A Guidance in Logistics Investments through Logistics Activity Center (LAC) Site Location Criteria Development

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Outline

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1. Background and Introduction

- United States is one of the most consumer driven markets in the world – high demand for goods, commodities and services
- Freight mobility is an important element in fulfilling demand – affects state economy – driving force for maintaining and creating jobs/economic development
- Strategic investments in the freight and logistics sector are crucial to accommodate this continuing rise in domestic and international freight

- Logistics Investments
  - Apportionment of funds to improve the efficiency of freight distribution through infrastructure (terminals, real estate and telecommunications); operations (transport modes and equipment); and human resources (labor, management, governance, research and development) - Rodrigue, 2013
  - Focus of this presentation – infrastructure – logistics activity centers (LACs)

1. Background and Introduction (cont’d)

- Logistics Activity Centers (LACs)
  - Intermodal Logistics Centers (ILCs) + satellite marine terminals + multimodal logistics parks + inland ports + seaports, etc.
  - LAC – term used to steer away from a lack of consensus on terminology and functions

2. Objectives

• Determination of “optimized” location criteria for LAC development potential to help guide the appropriate investments for successful LAC development

• Identify and prioritize different land parcels based on their LAC development potential

3. Literature Review

Determining Success Factors for LAC Development

• The development of LACs is on the rise to address increasing costs by achieving higher logistics efficiencies

  • Five major categories of success factors for LACs
    1. Strategic location
    2. Economic incentives for development
    3. Champion
    4. Government support
    5. Other factors
  • These factor were applied to evaluate LAC sites identified in the project
3. Literature Review (cont’d)

Evaluating Success Factors of Logistics Activity Centers (LACs)

- World Bank’s Logistics Performance Index (LPI)
  - Comprehensive index to assist countries to identify challenges and opportunities they face in logistics trade performance
  - Six parameters – customs, infrastructure, international shipments, logistics quality and competence, tracking and tracing, timeliness

3. Literature Review (cont’d)

Factors Influencing the Success of Logistics Investments

  - Assessing potential for successful investments in logistics in order to achieve economic development
  - Country-wise ranking using data from World Bank and World Economic Forum

- Key insights
  - The need for a strategic location
  - The need for an integrated logistics approach instead of a modal approach
  - The need for a highly skilled labor force

Source: Khan (2003)
3. Literature Review (cont’d)
Factors Influencing the Success of Logistics Investments

• Munoz & Rivera (2010)
  • Analysis of the critical factors needed for developing a logistics hub – a case study of Panama

• Key insights
  • Strategic location as the foundation to a successful logistics hub
  • Pillars – required processes
  • Capstone – reinforcement element that guarantees successful development

Source: Munoz and Rivera (2010)

3. Literature Review (cont’d)
Factors Influencing the Success of Logistics Investments

• Brito (2010)
  • Analyzing the key elements for a successful logistics hub

• The Tioga Group et. al (2006)
  • Case studies of inland ports and related developments with the goal of developing economic activity around transportation infrastructure

Source: Brito (2010)
4. Methodology

- The literature review suggests that strategic location is an important determinant of the success of an LAC investment

- A list of primary strategic location factors that contribute to successful LAC development and site selection were determined and analyzed under four subsections:
  1. Buffer Distance Criteria Selection
  2. Buffer Weight Selection
  3. Availability of Utilities
  4. Land Cost Consideration

4. Methodology (cont’d)

Buffer Distance Criteria Selection

- **Strategic location criteria** - availability or proximity of
  - Rail track
  - Intermodal yards (land access)
  - Florida’s Strategic Intermodal System (SIS) Roads (Access Points/Interchanges)
  - State and US roads (truck routes)
  - Cargo airports (land access)
  - Seaports (land access)

- Data were obtained using spatial analysis/GIS for the FDOT D7 region

- Each of the facility types was assigned a specific buffer distance which, when entered in the GIS tool, resulted in maps with overlapping areas
4. Methodology (cont’d)

Buffer Distance Criteria Selection

Rail Track Buffers

- Railroad carriers can be used to transport a greater amount of goods/commodities

- Radial distance buffer
  - High - 0.25 miles
  - Moderate - 0.5 miles
  - Low - 0.75 miles

Intermodal Yard Buffers

- Intermodal yards are major freight generators where different commodities are received and sent off
- Containerized freight is brought in and taken out of an intermodal yard by commercial trucks

- Driving distance buffer
  - High - 5 miles
  - Moderate - 10 miles
  - Low - 15 miles
4. Methodology (cont’d)

Buffer Distance Criteria Selection

SIS Roads & Access Point Buffers

• The SIS roadways were analyzed using corresponding interchanges/exits (access points)

• Driving distance buffer
  • High - 1 mile
  • Moderate - 2 miles
  • Low - 3 miles

State and US Roads Buffers

• State and US roadways serve the commercial truck population as truck routes for reaching further towards their final destination

• Radial distance buffer
  • High - 1 mile
  • Moderate - 2 miles
  • Low - 3 miles
4. Methodology (cont’d)

Buffer Distance Criteria Selection

Cargo Airport Buffers

- Air cargo is of high importance for logistics companies that provide overnight shipments for their customers

- Driving distance buffer
  - High - 5 miles
  - Moderate - 10 miles
  - Low - 15 miles

4. Methodology (cont’d)

Buffer Distance Criteria Selection

Seaport Buffers

- Seaports are key facilities for the import and export of goods to/from the US

- Driving distance buffer
  - High - 5 miles
  - Moderate - 10 miles
  - Low - 15 miles
4. Methodology (cont’d)

FDOT District 7 Buffer Criteria Maps

5. LAC Development Potential Criteria

Buffer Methods

**Simple (Linear Type)**

- Simplest form of buffer generation using a radial distance, similar to a circular range from the point of origin

- Gives an area that falls within a certain distance criteria and can be accurate if the origin point is small

- It was used for the rail tracks and state and US roadway buffer analyses, since only the immediate direct distance to access them was necessary

5. LAC Development Potential Criteria (cont’d)

Buffer Methods

Driving Distance (Network Availability)

- In the cases of SIS roads, intermodal yards, cargo-capable airports, and seaports, the simple buffer method will not yield the best results, since any vehicle entering or exiting these facilities must do so at specific access points (entry/exit).

- To achieve a driving distance buffer to a specific access point, the Network Analysis tool of ArcGIS was used so that driving distance buffers could be determined accordingly.

5. LAC Development Potential Criteria (cont’d)

Buffer Methods

Driving distance buffer generated for SIS roadways
5. LAC Development Potential Criteria (cont’d)

Buffer Methods

Buffer Assimilation Process
- Buffers generated for the different types of facilities were merged to obtain one layer depicting the final buffers for each level of LAC development potential

Raster graphics:
- is a dot matrix-type of data structure generally representing a rectangular grid of pixels, or points of different color
- raster images are technically characterized by the width and height of the image pixels (smallest unit of the image on screen)
- the pixels used for this study are represented by a square that is 0.1 mile (528 ft) on each side. This correlates to an area of 0.01 square miles, about 6.4 acres

5. LAC Development Potential Criteria (cont’d)

Buffer Methods
Buffer Assimilation Process (cont’d)
- These pixels contained the “heat” or measure of their proximity to each of the facilities mentioned previously
- Raster images were stacked on top of each other
- The resulting map accounted for all LAC development criteria, including the strategic location criteria discussed previously and the availability of utilities and land cost criteria discussed in the following sections
5. LAC Development Potential Criteria (cont’d)

Buffer Methods

Buffer Weight Selection

- The maximum total net weight for a facility (the highest end of “Very High” LAC development potential) was fixed at 100
- The total influence of all facilities sum to a specific score for each location on the map, resulting in a measure of LAC development potential of that specific site

Table 1. Buffer Distances and Corresponding Weights for All Facility Types per LAC Development Potential

<table>
<thead>
<tr>
<th>Facility Type</th>
<th>Buffer Type</th>
<th>Buffer Distance (mi)</th>
<th>Buffer Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>High</td>
<td>Moderate</td>
</tr>
<tr>
<td>Rail Track Simple (Linear)</td>
<td></td>
<td>0.25</td>
<td>0.5</td>
</tr>
<tr>
<td>Rail Intermodal Yards</td>
<td>Driving Distance</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>SIS Roads (Access Points)</td>
<td>Driving Distance</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>State and US Roads (Track Routes) Simple (Linear)</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Cargo Airports (Land Access)</td>
<td>Driving Distance</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>Seaports (Land Access)</td>
<td>Driving Distance</td>
<td>5</td>
<td>10</td>
</tr>
</tbody>
</table>

5. LAC Development Potential Criteria (cont’d)

Availability of Utilities

- To fully account for the LAC development potential of an area, the availability of utilities was determined to be a major element
- If a site does not have readily-available utility access, the costs associated with bringing utilities to the site within the permitting/construction timeline might be too high to be able to attract/retain an LAC developer/investor
- A penalty of negative five (-5) points out of 100 possible weight points was applied to sites that did not have utility access (water, sewer, or electricity)
5. LAC Development Potential Criteria (cont’d)

Buffer Methods

Land Cost Consideration
• **Land cost** is an important aspect behind any successful LAC development initiative
• The land cost data acquired from FDOT D7 were converted into square-shaped land areas (raster pixels) that would represent the mean cost per square foot
• **Each pixel** was composed of an area of 0.01 square miles with an average cost

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5. LAC Development Potential Criteria (cont’d)

Buffer Methods

Land Cost Consideration (cont’d)
• Existing land price was evenly distributed and high-priced areas were penalized
• Due to a penalty of -50 and -90 out of a 100 scale, any region that was indicated as having “very high” LAC potential but that was priced extremely high was normalized to drop down to the “moderate” or “minimal” LAC development potential categories
• The addition of +5 to the lower land cost areas could boost their heat designation and push them towards the “moderate” LAC development category

<table>
<thead>
<tr>
<th>Class</th>
<th>Cost Per SF</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Cost</td>
<td>$ 0–5</td>
<td>5</td>
</tr>
<tr>
<td>Moderate Cost</td>
<td>$ 5–15</td>
<td>0</td>
</tr>
<tr>
<td>Moderate-to-High</td>
<td>$ 15–50</td>
<td>-50</td>
</tr>
<tr>
<td>High Cost</td>
<td>$ 50+</td>
<td>-90</td>
</tr>
</tbody>
</table>
6. Results

- Once the location criteria for LAC development potential were finalized to include **strategic location, utility availability, and land cost**, an LAC development potential heat map was generated to analyze the FDOT D7 area.
- The final LAC development potential types were classified into five major groups shown in the table below.

<table>
<thead>
<tr>
<th>Class</th>
<th>Range of Total Weight Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very High</td>
<td>72-100</td>
</tr>
<tr>
<td>High</td>
<td>51-72</td>
</tr>
<tr>
<td>Moderate</td>
<td>26-51</td>
</tr>
<tr>
<td>Minimal</td>
<td>13-26</td>
</tr>
<tr>
<td>Low</td>
<td>0-13</td>
</tr>
</tbody>
</table>

Table 3. Final LAC Potential Categories and Corresponding Range of Total Weight Factors

6. Results (cont’d)

1. Very High
   - These areas have the highest potential for LAC development
   - Most likely to have **close proximity to all logistics facility types** considered in the strategic location criteria
   - In most cases, these areas have a **close proximity to all three major freight generators** (seaport, cargo airport, intermodal yard)
   - A location with a total score of 72–100

2. High
   - These areas are located close to multiple logistics facilities and satisfy many of the LAC potential criteria
   - They are located in close proximity to at least two of three major freight generators (seaport, cargo airport, intermodal yard) and meet most of the LAC development buffer criteria
   - A location with a total score of 51–72
6. Results (cont’d)

3. Moderate
   • These potential LAC development areas may not be the immediate best choice but still are good
   • They have close proximity to at least one of the major freight generators (seaport, cargo airport, intermodal yard) or may be a moderate distance away considering other factors included in the criteria
   • A location with a total score of 26–51

4. Minimal
   • These areas have a low number of nearby strategic location facilities available, and, therefore, have a minimal LAC development potential
   • A location with a total score of 13–26

5. Low
   • These areas have little or no LAC potential according to the developed analysis criteria
   • These areas have a total score of 0–13

6. Results (cont’d)

   • The initial maps obtained through assimilating only the strategic location data were continuous and LAC development potential zones were distributed evenly

   • However, with the introduction of utility availability and land cost factors, the final LAC development potential heat map was found to be patchy rather than solid and linear
7. Validation

- The generated LAC development potential map was compared to the existing warehouses distributed in the Tampa Bay region.
- Only warehouses with an area greater than 25000 sq. ft. were considered for referencing.
- Most of the large warehouses are clustered around the very high and high heat areas thus supporting the criteria development for LAC development potential by this study.

8. Conclusion

- Freight and logistics planning agencies in the government, LAC development firms, and real estate investors can utilize the methods and findings of this research to determine the LAC development potential of possible sites of interest to ensure the success of their investment and to maximize their return on investment (ROI).
- These results can help freight and logistics decision-makers make more informed decisions regarding LAC site investments based on their potential, referred to in this study as the “heat” level.
8. Conclusion (cont’d)

As a future research direction, the research team will look into the exclusion of areas that are not available for LAC development, such as non-vacant lands with existing facilities, military zones, environmentally-protected lands, etc. so a better understanding of readily-available sites for LAC development can be achieved.