Morales, 2016; Hung & Wu, 2020), producing a lively environment, indicating that such a problem might still be tolerable for

some actors. Although the lighting generated by the nighttime urban events may have some undesirable impacts to the residents, the data landscape established in this study could not reveal such issues because the actors mainly posted hashtags about the entertaining experience, the techniques of photography in capturing the lights and the dynamic lights in the night market rather than expressing their criticism regarding light pollution.

The data mapping shows how the visitors have a sense of belonging to certain places, such as #binjaikotaku (my city Binjai), #tegalstory and #jayapurahits. The hashtags implicitly indicates that the night market builds and gathers the community, leading to the emergence of crowds in the night market. Such crowd emergence may create uncomfortable experiences for some actors, while at the same time such a crowded situation may create an authentic atmosphere for the night market (Pottie-Sherman & Hiebert, 2013). Understanding the relations of the nighttime elements is necessary to understand the emergence and characters of the crowds, thus providing direction for managing the experience of the nighttime urban events for different participants.

This study has presented five categories of elements that construct and capture the night market as a nighttime urban experience. However, there are some other urban complexities that cannot be revealed through the data landscape as the available data from the social media are limited to the night market visitors' experience within a certain period. It is necessary for further inquiry to relate the data from social media and the real nighttime experience of the visitors and residents.

6. Conclusion

This study presents a mapping analysis to identify various elements that construct an urban nighttime environment through a case of *pasar malam* (night market) as a form of urban nighttime entity. The findings illustrate the emergence of data landscape as the network of entities related to the elements of events, food, entertainment and experiences that construct nighttime urban places. The data landscape also reveals how nighttime is represented through various methods, tools and techniques for capturing the nighttime experience and atmosphere through visual narratives.

The finding of this study suggests the critical role of the data landscape generated from social media in understanding the construction of the nighttime urban environment. The data landscape of urban nighttime represents the collective reading of urban nighttime place dynamics. Such data landscape could become the basis of data-driven urban place-making that can incorporate the dynamics and complexities of nighttime urban elements.

The findings on the emerging clusters of nighttime elements and their interrelationship become important for urban designers to expand the possibility of elements that could generate events and experiences in nighttime places. These elements might depend on and influence other elements' qualities and conditions. Meanwhile, the knowledge of how urban nighttime can be captured and represented is important to understand the ways of representing urban place experiences. Therefore, the construction of nighttime places should consider the wide range of possibilities of how these might be captured. Attention to elements that highlight the physical and experiential qualities of the nighttime urban environment could open up opportunities to enhance nighttime urban place-making that is contextual and meaningful for various

dimensions of urban everyday life. However, this research is limited to the night market as one of the nighttime entities and the mapping analysis is limited to the data available in social media, which may not reveal the hidden complexities of urban environment from various perspectives. Further research can explore other nightlife entities that can expand the dynamic nighttime environment in the city and relate the social media data with the evidence from the real nighttime experience by different urban actors.

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