The Impact of ESG Performance on Investors' Decision-Making in the Real Estate Industry: Based on Green Building Certification and Facility Management

Yilin Liu

Bachelor of Arts, McGill University, Montreal, Canada

Yilin.liu@mail.mcgill.ca

Abstract. With the global climate problem escalating, the real estate investor's environmental awareness is gradually rising, and financial returns are no longer the only consideration for investors, who are increasingly interested in the real estate industry's performance on the environmental level. This paper focuses on the impact of real estate practices in green building certification and facility management on investors' economic returns and environmental considerations. The study shows that improved environmental, social and governance (ESG) performance not only increases property values and rent levels, but also improves tenant satisfaction and lease renewal rates, which in turn enhances the competitiveness of the real estate market, and thus ESG performance improvement has a positive effect on investors. However, the existing leadership in energy and environmental design (LEED) certification for green building certification still has some limitations in terms of actual energy efficiency assessment and LEED's assessment criteria, which need to be further optimized. In addition, the introduction of edge computing in this paper is superficial and weakly referential to the practice of real estate industry, but it can be used as a general direction to enhance ESG performance.

Keywords: ESG; Sustainable development; LEED; Edge-computing.

1. Introduction

In recent years, the problems associated with global warming and climate change have become more pronounced, and they have already had far-reaching impacts on global ecosystems and human societies. In response to this global challenge, the Paris Agreement reached by participating countries in 2015 sets the goal of achieving net-zero greenhouse gas emissions by the end of the century. The real estate industry is one of the key participants in carbon emissions and energy use, and its ESG performance has a significant impact on environmental improvement. Responsible investors who value ESG performance, or ESG investors, are more likely to select projects with good ESG performance that meet sustainability criteria. Investors value not only the financial return of a project, but also the social and environmental impact of the project.

Early research on real estate investment focused on the profitability of construction as well as profitability of real estate trusts (REITs), such as Allen et al. examined the relationship between REIT returns and variations in the financial market and interest rates [1]. Early studies focused on the economic returns of real estate investments and paid less attention to the connection between environmental sustainability and real estate. As the issues of global warming and resource scarcity intensify, ESG factors are increasingly emphasized in real estate investments, and studies have demonstrated the positive impact of green building certification on property values and rental levels [2].

This paper reviews the impact of real estate ESG performance on investor decision-making, with a particular focus on the application of LEED certification in green building certification and the use of edge computing and the Internet of Things (IoT) in facility management, as well as the combination of edge computing and financial technology (Fintech) and edge computing and geographic information technology (GIS) in real estate. Taking LEED-certified buildings as an example, this paper elaborates on the impacts of real estate industry's ESG performance on rents, comfort and building market competitiveness, as well as energy loss, showing the positive effects of real estate

industry's ESG performance on investors' investment. In addition, this paper takes edge computing as an example to illustrate its impact on energy efficiency, comfort and operating costs, which influences investors' decision-making in terms of economic benefits and environmental considerations.

This paper analyzes the positive impacts of real estate industry practices to enhance ESG performance on investors, not only in terms of financial returns, but also in terms of promoting environmental sustainability and responding to the demands of responsible investors for environmental benefits. It also points out the shortcomings and areas for improvement in the green building certification assessment system. Edge computing is a high-tech concept that has emerged in recent years, and its combination with the real estate industry can be used as an important tool for real estate to improve ESG performance. Not only the real estate industry, but also other industries can learn from these practices, and take advantage of the effectiveness, energy efficiency, and other characteristics of edge computing to improve ESG performance.

2. Impact of Green Building Certification on Investors' Decisions

2.1. Impact of LEED Certification on Energy, Comfort and Cost

Green Building Certification is awarded to buildings that meet certain sustainability and environmental standards. Green building certification is assessed by integrating the three aspects of ESG, evaluating a building's energy depletion, environmental pollution, and social responsibility, and corporate transparency, so that the outcomes of green building certification reflect the concepts and performance of ESG. In the early practice of environmentally friendly development in the real estate industry, green building certification has received widespread attention and recognition. The positive impacts of green building certifications such as LEED are mainly in areas of occupant satisfaction, energy efficiency and operating costs. In addition, the impact of green building certifications on financial products for the real estate industry, such as REITs, is also increasingly being recognized. In recent years, as environmental issues have worsened, research on green building certification has intensified and revealed some shortcomings of LEED certification.

LEED certified buildings increase the potential for lease renewals, reduce energy consumption, and enable greater occupant comfort. Commercial office buildings with higher energy efficiency or sustainability labels typically have slightly higher rents, higher occupancy rates, and higher sales prices [3]. For real estate investors, energy efficiency and sustainability concepts have a remarkable influence on the yield of investments in real estate, but occupant satisfaction is easily overlooked in the consideration of economic benefits, but with the implementation of ESG concepts, occupant satisfaction and corporate social responsibility play an important role for real estate investors. By comparing residents' comments on social networks about LEED-certified and non-LEED-certified apartments, Guo et al. found that residents were more satisfied with LEED-certified apartments in terms of their accessibility and transport, cost efficiency, and occupant's well-being in comparison with non-LEED-certified apartments. This leads to the conclusion that LEED certified apartments have higher resident satisfaction [2]. Sanderson and Devaney used statistical methods to study commercial housing in the UK and showed that there is a positive correlation between tenant satisfaction and investment performance, and that if satisfaction implies a greater possibility of renewal of tenancy or recommendation by the landlord, then properties with higher tenant satisfaction should receive a higher valuation, as this will reduce vacancy periods and improve cash flow [4]. Investing in real estate for rent requires increasing tenant renewal rates, which are closely related to tenant satisfaction. LEED-certified buildings help increase tenant satisfaction, and increased tenant satisfaction contributes to higher tenant renewal rates, which help improve the economics of real estate rentals.

2.2. The Impact of LEED-certified Buildings on REITs

Another form of real estate investment that also showcases the impact of ESG performance is REITs, a type of company that invests in real estate that generates economic returns, where investors invest by purchasing the products of REITs, and REITs pool investor funds to purchase, manage, and operate a diverse range of real estate types and distribute profits to investors in the form of dividends. The low capital thresholds of REITs allow investors to purchase, manage, and operate real estate, and distribute the revenue to shareholders. The low capital threshold feature of REITs enables individuals with limited capital to participate in investments. The operation of REITs is similar to that of financial market funds, so investors need to evaluate the risk and return of REITs. At the same time, investors have strengthened their awareness of environmental protection and green development in the context of sustainable development, and have taken the environmental and social performance as one of the criteria for evaluating REITs' products. One of the risk management approaches of REITs is to combine them with the certification of green buildings, and to select buildings that are less risky and that satisfy the requirements of policy and sustainable development for financing and management. The sustainable environmental performance of real estate assets reduces the interest expense and other cost associated with borrowing, reflecting the fact that green certified buildings have lower risk and greater revenue [5]. REITs with more green assets are able to obtain higher return on assets and operating margins [6]. The combination of REITs and green building certification has the characteristics of high income and low risk, which is favorable for investors to obtain higher economic profits and satisfy investors' demands for environmental sustainability.

2.3. Shortcomings of LEED Certification

While LEED has a positive impact on the financial returns of real estate investors, the limitations of LEED certification should not be overlooked. First, there are limitations to the benefits of energy efficiency in LEED-certified buildings. Since it is not possible to collect data on the energy efficiency of buildings in different locations around the world, it is not feasible to verify whether LEED-certified buildings are actually more energy efficient. In addition, the actual impact on the efficiency of certified and non-certified buildings should be assessed by taking into account factors such as the age of the building, climate zone, and occupant behavior [7]. Second, there are incomplete aspects of LEED assessment, such as building resilience, which is not an evaluation aspect of LEED, though building resilience is related to sustainable places, water and energy, and innovation in LEED assessment. The U.S. Green Building Council (USGBC) recognized the need to continually evolve and evaluate the LEED rating system by way of pilot credits, and researchers have recognized this need to assess LEED certified building performance and building resilience as two concepts that have received extensive attention in research [8]. The condition of buildings affects investor returns and occupant satisfaction, and with the frequency of natural disasters such as melting glaciers and rising sea levels caused by climate change, the ability of buildings to cope with and recover from natural disasters, climate change, etc. should be given higher priority.

3. Impact of Housing Facilities Management on Investors' Decision

3.1. Utilization of Edge Computing and IoT

Real estate facility management is the management and repair of buildings and their associated infrastructure to ensure that the building operates more efficiently. As global environmental awareness increases, the application of ESG in the real estate industry is becoming increasingly important to real estate investors. Facility management not only serves to maintain buildings, but also supports and develops ESG practices in different approaches. Facility management reduces operating costs by improving energy efficiency, which is also reflected in rental rates and asset values. Effective facility management maintains and enhances property values and ensures the competitiveness of the building in the marketplace. The added value provided by efficient facility management has a

significant economic value, and the quality of maintenance in facility management enhances tenant satisfaction [9-12]. The practice of facility management using edge computing to support ESG is a reflection of ESG performance in the real estate industry. Edge computing plays an important role in improving energy efficiency, operating costs, and tenant satisfaction, and the utilization of edge computing in the real estate industry can be perceived as a practice of the real estate industry under the goal of improving ESG performance.

Edge computing technology refers to the processing of data near the place where the data is generated, real-time processing of data is a distinctive feature of edge computing, edge computing plays an important role in improving energy efficiency, reducing operational costs, and increasing user satisfaction. One of the characteristics of edge computing is efficient energy usage, which is regulated by sensors, and the overall energy consumption of edge data centers is correspondingly less due to their smaller size and output [13]. The low energy consumption of edge computing helps to conserve energy and reduce pollution and waste associated with energy consumption as compared to traditional data transmission methods. In the context of energy consumption, there is also a need to consider the latency factor, the data latency in energy management may affect the effectiveness of decision making and the inability to adjust the use of energy in time to match the demand, which may lead to wastage of energy. In addition, data delays can affect the accuracy of predictive data, which can lead to the inability to maintain facilities in a timely manner before failures occur, thereby increasing energy and maintenance costs and potentially affecting occupant satisfaction. Mobile Edge Computing (MEC) retains the energy efficiency benefits of cloud computing and enables users to offload their computational tasks to Mobile Edge Computing Servers (MECS) utilizing edge technology with lower latency, resulting in shorter response times and energy savings [14]. Edge computing improves the efficiency of energy usage and helps to reduce the cost of energy usage and pollution control while saving energy, the reduction in operating costs and pollution allows investors to make higher profits and better environmental outcomes from their investments in housing rentals. Edge computing is an important technology support for IoT, and in recent years, the potential of IoT devices to improve energy efficiency, reduce costs and enhance the occupant experience has been progressively demonstrated, thus IoT devices are increasingly being used in practices to improve ESG performance, it better meets the needs of populations such as the elderly and improves tenant comfort, IoT-enabled workplaces can improve occupant productivity and health, and provide building owners with significant energy savings [15-17]. Occupant satisfaction and comfort in the context of social factors are closely related to tenancy renewal and building image; high occupant satisfaction increases tenancy renewal and improves building image, while tenancy renewal directly affects the financial returns of investors. The EDGE building in Amsterdam is an example of utilizing IoT to enhance facilities management, which employs IoT sensors to detect temperature, humidity, and light intensity to optimize energy use and indoor environments. The building uses IoT sensors to detect temperature, humidity, light intensity, and other factors to optimize energy use and indoor environment, which improves the overall market competitiveness of the building. In summary, the use of edge computing and IoT improves the ESG achievements of the real estate industry, optimizes the energy structure, reduces operating costs, improves tenant comfort and tenant experience, which in turn improves lease renewals and increases the market competitiveness of the building. For investors in the real estate industry, edge computing and IoT not only bring higher economic benefits, but also fulfill their demands for environmental sustainability and corporate sustainability in the context of global sustainability.

3.2. The Application of Edge Computing in Fintech and GIS

In addition to the extensive use of IoT, the combination of edge computing with Fintech or GIS is also a practice of real estate to enhance ESG performance, which can promote the sustainable development of the real estate industry, and bring higher economic and environmental benefits to real estate investors. Fintech refers to a technology that enhances the efficiency of financial services through technological innovations, which can be applied to the sustainable development of the

sustainable practice, Fintech can optimize the energy structure to promote green total factor productivity (GTFP) [18]. GTFP requires not only focusing on the utilization efficiency of traditional factors of production, but also considering the factors of environmental protection and resource conservation, therefore, the practice of combining Fintech and edge computing will have impact on environmental protection and resource conservation. Blockchain technology has the characteristics of transparency, security and decentralization, and the application of blockchain technology in real estate has a greater capacity to improve the efficiency, transparency and security of real estate transactions. Edge computing can enhance the use of blockchain technology in terms of both reducing latency and improving energy efficiency, combining blockchain and Fintech, meaning the digitalization of real estate assets using blockchain technology to enable asset segmentation and tokenization and automation, real estate tokenization provides an opportunity for small investors to invest, expanding the pool of possible investors, and automation also saves costs and time [19]. Real estate tokenization lowers the capital threshold for property investment, broadening the range of potential investors and making it more accessible to a larger pool of individuals. Segmentation and automation of real estate reduces the risk of investment, optimizes the structure of real estate investment, and provides more benefits to investors. GIS is closely related to the development of the real estate industry, for example, the prospect of GIS to improve the efficiency of coordinating and analyzing the information collected by real estate companies [20]. In recent years, the combination of GIS and edge computing, the ability of GIS to process geospatial data and properties, together with real-time data collection and monitoring, has made it an adequate resolution to many challenges [21]. GIS can be used in water management, pollution control and outdoor environment optimization. The combination of GIS and edge computing improves the efficiency of GIS, reduces pollution and resource waste in the real estate industry, saves investors' operating costs and governance costs, and its effective use of resources and pollution management promotes environmentally sustainable development, which better meets the requirements of responsible investors for environmentally sustainable development.

4. Conclusion

This paper examines the impact of the real estate industry's performance in enhancing ESG performance on investors, and clarifies the important role of ESG performance in enhancing property values, rent levels, and tenant satisfaction and comfort through an overview of the real estate industry's practices in green building certification and advanced facility management. However, while the positive effects of ESG performance on investor decision-making has been widely recognized, there are still some shortcomings in evaluation and implementation, such as the actual impact of LEED certification on energy efficiency and the need for certification systems to be more comprehensive in terms of assessment criteria that are responsive to climate change trends. In conclusion, the ESG achievements of the real estate industry has significant impact on investor decision-making. As the concept of global sustainability continues to grow, real estate investors will prioritize evaluating how buildings perform regarding environmental stewardship, societal contribution, and corporate governance when choosing investment projects. The green building certification chosen in this paper has been widely used in the industry, so it is less informative for the industry to improve its performance, and it is not an emerging aspect of assessment for investors, therefore, it does not have a high innovative value for investors or industry. Moreover, this paper does not explicitly point out the connection between blockchain and the real estate industry, and the overview of the results of the combination of fintech and edge computing is rather superficial. However, the problems faced by green building certification proposed in this paper may be able to help investors to avoid the shortcomings of ESG performance in order to better adjust their strategies to obtain higher profits. Although this paper does not provide a detailed overview of the use of edge computing, it can provide a general direction for the practice of improving ESG achievements in the real estate industry and provide higher economic and environmental benefits for responsible investors.

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