



GIS-Based Corporate Real Estate Assets Management: A Conceptual Framework

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Abstract

The paper presents the application of Geographic Information Systems (GIS) technology to the management of corporate real estate assets through location analysis. It develops a conceptual model for GIS-Based Corporate Real Estate Asset Management (CREAM), drawing upon insights from existing literature on the application of Geographic Information Systems (GIS) technology in Corporate Real Estate Assets Management. The model presents a framework to understand the key components and processes in GIS-Based CREAM. It highlights the importance of factors like location suitability and data integration. This paper contributes to the field by providing a structured framework to enhance the understanding and implementation of CREAM with the help of GIS technology, ultimately improving corporate real estate asset management practices.

Keywords: Geographic Information Systems, Corporate Real Estate, Asset Management, Spatial Analysis.

INTRODUCTION

Companies are actively exploring possible avenues to boost their overall profits. The cost of corporate real estate is substantial for any corporation.

Corporate Real Estate (CRE) typically encompasses the physical assets, including buildings and land, owned by large organizations, whether public or private entities. It refers to the real property held by corporations in a broad sense (Oluwoye et al., 2001). The real estate sector has consistently held a central position in the global service industry. In Europe, for instance, this industry generated a total gross product of approximately 965 billion Euros in 2010, with France, Germany, the United Kingdom, Spain, and Italy contributing 600 billion Euros to this total (Scenari, 2011).

Furthermore, it is widely acknowledged that the global financial crisis can be primarily attributed to the recent bursting of the 'housing bubble' in the United States of America (Abatecola et al., 2013). Given the globalization of the real estate market, the need for swift decision-making is paramount. However, employing a decision support system integrated with GIS can expedite decision-making and elevate decision quality (Pödör, 2010).

According to Yao and Li (2011), a Geographic Information System (GIS) is a system that allows one to analyze, visualize, question, understand, and view data in a variety of ways, revealing patterns in the form of maps, reports, charts, and globes.

Recent advancements in GIS technology will significantly impact real estate and associated industries. The main force behind these advances is the transfer of research from academia to the demands of practitioners. In their field, real estate professionals have always recognized the critical role of "location." However, only a few experts have considered GIS as a tool for locational analysis. For several decades, however, few geography academics have been using it to examine problems that are fundamental to the real estate industry (Thrall, 1998).

Purpose of the paper

The purpose of this paper is to present a conceptual model for GIS-based Corporate Real Estate Asset Management (CREAM) as emergent from a review of the literature on the subject. The paper is structured into four sections: The first reviews existing literature on the subject of GIS-Based Corporate Real Estate Asset Management, the second gives a conceptual framework of GIS-Based Corporate Real Estate Asset Management as emergent from the literature review, section three presents an analysis of the conceptual framework, and the final section concludes the findings of the discussions in earlier sections.

LITERATURE REVIEW CORPORATE REAL ESTATE

The research underscores the growing recognition of CRE as a strategic resource. Firms increasingly view CRE as a tool to enhance organizational performance, not just a cost to be minimized (Gibler et al., 2020). Corporations are adopting a more holistic approach to CRE strategy, aligning it with broader business objectives and focusing on workplace design that supports employee productivity (Brown & Stoner, 2017). The COVID-19 pandemic accelerated the adoption of flexible work arrangements, spurring interest in hybrid work environments that balance remote and office-based work (Rindova et al., 2021). Research suggests that CRE will need to adapt to provide spaces that support collaboration, innovation, and well-being, not just traditional office functions (Ofori-Kuragu et al., 2021).

The integration of technology, including the Internet of Things (IoT), is transforming how CRE is managed. IoT sensors and data analytics offer insights into space utilization, building performance, and occupant preferences (Anvuur & Papadopoulo, 2018). Advanced data analytics enable predictive maintenance, energy efficiency, and better space planning, optimizing CRE portfolios (Chun & Choi, 2020). Corporate Real Estate is increasingly influenced by environmental, social, and governance (ESG) considerations. Sustainable building practices, energy efficiency, and green certifications like LEED are central themes (Vornberger et al., 2019). Sustainable CRE practices not only reduce environmental impact but also improve brand image and attract investors seeking ESG-aligned portfolios (Neupane & Soh, 2021).

ASSET MANAGEMENT

Asset management is a pivotal function in both financial and operational domains. It encompasses the management of tangible and intangible assets, and its significance extends to optimizing investments, risk mitigation, and organizational performance (Hsu & Chiang, 2020; Keane & Yano, 2017). A comprehensive literature review offers insights into the evolving landscape of asset management across various industries.

Strategic asset management has gained prominence in the context of infrastructure and real estate (Nguyen et al., 2016). Organizations recognize the need for a holistic approach to asset management, ensuring alignment with business objectives and long-term sustainability. This is achieved by integrating asset management into strategic planning, optimizing asset lifecycles, and addressing regulatory compliance (Keane & Yano, 2017; Sinha et al., 2014). Technological advancements are reshaping asset management practices. The adoption of Geographic Information Systems (GIS) and data analytics has enhanced asset performance monitoring, predictive maintenance, and resource allocation (Raza et al., 2020; Satria et al., 2017). These technologies facilitate real-time data collection and analysis, enabling informed decision-making and improving operational efficiency (Hsu & Chiang, 2020). Asset management in the financial sector is critical for optimizing investment portfolios and risk management (Antolin et al., 2018). Portfolio optimization models, data-driven approaches, and the use of Artificial Intelligence (AI) have become integral to asset allocation and investment strategies (Barroso et al., 2019; Zimmermann et al., 2018). Asset management is increasingly linked to sustainability and environmental considerations (Jannelli et al., 2019). There is a demand for asset managers to include Environmental, Social, and Governance (ESG) considerations in their investment plans. (Eccles et al., 2019). This not only reflects ethical investment practices but also serves to meet the demands of socially conscious investors.

GIS

Geographic Information Systems (GIS) have revolutionized asset management by providing spatial insights and enhancing data-driven decision-making processes. This literature review explores the applications and significance of GIS in asset management across various domains.

In asset management, GIS plays a pivotal role in improving the maintenance and lifecycle management of assets. GIS allows for the efficient mapping and monitoring of assets, enabling better maintenance planning and resource allocation (Arbab et al., 2018; Deakin & Al-shamma'a, 2015). The integration of GIS with asset management systems leads to cost savings, as well as improved asset performance (Cameron & Yao, 2017). In the real estate sector, GIS facilitates location analysis and site selection. It assists in identifying optimal locations for real estate investments, considering factors such as accessibility, demographics, and market trends (Bieker et al., 2014; Laarabi et al., 2017). GIS

technology allows real estate managers to visualize property portfolios spatially, aiding in decision-making processes and risk management. While GIS has transformed asset management, challenges exist, including data quality and integration complexities (Alshehri & Eastman, 2016; Gu et al., 2018). Future research should focus on addressing these challenges and further enhancing GIS capabilities for asset management.

Location analysis is a pivotal component of real estate asset management, and Geographic Information Systems (GIS) have revolutionized the way location analysis is conducted. Location analysis, as applied in asset management, involves the assessment of geographic areas to make informed investment decisions, optimize property portfolios, and mitigate risks (Wyly et al., 2009).

The power of GIS in location analysis is evident in its ability to overlay various spatial data layers, such as demographic information, market conditions, transportation accessibility, and competitive properties (Bieker et al., 2014). This spatial data integration enables asset managers to gain comprehensive insights into potential investment locations. For instance, GIS provides tools to assess the demographic composition of an area, allowing asset managers to target specific markets based on factors like income levels, age distribution, and consumer behavior (Fuerst et al., 2015). In addition to demographics, market conditions play a critical role in location analysis. GIS allows asset managers to incorporate market data, such as historical property values, vacancy rates, and rental trends, in their assessments (Heikkila & Gordon, 2017). The visual representation of market data over time helps identify locations with appreciating property values and increasing demand, guiding investment strategies and portfolio management decisions. Transportation accessibility is a fundamental aspect of location analysis. GIS provides the means to analyze proximity to transportation hubs, roads, and public transit systems (Zhao et al., 2019). For commercial and mixed-use developments, easy access to transportation can significantly impact the success and profitability of an investment. Competitive property analysis is another key feature of GIS-based location analysis. Asset managers can examine existing properties and developments in the chosen area, evaluating their strengths and weaknesses (Zhang & Oh, 2012). This information aids in assessing market saturation and potential competition for tenants or buyers.

Spatial analysis has become an essential tool in real estate asset management, enabling stakeholders to make data-driven decisions regarding property investments, portfolio optimization, and risk assessment (Chen et al., 2018). Incorporating Geographic Information Systems (GIS) and spatial data, asset managers can perform a wide range of spatial analyses. One of the primary applications is location suitability assessment. By overlaying spatial data on factors like demographics, market conditions, transportation accessibility, and competition, asset managers gain insights into the optimal locations for property investments (Wu & Wu, 2017). This information can lead to more successful investment decisions and increased returns. Spatial analysis is also crucial in market trend identification. Asset managers use GIS to visualize historical property values, rental trends, and vacancy rates, identifying areas with appreciating property values or increasing demand (Levy & Schuck, 2016). This knowledge helps in timing property acquisitions, divestments, and other portfolio management strategies. Spatial analysis allows asset managers to assess the geographic distribution of their assets. By understanding spatial diversification, they can reduce the concentration of assets in a single location. This diversification strategy helps mitigate the risk associated with local economic downturns, regulatory changes, or environmental factors that may impact a specific region (Li & Kang, 2020). Spatial analysis helps asset managers identify market trends in different geographic areas. By visualizing data on property values, rental trends, and vacancy rates across locations, managers can recognize areas with increasing demand and appreciating property values. This information guides decisions on where to allocate more resources for acquisitions or development (Levy & Schuck, 2016). The proximity of properties to transportation hubs, road networks, and public transit systems is a key factor in real estate investment. Spatial analysis aids in evaluating the accessibility of properties to transportation infrastructure, which can be crucial for commercial or mixed-use real estate. Investments in properties with excellent transportation access tend to attract more tenants and buyers, leading to higher returns (Zhong et al., 2019). By analyzing environmental conditions, urban development trends, and potential regulatory changes in the vicinity of properties, managers can proactively identify and mitigate risks. This comprehensive understanding of risk factors enables more informed decision-making (Li & Kang, 2020). It can provide insights into the costs and benefits of property investments in different locations. By considering factors such as property prices, maintenance costs, and potential income, asset managers are able to make more informed decisions regarding where to allocate resources for development or acquisition. Spatial analysis supports the efficient allocation of resources within the portfolio. By identifying underperforming properties or regions with limited growth potential, asset managers can reallocate investments to areas with higher growth potential. This resource optimization enhances the overall performance of the portfolio (Chen et al., 2018).

Effective decision-making in GIS-based asset management is vital for optimizing corporate real estate portfolios. According to Li et al. (2017), GIS empowers decision-makers by providing spatially informed insights. Decision-makers can use spatial analysis to identify underperforming assets, plan optimal locations, and forecast asset maintenance needs (Yang et al., 2018). Integrating GIS with asset management enhances strategic decision-making and supports cost-effective asset optimization (Dong et al., 2016). Strategic Asset Allocation: One of the primary areas where GIS

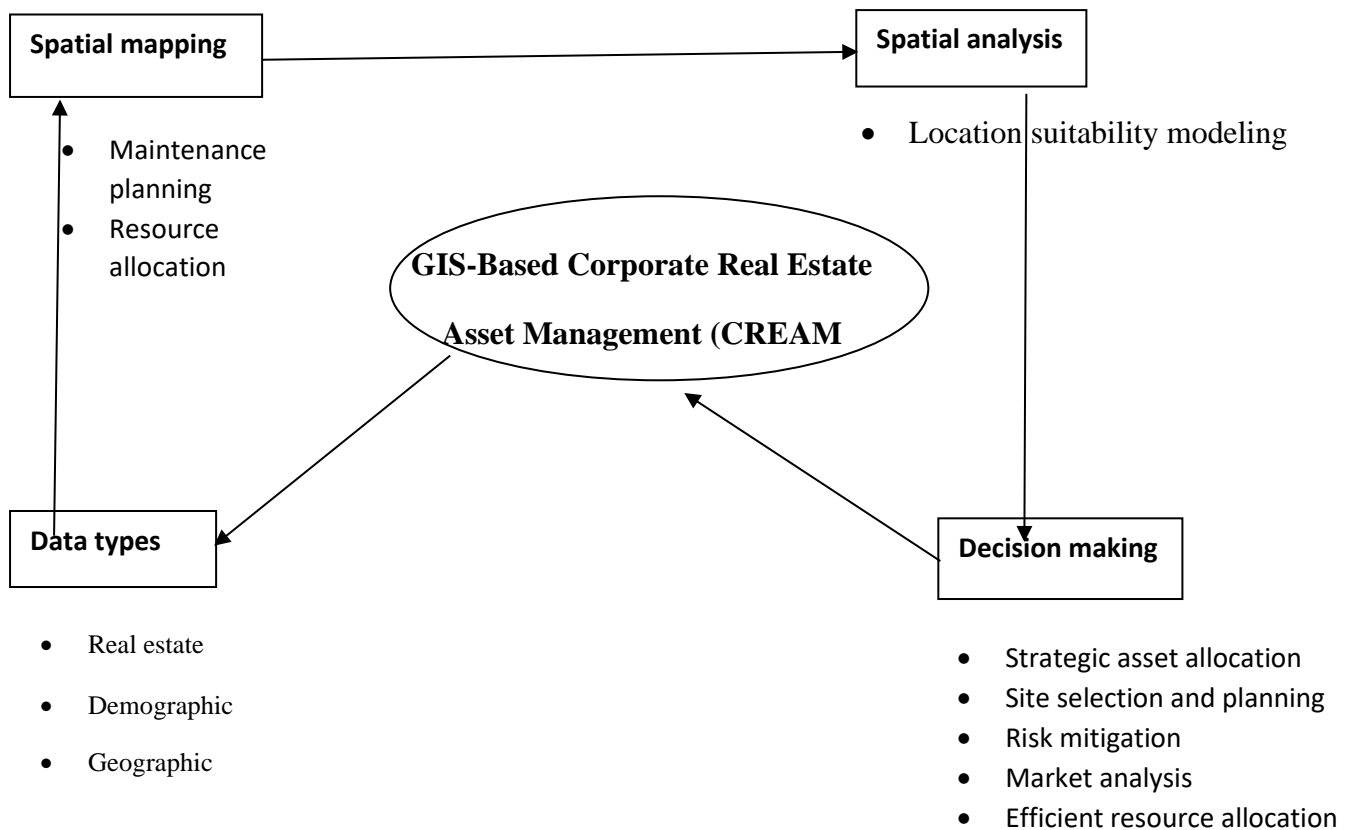
influences decision-making is strategic asset allocation. Through spatial analysis, decision-makers can assess the performance and potential of each asset within the corporate real estate portfolio. This enables the identification of underperforming assets, helping organizations make decisions about whether to divest, renovate, or expand specific properties (Yang et al., 2018). The ability to visualize assets' spatial relationships and market dynamics contributes to a more data-driven and strategic approach to asset allocation. GIS aids in selecting the most suitable sites for new facilities, such as offices, warehouses, or manufacturing plants. Decision-makers can evaluate potential locations based on factors like proximity to suppliers, customers, and transportation networks. Furthermore, spatial analysis enables scenario planning for expansion, ensuring that new facilities align with the company's strategic objectives (Wang et al., 2016). By harnessing geospatial data, businesses can make more informed and cost-effective decisions about where and when to expand their real estate assets. Risk Mitigation: Decision-making in CRE asset management often involves risk assessment and mitigation. GIS provides a spatial understanding of environmental risks, zoning regulations, and external factors that may affect property values. Through spatial analysis, decision-makers can make informed choices to mitigate these risks, such as avoiding investments in high-risk areas or ensuring compliance with local land-use regulations (Dong et al., 2016). This proactive approach helps minimize potential financial and operational risks in the portfolio. Market Analysis: GIS can assist in market analysis, allowing decision-makers to stay competitive and responsive to changing market dynamics. By integrating market data with spatial analysis, businesses can identify emerging trends, assess the impact of market forces on their real estate holdings, and make decisions about property acquisitions, leases, or divestments (Goodchild, 2019). In essence, market-informed decision-making becomes a strategic advantage in a GIS-enhanced CRE asset management framework.

CONCEPTUAL FRAMEWORK

From the literature review in this paper, certain issues have been found to be relevant to GIS-based Corporate Real Estate Asset Management. The issues can be identified as:

1. Data type
2. Spatial mapping
3. Spatial analysis
4. Decision making.

A conceptual model of GIS-based Corporate Real Estate Asset Management, which is based on the major issues arising from the literature review, is presented below.



Conceptual Model of GIS-Based Corporate Real Estate Asset Management (CREAM)

ANALYSIS OF THE CONCEPTUAL FRAMEWORK.

Analysis of the four GIS-based Corporate Real Estate Asset Management and the issues surrounding it are discussed in this section.

• DATA TYPES

Real Estate Data

The literature review highlights the importance of real estate data in corporate real estate asset management. Real estate data includes information about the properties within a portfolio, such as location, size, condition, and usage (Mao et al., 2017). Real estate data is essential in spatial mapping and analysis. GIS technology allows for the efficient visualization of real estate assets on maps, providing a spatial understanding of the distribution of properties (Arbab et al., 2018). Real estate data is essential for maintenance planning and resource allocation. Decision-makers can use this data to identify high-value properties, prioritize maintenance activities, and allocate resources where they are most needed (Cameron & Yao, 2017). It also contributes to risk mitigation through diversification. Understanding the characteristics and performance of real estate assets in different locations is crucial for reducing risk by spreading investments across diverse geographical areas (Li & Kang, 2020).

Demographic Data

Demographic data, such as information about the population in specific areas, is a key component for location suitability modeling. This data includes income levels, age distribution, education, and consumer behavior (Fuerst et al., 2015). Demographic data is crucial for making informed decisions about site selection. By assessing the demographic composition of an area, asset managers can target specific markets based on the characteristics of the local population (Wu & Wu, 2017). Demographic data greatly inform the market analysis. By integrating demographic information with spatial analysis, businesses can identify emerging market trends, assess the impact of market forces on their real estate holdings, and make decisions about property acquisitions, leases, or divestments (Goodchild, 2019). Understanding demographic data is essential for assessing location suitability based on the potential consumer base and market demand. This data guides decisions about where to invest and helps in tailoring real estate strategies to meet the needs of the local population (Heikkila & Gordon, 2017).

Geographic Data

Geographic data refers to information related to the physical environment and spatial attributes of locations. It includes factors like transportation accessibility, proximity to infrastructure, and competitive properties (Bieker et al., 2014). Geographic data is instrumental in location suitability modeling. It helps asset managers assess the suitability of different locations based on factors like transportation accessibility, proximity to suppliers and customers, and connections to transportation networks (Wang et al., 2016). Market analysis benefits from geographic data by incorporating market conditions, such as historical property values, rental trends, and vacancy rates. Geographic data provides insights into locations with appreciating property values and increasing demand, guiding investment strategies (Levy & Schuck, 2016). The literature emphasizes the importance of assessing transportation accessibility through geographic data. Proximity to transportation hubs, road networks, and public transit systems is a critical factor in real estate investment. Geographic data aids in evaluating this aspect for commercial and mixed-use developments (Zhong et al., 2019).

• SPATIAL MAPPING

GIS technology enables real estate professionals to visualize and map their assets efficiently. The visual representation of assets on maps provides a clear overview of the location and distribution of properties. This aids in better understanding the geographical spread of assets and can be instrumental in strategic planning (Arbab et al., 2018). Spatial mapping is essential for planning maintenance activities and allocating resources effectively. By mapping assets, decision-makers can identify high-value properties, prioritize maintenance, and allocate resources where they are needed most. This leads to cost savings and optimized asset performance (Cameron & Yao, 2017). Understanding the geographical distribution of assets is essential for risk mitigation. Spatial mapping helps in reducing risk by diversifying the portfolio across different locations. This strategy minimizes exposure to risks associated with local economic downturns or changes in regulatory environments (Li & Kang, 2020).

• SPATIAL ANALYSIS

Spatial analysis plays a critical role in location suitability modeling. It involves overlaying multiple spatial data layers, such as demographic information, market conditions, transportation accessibility, and competition. This process provides a comprehensive evaluation of potential investment locations (Wu & Wu, 2017). Spatial analysis helps asset managers identify market trends by visualizing historical property values, rental trends, and vacancy rates across locations. This information aids in making timely decisions about property acquisitions, divestments, and other asset management strategies (Levy & Schuck, 2016). Spatial analysis is instrumental in assessing risks associated with environmental

factors, zoning regulations, and other external variables. By analyzing spatial data, decision-makers can proactively identify and mitigate potential risks, such as avoiding investments in high-risk areas or ensuring compliance with local land-use regulations (Dong et al., 2016). Accessibility to transportation infrastructure is a critical factor in real estate investment, especially for commercial properties. Spatial analysis enables the evaluation of the proximity of properties to transportation hubs, road networks, and public transit systems. This analysis guides decisions about property investments that can lead to higher returns (Zhong et al., 2019).

- **Location suitability modeling**

Location suitability modeling involves an in-depth assessment of potential investment sites. GIS allows asset managers to overlay diverse spatial data layers, including demographic characteristics, market conditions, transportation networks, and competition. The outcome is a comprehensive evaluation of the suitability of each location (Bieker et al., 2014). The integration of location suitability modeling with GIS facilitates data-driven decision-making. Decision-makers can assess the geographic distribution of assets, enabling them to make informed choices regarding site selection for new facilities, such as offices, warehouses, or manufacturing plants (Wang et al., 2016). Location suitability modeling helps in assessing potential risks and ensuring regulatory compliance. Decision-makers can use spatial data to identify areas with environmental risks or regulatory restrictions, allowing for proactive risk mitigation strategies (Dong et al., 2016). By integrating market data with location suitability modeling, businesses can gain a competitive advantage. This approach enables asset managers to identify emerging market trends, assess the impact of market forces on their real estate holdings, and make informed decisions about property acquisitions, leases, or divestments (Goodchild, 2019).

- **DECISION MAKING**

Strategic Asset Allocation

Decision-making in corporate real estate (CRE) asset management involves strategic asset allocation. The literature emphasizes the role of Geographic Information Systems (GIS) in helping decision-makers assess the performance and potential of each asset within the CRE portfolio (Yang et al., 2018). GIS enables decision-makers to identify underperforming assets and make informed decisions about whether to dispose, renovate, or expand specific properties. Visualizing assets' spatial relationships and market dynamics contributes to a more data-driven and strategic approach to asset allocation (Yang et al., 2018).

Site Selection and Expansion Planning

GIS plays a crucial role in decision-making for site selection and expansion planning. Decision-makers can evaluate potential locations for new facilities based on proximity to suppliers, customers, and transportation networks. Spatial analysis enables scenario planning for expansion, ensuring that new facilities align with the company's strategic objectives (Wang et al., 2016). By harnessing geospatial data, businesses can make more informed and cost-effective decisions about where and when to expand their real estate assets. This aspect of decision-making is integral to optimizing corporate real estate assets.

Risk Mitigation

Decision-making in CRE asset management often involves risk assessment and mitigation. GIS provides a spatial understanding of environmental risks, zoning regulations, and external factors that may affect property values (Dong et al., 2016). Through spatial analysis, decision-makers can make informed choices to mitigate these risks, such as avoiding investments in high-risk areas or ensuring compliance with local land-use regulations. This proactive approach helps minimize potential financial and operational risks in the portfolio (Dong et al., 2016).

Market Analysis

Market analysis is a critical aspect of decision-making in CRE asset management, and GIS-enhanced data supports this process. Decision-makers use GIS to integrate market data with spatial analysis, allowing them to identify emerging market trends, assess the impact of market forces on their real estate holdings, and make decisions about property acquisitions, leases, or divestments (Goodchild, 2019). In this context, market-informed decision-making becomes a strategic advantage, enabling businesses to stay competitive and responsive to changing market dynamics. Spatial data aids in evaluating the performance and potential of real estate assets in different markets.

Efficient Resource Allocation

Decision-making in CRE asset management is closely tied to the efficient allocation of resources within the portfolio. Decision-makers identify underperforming properties or regions with limited growth potential through spatial analysis (Chen et al., 2018). By recognizing areas with higher growth potential and allocating resources accordingly, asset managers enhance the overall performance of the portfolio. GIS technology provides the data and insights necessary for optimizing resource allocation within the corporate real estate portfolio (Chen et al., 2018).

CONCLUSION

The conceptual framework for GIS-Based Corporate Real Estate Asset Management (CREAM) presented in this paper highlights the critical components and processes involved in utilizing Geographic Information Systems (GIS) technology to enhance corporate real estate management practices. Through analysis of the framework, we can draw several insights. First, data types serve as the foundation of effective CREAM. Real estate data, demographic data, and geographic data provide the essential information needed for spatial mapping, analysis, location suitability modeling, and decision-making. These data types empower decision-makers to understand the spatial distribution of assets, assess site suitability, and mitigate risks effectively.

Spatial mapping plays a pivotal role in the framework, allowing asset managers to visually represent their real estate assets, leading to an improved understanding of their geographical distribution. This understanding underpins strategic planning, maintenance activities, resource allocation, and risk diversification within corporate real estate assets.

Spatial analysis complements spatial mapping by facilitating location suitability modeling, using various spatial data layers to evaluate the appropriateness of different investment locations. It helps in identifying market trends, assessing risks, and ensuring regulatory compliance. Moreover, it guides decision-makers in selecting suitable sites for expansion and aligning new facilities with organizational goals.

Decision-making within the CREAM framework relies on spatial insights provided by GIS technology. Decision-makers employ GIS to assess asset performance, strategically allocate resources, mitigate risks, and conduct market analyses. By integrating market data with spatial analysis, businesses can make informed choices about property acquisitions, leases, and disposal, giving them a competitive edge in a dynamic real estate market.

Ultimately, this conceptual framework offers valuable insights for corporations looking to maximize the value of their real estate assets, make informed decisions, and adapt to changing market dynamics. By leveraging the power of GIS technology and the structured framework presented in this paper, organizations can reduce risks and make more strategic investments in their corporate real estate assets.

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