IDENTIFYING POTENTIAL URBAN FOCAL POINTS USING MULTIPLE CENTRALITY ASSESSMENT (MCA): DA NANG'S CENTER AS A CASE STUDY

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Abstract - Conventionally, identifying urban focal points is primarily based on subjective and intuitive evaluations. This paper aims to establish an objective method for identifying urban focal points by applying Multiple Centrality Assessment (MCA), a spatial network analysis tool. The authors calculate Betweenness, Straightness, and Closeness values within the urban street network and combine these metrics to generate a composite value, thereby identifying urban focal points in terms of connectivity and accessibility. This combined value is used to create maps of focal points and focal clusters, providing a scientific approach in this practice of urban design. The paper uses Da Nang City as a case study. The study's results offer an evident-based approach in proposing urban focal points in urban design and planning.

Key words – MCA; hotspot analysis; Da Nang

1. Introduction

Identifying urban focal points plays an important role in guiding urban development and attracting investment. In the Explanatory Report for the Adjustment to the General Planning of Da Nang in 2030, with a vision to 2045, on page 252 [1], the focal points are described as *"...special destinations, aimed at emphasizing the identity of Da Nang... Various focal points are oriented to create diversity and excitement for residents and tourists when visiting and experiencing the city. The focal points are arranged along coastal and river corridors, hillside subdivisions, gateway areas, and within tourism, entertainment, and recreation complexes..."* Thus, it can be seen that the focal points are identified based on whether they possess a distinctive identity or create an impressive image. In addition, the focal points are also positioned "along coastal and river corridors... gateway areas..."

If we exclude the first groups of features that define the focal points through qualitative means, which are difficult to quantify - such as identity or interest - the other characteristics of the focal points suggest that they can and should be identified more objectively, relying more on evidence or data (i.e., data-driven or evidence-based approach).

Specifically in Da Nang, the potential focal points include (Figure 1):

The focal points are structures: These include structures such as the Da Nang City Administrative Center, the new CBD (i.e., the An Don area), the Financial, Commercial, Entertainment, and Casino Complex Project at the corner of Pham Van Dong and Vo Nguyen Giap streets, the area at the end of Phan Dang Luu Street, the corner of Hoang Sa and Le Duc Tho streets, the corner of Nguyen Tat Thanh and Nguyen Sinh Sac streets, and the corner of Truong Sa and An Nong streets, etc.

The open space focal points: These include 2-9 Square and the Fireworks Festival grandstand area, Asia Park, etc.

Cluster focal points: These include the area of Cham Museum – APEC Park – Bach Dang Street – Nguyen Van Troi Bridge – Tran Hung Dao Street, the Ba Na Hills Tourist Area, the integrated resort area of Lang Van, the Vinacapital golf course project area, the Son Tra tourism area, and the area surrounding Dragon Bridge – the square – nearby structures, the Financial, Commercial, Entertainment, and Casino Complex Project, the International Fireworks Festival Complex, and the InterContinental Danang Sun Peninsula Resort.

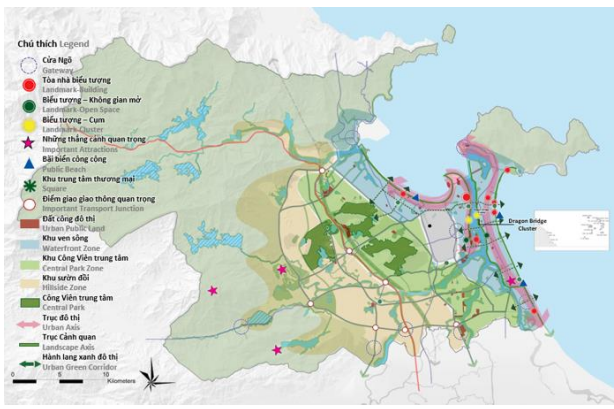

Figure 1. *The focal points are identified according to the overall urban design framework*
(Source: Explanatory Report – Adjustment of the General Planning of Da Nang in 2030, with a vision to 2045)

If we only consider the focal points located in "... coastal and river corridors, hillside subdivisions, gateway areas, and tourism, entertainment, and recreation complexes..." they still tend to be subjective and emotional. For example, the city's focal points are primarily based on tall buildings and architecturally prominent structures. This approach lacks scientific basis, is not evidence-based, and does not fully reflect important factors like connectivity and accessibility within the urban network. This subjective method can lead to an excessive focus on existing tall buildings while overlooking other important factors such as transportation, connectivity, and the functionality of the space. Similarly, some open space and cluster focal points tend to favor certain investors (e.g., Sun Group, Financial Center Complex), etc.

Therefore, it is crucial to objectively identify focal points in a scientific way, which can serve as a foundation for urban space redevelopment and attracting investment.

In this study, the authors propose the use of the Multiple Centrality Assessment (MCA) method as a scientific tool to objectively identify urban focal points and focal point clusters. MCA is a spatial network analysis method that calculates key values such as Betweenness, Straightness, and Closeness - developed by Porta et al. [2] - to assess the connectivity and accessibility of areas within the city. By using an objective approach, this study not only helps to scientifically identify focal points but also supports planners in making evidence-based decisions for selecting focal points.

2. Literature Review

Currently, methods for identifying urban focal points often rely on easily recognizable and subjective criteria such as tall buildings, iconic architectural structures, or famous public spaces. These methods are typically used by planners and architects. However, this approach is not systematic and lacks a scientific foundation, leading to an incomplete reflection of factors that affect the urban spatial experience, such as accessibility, transportation connectivity, and interactions between areas.

The Multiple Centrality Assessment (MCA) method has been widely applied in urban studies to analyze and evaluate the spatial network structure of cities. MCA allows for the calculation of indicators such as Betweenness, Straightness, and Closeness to assess the importance of each point in the urban network, thereby identifying areas that play a strategic role in the transportation system and public spaces. Studies have shown that MCA can provide valuable information for urban development, from identifying key transportation corridors to proposing suitable locations for new buildings.

The importance of Betweenness, Straightness, and Closeness values in analyzing the urban spatial network has been demonstrated in numerous studies. Research by Porta and colleagues indicates that the centrality of a network correlates with accessibility, proximity, connectivity, and efficiency [3]. However, network centrality research has been established for a long time. Alex Bavelas was the first to apply network research to interpersonal communication in sociology [4], showing that good positions in a social network are equivalent to power, influence, and control over others. The concept of centrality was further developed by Freeman and colleagues [5] to study networks of social relationships. Freeman defined central attributes as Closeness and Betweenness.

Network analysis is developed based on a graph theory, in which relationships simplify any network into a set of nodes and edges with different configurations. In network studies, particularly road networks, Multiple Centrality Assessment (MCA) uses four different centrality indicators: Closeness, Betweenness, and Straightness. MCA indicators have been used to quantify the relationship between street centrality and density, as well as the types of economic, commercial, and service activities [6], [7]. Additionally, studies have employed MCA indicators to explore the importance of different public transportation nodes [8], evaluate factors influencing traffic flow at specific intersections [8], and examine the redistribution of subway passenger traffic [10].

The Betweenness indicator measures the extent to which a point acts as an intermediary in the shortest routes between other points in the network, helping to identify areas likely to regulate high traffic flow. The Straightness indicator evaluates the directness of routes connecting a point to other points, reflecting the efficiency of movement through urban space. Closeness is a type of centrality measure that reflects how close a node (i.e., an intersection) is to all other nodes in the street network. This indicator measures the accessibility of a point to the entire network, showing areas that are easily accessible and well-connected. These centrality indicators provide a comprehensive view of the urban spatial structure, helping to identify points with strategic roles and high development potential.

The gap in current research highlights the need to objectively identify urban focal points. Most current studies focus on traffic analysis or spatial network evaluation but have not fully explored the potential of MCA indicators in urban design.

3. Methodology

The scope of this paper focuses on the central urban area and the adjacent northern and southern areas of Da Nang City. The criteria for selecting focal points in the study area include locations with high centrality values, indicating prominence in terms of connectivity and accessibility. These points represent areas with the potential to become urban focal points and play an important role in the spatial structure of the city.

The research data were collected from the road network map of Da Nang City, including detailed information on the street system and intersections. This data includes geographic coordinates, connections between points in the network, and specific characteristics of the roads. The data sources were obtained from Open Street Map.

Multiple Centrality Assessment (MCA) was applied to calculate the Betweenness, Straightness, and Closeness indices for each point in the urban network. Betweenness measures the intermediary role of a point within the network, Straightness assesses the efficiency of connecting routes, and Closeness reflects the accessibility of a point to the entire network. After calculating the Betweenness, Straightness, and Closeness values, these indices were combined to create a single composite centrality score. This combined value allows for evaluating the importance of each node in terms of connectivity and accessibility.

In this study, the authors assigned weights to Betweenness (0.4), Straightness (0.3), and Closeness (0.3), reflecting the relative importance of each index in terms of urban connectivity and accessibility. Betweenness was given the highest weight (0.4) because it measures how much an intersection acts as an intermediary in the shortest

routes between other nodes. This is significant for assessing the role of an intersection in traffic flow control within the road network.

Straightness and Closeness were assigned lower weights (0.3), but they still play important roles. Straightness measures the directness of routes, reflecting the efficiency of movement through the road network. Closeness measures the accessibility of a point to the entire network, indicating the proximity and direct connection of an intersection. These weights have been emphasized in studies by Sevtsuk and Mekonnen [8]. After calculating these values, the authors divided the composite centrality values into 2, 3, and 4 standard deviations. Locations with values of 2 standard deviations or higher were selected as focal points.

The analysis was conducted using the Python programming language, utilizing the Osmnx package built by Jeff Boeing [9] and the Momepy package by Martin Fleischman [10] to analyze Betweenness, Straightness, and Closeness values. These tools allow for visualizing the analysis values and creating composite index maps, clearly illustrating prominent areas within the urban network of the central city area of Da Nang.

4. Results

The results indicate that with values greater than 1.5 times the standard deviation, there are 540 locations across the entire city of Da Nang can be candidates for potential focal points. Corresponding to 2 times the standard deviation, there are 357 locations; greater than 2.5 times the standard deviation, there are 209 locations; and greater than 3.5 times the standard deviation, there are 71 locations.

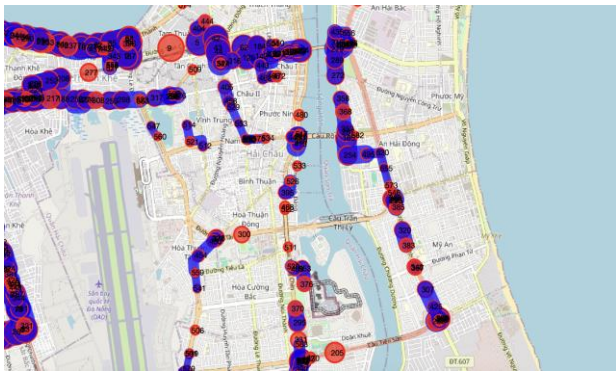

Figure 2. *The focal points in the central area show that very few align with the Adjusted Planning. (Source: the author)*

When considering only the central area and adjacent peripheral areas of the city, there are 27 points and clusters (i.e., when focal points are within 100 meters of each other, they are grouped into a cluster) along Nguyen Tat Thanh Street with values ranging from 2.33 to 4.53 times the standard deviation.

There are 19 points and clusters along Truong Chinh Street, 15 points and clusters along Le Trong Tan - Tran Duc Streets, and 4 points and clusters along Au Co Street. However, since these points are not in the inner city center and adjacent areas, the authors did not take them into consideration.

In the inner city center (Hai Chau District and part of Thanh Khe District), 18 points were selected with values greater than 3 times the standard deviation. These points are located along Tran Cao Van Street (4 points and clusters), Ong Ich Khiem Street (2 points and clusters), and Dien Bien Phu Street (5 points and clusters). Other streets in the inner city center generally have only a few points and clusters that could serve as focal points, such as: Hai Phong Street (3 points and clusters), Le Duan Street (3 points and clusters), and Nguyen Van Linh Street (1 point).

To the north of the inner city center, there are 5 points and clusters along Hoang Thi Loan Street and one point on Tot Dong Street.

To the south of the city center, there are also several locations with the potential to become focal points. There are a total of 11 locations with this potential: Duy Tan Street (2 points), Bach Dang Street (2 points), 2-9 Street (4 points and clusters), Xo Viet Nghe Tinh Street, Tien Son Bridge, and Ho Xuan Huong Street (3 points and clusters).

East of the Han River, there are 10 locations, with Tran Hung Dao Street containing many potential focal points (5 points and clusters)-including a cluster at the head of the Han River Bridge-and along Ngu Hanh Son Street (5 points and clusters).

In the area outside the inner city, there are 29 points and clusters with values over 2 times the standard deviation. Most of these points are located along Le Dai Hanh Street (10 points and clusters). Additionally, there are points along Cach Mang Thang Tam Street (7 points and clusters), Ong Ich Duong Street (3 points and clusters), Thang Long Street (4 points and clusters), and Nguyen Huu Tho Street (5 points and clusters).

The Hoa Xuan area alone has up to 8 points and clusters.

Figure 3. *Comparison of focal points from MCA and focal points in the Adjusted Planning. (Source: the author)*

5. Discussion

After comparing the research results with the urban focal points that have been planned in the Adjustment of Da Nang City's General Planning in 2030, with a vision to 2045, the authors found the following points:

First, most of the focal points identified through the MCA analysis do not overlap with those in the Adjusted Planning. Among the 82 locations with the potential to become focal points in the central and adjacent northern and southern areas of the city, according to the MCA

analysis, *only three points* coincide with the positions in the General Planning Adjustment. These are the focal point at the intersection of Nguyen Sinh Sac and Nguyen Tat Thanh streets, and two cluster focal points in the eastern and western areas of the Dragon Bridge. This indicates a need to reconsider and re-evaluate the selection of focal points in the General Planning Adjustment.

However, it is important to note that the proposed locations are suggestions and do not include focal points with urban or architectural identity or landscape value. The suggested locations are based on the combined index of the quantitative MCA method and can be selected as focal points. Future research should focus on evaluating these identity-building or image-creating focal points. Another essential task is to review the proposed focal points from the MCA analysis based on the approved land-use planning maps.

This study highlights the need to reassess focal points in a more objective way and to identify them through data-driven or evidence-based research. The focal points identified need not be at the city-wide scale; they can serve as *local centers*. One important point that this study reveals is that the number of focal points can be quite large. Rather than just a few points or a few dozen, *the focal points must be local and serve specific positions in each area, rather than being city-wide landmarks.*

The selection of focal points in this study does not yet include landscape or identity-preserving focal points. To ensure comprehensiveness, a serious study is needed to evaluate focal points related to culture, history, and urban identity.

Urban identity is not only limited to physical factors but also includes historical and cultural values, as well as how residents and visitors perceive that space. Therefore, to provide a comprehensive perspective, future research must integrate the element of urban identity with the quantitative indices used in the MCA. This combination will help create an integrated approach, evaluating both the connectivity and accessibility values of the urban network, while also incorporating cultural, historical, and aesthetic factors.

6. Conclusion

This paper uses the Multiple Centrality Assessment (MCA) method to identify urban focal points based on road network data. This is a new approach to studying focal points in urban design. Instead of relying solely on qualitative criteria such as visual appeal or the prominence of existing structures, the focal points identified in the Adjustment of Da Nang City's General Planning in 2030, with a vision to 2045, emphasize architectural prominence, primarily tall buildings or famous structures. *This has led to the neglect of important factors like connectivity and accessibility within the urban network*. Through the MCA combined index analysis, only three locations coincided with the focal points identified in the General Planning Adjustment. The analysis results show that these focal points do not necessarily align with the city's current planning framework. The study reveals that the focal points in the adjusted plan may be incomplete and have overlooked locations with potential to serve the city.

In this study, the authors use the Multiple Centrality Assessment (MCA) method, combining the Betweenness, Straightness, and Closeness indices. The paper provides a quantitative analysis approach to identifying urban focal points based on connectivity and accessibility. The study shows that focal points are not just prominent locations across the entire city but can also include smaller points that serve local areas. This study expands the concept of focal points, suggesting that urban design should consider many smaller centers that meet local needs.

The authors have developed an innovative approach to identifying urban focal points. The study uses quantitative methods and evidence-based research in urban planning.

Future studies on focal points should continue to explore how data-driven focal points can be combined with qualitative assessments, including locations or structures with identity and historical value. It is also necessary to cross-check the potential focal points identified with approved land-use planning.

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