

Impact of ESG Investment Criteria on Smart City Infrastructure Project Selection

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Abstract: This study examines how environmental, social, and governance (ESG) investment criteria are reflected in smart-city infrastructure project selection in Shenzhen, China. It adopts a qualitative secondary-data case-study design based on document analysis. The study does not use interviews, surveys, or direct project-performance measurements; instead, it analyzes publicly available policy documents, procurement/project-selection materials, corporate ESG/CSR reports, and related academic and policy literature published between 2020 and 2025. The coding of the ESG indicators under the environmental, social, governance, and life-cycle performance and the finance/risk dimensions was done through a qualitative approach of document analysis. As the results indicate, the environmental indicators were most commonly represented, in particular, energy efficiency, carbon reduction, green construction, and smart mobility. Social indicators existed in the language of public service and livability, but few standards were regularly expressed as formal requirements. Other indicators of governance, such as cybersecurity, transparency, data sharing and accountability were very relevant to digital infrastructure but were not evenly represented in terms of selection criteria. The work contributes to the coding framework of ESG on a project level, and it demonstrates how secondary-data case analysis can be of help in determining the gap between corporate ESG disclosure and implementation at the asset level.

Keywords: ESG Criteria; Smart City Infrastructure; Project Selection; Green Finance; Shenzhen

1. Introduction

With the rapid digital transformation of urban governance and the advancement of low-carbonization in China, the environmental, social, and governance (ESG) requirements have become more pertinent to infrastructure finance and project investment decisions. ESG in smart-city infrastructure applies not only in corporate reporting, but also to project screening, prioritization, fund allocation, project delivery, and project monitoring. Projects of smart cities include digital, smart-transport, smart-data center, smart-energy system, urban-safety, and smart-infrastructure. These resources are capital intensive, technologically complex and sensitive to society. This enhances the need to be more selective about them, which extends beyond the conventional analysis of cost-benefit to encompass the environmental performance, the value to the populace, the reliability of governance, and long-term responsibility.

China is a key location in this concern because the development of ESG is influenced by the policies of the country in terms of national interest, regulation of green finance, the carbon-neutral goal, and the implementation capacity of the local governments there. In the 2022 Green Finance Guidelines for the Banking and Insurance Industry, the requirements of financial institutions are reinforced to include the green development and climate-based risk in credit and investment decisions [1][2]. Simultaneously, the smart city policies motivate local governments to leverage the digital infrastructure to deliver better services to the citizens, environmental management, and city management [3]. These policy forces have a robust foundation towards the selection of projects based on ESG.

Although this policy course is moving in the right direction there is still a disjunction between corporate level ESG reporting and project level ESG action. A considerable number of architectures, engineering and construction (AEC) companies produce ESG or sustainability reports, however, project-selection reports usually do not include as much evidence about how ESG principles are translated into quantifiable requirements of individual infrastructures [4]. A company might seem responsible on the organizational level and in regard to ESG but the project-selection process might pay little attention to the life-cycle carbon performance, social-inclusion, data-governance, or long-term-operational responsibility.

This paper fills such a gap, with a case study of Shenzhen in secondary data. The city of Shenzhen fits well due to its level of development of smart city, strong capacity of digital governments, ambitious low-carbon policies, and a thick ecosystem of firms developing technologies and infrastructure. According to public sources, Shenzhen is also considered a leader in the field of low-carbon policy and records such priorities as the focus on ecological protection and green industry, peaking of carbon emissions, electrification of transport, and digital governance of cities [5][6][7][8]. These characteristics enable Shenzhen to be a suitable empirical setting to research on the question of whether ESG criteria are only apparent in the policy and corporate-disclosure level, or also in the documents which direct project selection.

This paper is informed by three research questions: (1) how are ESG criteria manifested in the choice of smart-city infrastructure projects in Shenzhen? (2) What are the most easily converted dimensions of ESG onto a project level? (3) What are the unmet links between policy commitment on the ESG policy, corporate ESG disclosure, and project selection criteria? The article adds value by putting the unit of analysis on the corporate level of ESG ratings to infrastructure project selection and providing a coding framework that can be utilized on secondary literature. Figure 1 shows the logical thinking of analyzing the policy background, development of the city of Shenzhen, the secondary data, ESG coding, and interpretation of the project-selection.

The paper itself does not argue that Shenzhen is a case that is representative of all the Chinese cities. Rather, Shenzhen is an information-rich case, where the ESG-smart integration of the cities must be more evident than in the less digitally developed cities. When quantifiable project-levels of ESG criteria are unfinished within such an environment, there is evidence that the corporate-project ESG divide will be a bigger challenge in sustainable infrastructure governance

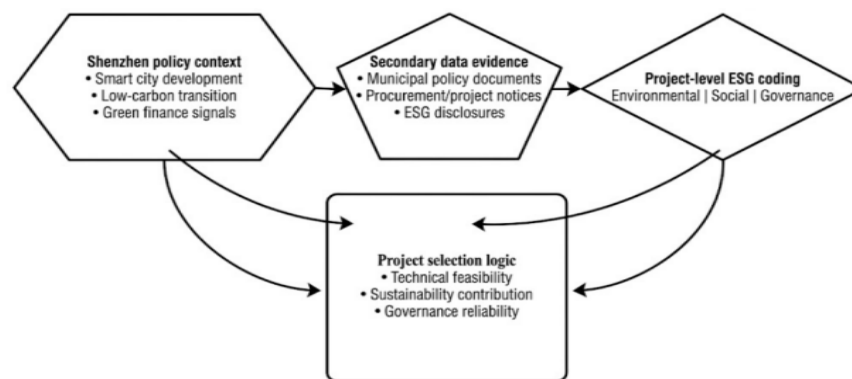


Figure 1. Analytical logic linking Shenzhen policy context, secondary data, ESG coding, and project selection.

2. Literature Review

2.1 ESG, smart cities and project selection

The focus of infrastructure finance is now on two aspects: ESG investment criteria due to the long-term environmental, social, and governance impacts on infrastructure assets. The environment requirements generally relate to green building, pollution, energy efficiency, climate-transition risk, and carbon emissions. The social criteria are associated with the community impact, inclusion, accessibility, reliability of the service, and safety. Governance metrics are transparency in procurement, accountability, reliability of data, protection, control of corruption, and institutional coordination. ESG in infrastructure finance can lead to less investment risk by helping to select projects that are less vulnerable to tightening of regulation, climate-transition stress, societal opposition, and project malfunction. Higher ESG performance could be associated with increased access to capital, as it can indicate that a company is less prone to credit risk and can overcome related operational difficulties. These advantages, however, are based on the credibility of ESG measurement. When ESG is evaluated at the corporate level, it might fail to give an insight on whether a certain project meets the sustainability conditions.

The concept of smart-city infrastructure is especially important to the ESG as it involves the integration of physical infrastructure and governance systems that are highly data intensive. The smart transportation, digital energy systems, smart construction platforms, city operation centers, smart public

services and data-sharing systems can enhance efficiency and service delivery. However, ESG concerns are also in place within these systems concerning electricity demands, data protection, cybersecurity, algorithm responsibility, access, and maintenance sustainability. Government steering highly influences the development of smart cities in China. Tang et al. (2024) demonstrate that smart city pilots can enhance the ESG performance of firms through the promotion of the technological change and decreased information asymmetry [3]. According to Shen et al. (2023), the institutional environment of ESG practice in China is based on interactions between state policy and financial regulation and market mechanisms [9]. Regarding project selection, it implies that the ESG criteria can be involved in the decisions based on policy requirements, procurement requirements, green finance incentives, and performance targets by the local-government.

Investment wise, the dilemma is not that ESG is relevant in theory, rather it is how it is established on the level of making investment decisions. The choice of infrastructure assets is based on a set of combinations of technical, budget, policy, contractor and anticipated public value. ESG criteria should then be converted into selection language which is able to compare amongst the alternatives. The energy intensity or green construction needs or operational monitoring should be an example of the carbon reduction. Social value has to relate to reliability, accessibility, safety and inclusion of service. The quality of governance should be in terms of transparency, protection of data, auditability, and accountability.

This project-selection view contrasts the traditional ESG research based on the corporate ratings or annual reports. Corporate disclosure of ESGs may demonstrate the existence of sustainability policies by a company, but may not indicate the presence of quantifiable carbon goals, or cybersecurity needs, user-inclusion metrics, or post-construction reporting systems within a particular infrastructure project.

2.2 The corporate-project ESG gap and theoretical framing

One of the main issues with the literature is that it gives little relation between corporate ESG disclosure and decision-making at the project level. Translating high-level commitments concerning ESG into project-level metrics is an issue, Zhang et al. (2024) stress, within the Chinese AEC firms [4]. This question is significant to smart-city infrastructure since benefits and risks associated with the projects become apparent during the asset life cycle. A project can meet the needs of short-term procurement but could still fail to meet the results of transparency, its inclusion, and a low-carbon operation. The methodological gap is also a significant one: numerous researches focus on the ESG rating, corporate value, or debt financing on the company level, whereas only a limited number researches get evidence of formal selection criteria as a bidding document, feasibility report, municipal plan, and corporate disclosure.

This gap is supported by measurement issues. Various indicators, scoring rules and weighting systems are often adopted by ESG rating agencies and generate significant variation in the case of ESG ratings of the same company [10][11]. Consequently, good corporate ESG ratings may not always translate to better performances on sustainability at an asset level. The issue of greenwashing and ESG washing are also growing as companies can focus on the reporting of sustainability without portraying quantifiable effects on the environment or society [12][13]. Governance risks, in particular, are particularly high in smart city projects due to the potential that digital infrastructure induces cybersecurity gap, privacy issues, bias in algorithms, and accountability. These challenges demonstrate why the evidence on project-selection is required in supplement to corporate ESG reporting.

This paper is predetermined by the Institutional Theory and Stakeholder Theory. Institutional Theory posits that the policies and practices embraced by organizations are as a result of the regulatory, normative and coercive influences in the surrounding environment where the organization operates. In China, not only investors but also government policies, rules of a green-finance or city development priorities can impact the implementation of ESG. The Stakeholder Theory also highlights that infrastructure choices should be made in ways that address interests of the subjects, such as government agencies, investors, users and communities as well as contractors. Combined, these views contribute to understanding why the ESG requirements might have a strong presence in the Shenzhen policy and procurement landscape despite the lopsided market-based incentives on ESG.

2.3 Shenzhen as an Empirical Case

Shenzhen can be an appropriate empirical example as it is a highly technologically advanced city, as well as one of the pioneers of the low-carbon policy. According to the public sources, the city is moving

towards ecological protection, green industries, the development of a carbon market, electric public transport, upgrades to smart-grids, system of digital energy, and digital government [6][7]. According to SmartCitiesWorld (2024), the initiative of Shenzhen called “Smarter City, Better Life” was seen as the one that was digitalized, managed urbanly, and developed sustainably [8]. Such features establish an information-abundant argument about the need to assess the visibility of the ESG criteria not only in policy discourses but also in the project-selection setting.

3. Research Methodology

3.1 Research Design

This paper adopts a qualitative secondary-data case-study design based on document analysis. The single-city case is suitable as the research problem is about the ways of institutionalization of ESG criteria in a particular urban governance and project-selection environment. Shenzhen has been chosen due to a combination of advanced smart cities development, experimentation of low-carbon policies, and high-capacity of the municipalities as based on public reports about the low-carbon city model, International Low Carbon City initiative, and smart city recognition [5][6][8]. The aim is not to statistically generalize to all Chinese cities, but to provide an analytical understanding of how ESG criteria move from policy and corporate disclosure into project-selection logic.

The analysis is based on the documents, however, instead of surveys or interviews. This decision is informed by the fact that formal project selection is recorded in policy plans, such as those in procurements, requirements of feasibility, public announcements, corporate disclosures, etc. These documents are traceable sources of official selection procedures, but may not be able to record all internal deliberations and secret scoring tests. The Shenzhen case has a time frame that ranges between 2020 and 2025 and encompasses the 14th Five-Year Plan, the fast-tracking of dual-carbon pledges, urbanization development of smart cities, and the plans of internalizing low-carbon city infrastructures. The project or category of smart-city infrastructure project is the unit of analysis, and the publicly available document will be called the unit of evidence.

Case-study rationale follows purposive sampling. Documents were considered and incorporated in the case when they met three criteria: being related to Shenzhen smart city or low-carbon urban infrastructure; appearing during the period of the study (2020-2025); and containing evidence related to ESG-related content, procurement specifications, project goals, corporate sustainability assertions or policy directives. Documents were not included when they were solely in general terms of urban development with no connection to the digital infrastructure or even project selection, ESG, low-carbon development, or governance requirements.

The document categories were made in such a way to allow triangulation. Policy and planning documents of municipalities show the institutional goals of project selection. Procurement and project-selection documents give an indication of the way these objectives can be expressed using formal selection language. Corporate ESG/CSR reports demonstrate the ways in which the firms display their sustainability ability. The interpretation is backed up in academic and policy literature and assists in the comparative thinking of how Shenzhen case can be related to other greater arguments regarding ESG, smart cities and infrastructure governance.

3.2 Data Sources and Sample Scope

The empirical data is comprised of 56 secondary sources that are related to Shenzhen smart-city infrastructure and the ESG-relevant urban development. The corpus contains the municipal policy and planning documents, smart city and digital-government documents, low-carbon and green development reports, public procurement and project-selection documents, corporate ESG/CSR reports, and academic or policy literature. The sustainable-development profile of the city, the case of low-carbon city based on the IEA, and the C40 International case of low-carbon cities are among the essential sources in Shenzhen [5][6]. These sources are used as documentary evidence to examine the visibility and translation of ESG criteria in Shenzhen’s smart-city infrastructure project-selection environment.

Table 1 summarizes the document sample, and Table 2 presents the project categories used to structure the case analysis.

Table 1. Secondary Data Sample

Document category	Number of documents	Analytical purpose
Municipal policy and planning documents	8	Identify Shenzhen's smart city, low-carbon, and ESG-related policy priorities
Smart city / digital government documents	6	Examine digital governance, data sharing, and smart infrastructure priorities
Low-carbon and green development reports	5	Identify environmental and carbon-related project-selection signals
Public procurement / project-selection documents	15	Examine ESG-related requirements in project selection and bidding
Corporate ESG / CSR reports	12	Compare firm-level ESG disclosure with project-level ESG requirements
Academic and policy literature	10	Support interpretation and triangulation
Total	56	

Table 2. Shenzhen Smart City Project Categories

Project category	Number of project documents	ESG relevance
Smart transportation and electric mobility	4	Low-carbon transport, public accessibility, service reliability
Digital government and city operation platforms	3	Data sharing, governance coordination, cybersecurity
Smart energy and smart-grid infrastructure	3	Energy efficiency, grid modernization, carbon monitoring
Green building / intelligent construction	3	Green construction, resource efficiency, safety
Low-carbon community / urban renewal projects	2	Livability, public service quality, community-level carbon reduction
Total	15	

3.3 ESG Coding and Analysis

A predefined ESG codebook based on the project-level ESG literature and smart-city infrastructure research was used in coding the documents (Table 3). All the indicators were coded based on their presence in a document and expression as a general policy statement, a project-selection requirement or a measurable performance indicator. Environmental, social, governance, life cycle performance and finance/risk were coded. The coding scale is shown in Table 4. This is a key difference, since the ESG language can be found in policy documents, but not in enforcement requirements of a project selection.

Table 3. Project-Level ESG Coding Framework for Shenzhen Smart-City Infrastructure

ESG Dimension	Project-level indicator	Coding focus
Environmental	Energy efficiency; carbon reduction; green construction; renewable or green electricity use; resource efficiency; smart-grid upgrades	Whether the document specifies measurable environmental performance requirements or only general green-development language
Social	Public safety; service reliability; accessibility; digital inclusion; community benefit; public-health or emergency-response capacity	Whether social value is expressed as a selection criterion, operational requirement, or broad public-service objective
Governance	Procurement transparency; data security; cybersecurity; data sharing; accountability; cross-departmental coordination;	Whether governance requirements are measurable and linked to project implementation or only mentioned as institutional

	monitoring and reporting	principles
Life-cycle performance	Design, construction, operation, maintenance, and decommissioning requirements	Whether ESG indicators continue beyond the bidding and construction stages
Finance and risk	Green finance eligibility; cost of capital; climate-transition risk; policy-compliance risk	Whether ESG criteria are connected to investment risk, financing access, or project prioritization

Table 4. Coding Scale

Coding value	Meaning	Example
0	Indicator absent	No mention of carbon reduction
1	General policy mention	Project supports green development
2	Project-selection requirement	Bidding document requires energy-efficiency standard
3	Measurable performance indicator	Specific energy-saving, carbon-reduction, or service-reliability target

The researcher carried out the coding manually. To begin with, smart-city infrastructure screening of documents was performed. Second, terms and requirements related to ESG were abstracted and coded under the categories. Third, extracted indicators were construed based on the location within the project life cycle planning and bidding, design and construction, operation and maintenance or monitoring and reporting. In order to enhance consistency, the coding was carried out in three rounds. The identification of relevant ESG terms was initially done followed by grouping of similar terms and the coded results were re-examined to the original documents. A period of two weeks then re-coded all documents and differences were sorted out by comparing. Since it is a single-researcher study, there was no inter-coder reliability therefore that has been listed as a limitation.

The qualitative content analysis with the help of descriptive coding was used in the analysis. There is no application of AHP, entropy weighting and factor analysis since our document corpus is heterogeneous and does not entail well-structured numerical inputs or expert-scoring matrices. Rather, the analysis found out the ESG criteria to be most clearly institutionalized in the policy, and project-selection environment in Shenzhen. Figure 2 is an example of the codification reason throughout the infrastructure life cycle.

	Planning & bidding	Design & construction	Operation & maintenance	Monitoring & reporting
Environmental	carbon targets energy-efficiency criteria	green green construction resource efficiency	operational energy use emission monitoring	life-cycle carbon public reporting
Social	public-service need accessibility screening	safety design inclusive facilities	service reliability digital inclusion	satisfaction complaint mechanisms
Governance	procurement transparency responsibility allocation	data standards contract accountability	cybersecurity data sharing controls	auditability performance disclosure

Figure 2. Project-level ESG coding framework across the Shenzhen smart-city infrastructure life cycle.

4. Results

The frequency of the ESG indicators found in the 56 secondary documents is reported in Table 5. It was found that the most common indicators were environmental ones, with social and governance indicators being the second and third respectively. This helps to confirm the connotation that the smart city project-selection environment in Shenzhen is more deeply institutionalized based on environmental performance than social or governance measurement.

The results have a mix of frequency evidence with qualitative interpretation, which will be addressed before discussing the particular dimensions. The frequency counts are the number of times the indicators were present in the document corpus, whereas the qualitative reading is a description of whether the indicators were described as the general policy language or the requirements that are specific to the project selection under the form of measurable language. This additional methodology enhances the empirical foundations of the case study, but is still suitable with regard to secondary data.

Table 5. Frequency of ESG Indicators

ESG indicator	Number of documents mentioning indicator	Share of sample
Energy efficiency	31	55.4%
Carbon reduction / low-carbon development	29	51.8%
Green construction / green building	24	42.9%
Electric transport / smart mobility	21	37.5%
Public service quality	20	35.7%
Public safety / emergency response	18	32.1%
Accessibility / digital inclusion	14	25.0%
Data sharing / digital coordination	17	30.4%
Cybersecurity / data security	13	23.2%
Transparency / accountability	11	19.6%
Life-cycle monitoring	9	16.1%

4.1 Institutional context and Shenzhen-specific project evidence

The case involving Shenzhen demonstrates that project selection is ingrained into the policy environment both linking the digital governance and low-carbon development. Official reports portray Shenzhen as a city that is seeking sustainable development, greening, green industrialization, electric transportation as well as experiments with a carbon market [6][7]. According to the IEA case study, the low-carbon model of Shenzhen wants to make the city more energy efficient by 14.5% in 2025 than in 2020, achieve a peak of carbon before 2030, and implement decarbonization via regulation, information systems, and infrastructure upgrades [6]. This background provides a policy cue that the smart-city infrastructure should not be analyzed as the level of technological advancement, short term cost per se, but the level of energy efficiency, service quality, digital coordination, and reliability of governance.

Three Shenzhen unique categories of projects demonstrate how ESG criteria get into the game. To start with, intelligent electric transportation infrastructure demonstrates the possibility of bringing together environmental and social requirements. The shift to the large-scale electric bus and taxi systems can be linked to a decrease in emissions, energy consumption, clean air, and the accessibility of transportation by citizens [6][7]. Second, the relationship between Shenzhen and its digital government as well as integrated urban-management platforms represent a form of governance-driven infrastructure. Aligning more closely to shared data, administrative, cross departmental/competency, interdepartmental coordination/collaboration, and service delivery, these systems bring to the fore issues of cybersecurity, privacy, data accountability and government oversight. Third, projects of low-carbon community and urban renewal involve generalizing energy-saving buildings, green transportation, landscape enhancement, and quality of community-tier services with global goals of reducing carbon. These instances reveal how selection viewpoint on ESG could be taken beyond individual technical performance criteria and as integrated sustainable urban city.

The positive policy status of the dual-carbon agenda in China is in line with its environmental results. With environmental indicators it is possible to attach them to set technical standards as well as reliable outcomes which can be more readily added to procurement documents. As an illustration, the smart mobility can be measured by fleet electrification, charging infrastructures, emissions lead, and energy-use measurements. Grid efficiency, integration of renewable energy and monitoring capability can be connected to the smart energy projects. Green buildings may be related to resource efficiency, the criteria of the building's construction and operational energy consumption.

The social results are a variant of the other pattern. Smart-city infrastructure is usually explained by the fact that it provides better livability and service quality, but these aims are more difficult to transform into the selection criteria unless it is stated in the documents who will benefit, how it is going to be measured, and how the service results will be ensured. An illustrative example is that a digital public-service platform can be more convenient to a large number of users, yet it can also be available to the elderly residents and migrants, as well as low-income and low-digital-literacy if the accessibility is not actively taken into account. That is why social indicators need to be measured more explicitly in the project-selection documents.

Findings of governance are of particular interest since the infrastructures of smart cities rely on data systems. An operation platform, smart transportation system/digital public-service system can be

technically successful yet pose a risk when there are poor data security, privacy, transparency, and accountability. The indicators of governance must thus be considered as the core points of selection as opposed to the subordinate compliance points. This is especially applicable to Shenzhen where a digital coordination and platform-based management is fundamental to the implementation of a smart city strategy in the city.

4.2 Environmental, Social, and Governance Findings

Environmental requirements were those that were most completely translated into measurable requirements. Energy efficiency and carbon reduction were the most widespread indicators, but at the same time, these are present in 31 and 29 documents respectively (see Table 5). Green building and intelligent mobility also were recurring themes. These are the themes that relate to the concept of low-carbon city of Shenzhen and International Low Carbon City [5][6]. Environmental indicators become more easily operationalized in project-selection terms since they can be operationalized in technical specifications such as energy-efficiency goals, green-building standards, low-carbon transport goals, smart-grid modernization, and carbon-monitoring ability. Nonetheless, there is also some evidence that environmental criteria may not be necessarily life-cycle based. Design and construction requirements are a frequent focus in documents, but are not as detailed as the operational carbon, energy use in maintenance work or in a circular-economy performance or end-of-life assets management.

The social criteria were represented in policy objectives although they were not as consistently measurable. In the Shenzhen discourse, the issues of public-service quality, safety, convenience, mobility, emergency response, environmental quality, and digital inclusion emerged. Infrastructure with smart city is predicted to enhance residents' quality of life by ensuring that the services given by the government to citizens are more efficient, transport processes more convenient, energy supply more stable and systems of management in this city are more receptive. Social outcomes were frequently, however, expressed in general terms, like livability, convenience, public benefit, service improvement. The concepts should be mentioned though they need to be measured with indicators like number of services, the vulnerable population accessibility, response time of the emergency services, customer satisfaction, cost and fair access to digital services. In the absence of such indicators, social value can play second fiddle to technical performance and compliance to the environment.

4.3 Corporate ESG disclosure and project-level evidence

Last, analysis of corporate ESG disclosure in comparison with project level, reveals that ESG alignments cannot be inferred based on the reporting on the firm level alone. The environmental management systems, employee safety, compliance structures, green finance involvement, and social responsibility may be reported in the infrastructure companies. These types of disclosures raise the legitimacy and can be an indicator of reduced risk to investors, although it does not demonstrate the implementation of ESG requirements to a certain smart city project. Figure 3 shows the prevalence of the ESG indicators mentions and Table 6 summarizes the key empirical results by the ESG dimension.

The trend depicted in Figure 3 should thus be interpreted as indications of relative emphasis and not project performance at the end of the project. The presence of many environmental mentions means that environmental criteria are more apparent in official documents. It does not necessarily indicate that post implementation there were environmental outcomes. This difference is significant as the investigation looks at the evidence of project-selection and not final life-cycle performance data.

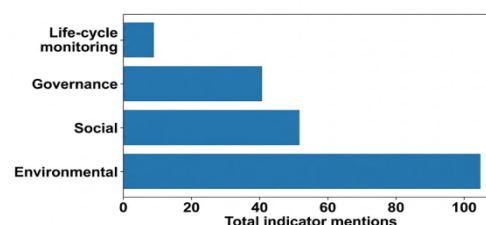


Figure 3. Frequency of ESG indicator mentions in the Shenzhen secondary document sample.

Source: Author's coding based on the 56-document secondary-data corpus. Environmental, social, and governance totals are calculated by summing indicator-level mentions listed in Table 5. Since one document may include multiple indicators, totals exceed the number of documents.

Table 6. Shenzhen Case Findings: ESG Criteria in Smart City Infrastructure Project Selection

Finding	Evidence from secondary data	Implication for project selection
Environmental criteria are strongest	Shenzhen's low-carbon policies, green transport progress, smart-grid upgrading, energy-efficiency targets, and green-development reports emphasize measurable environmental performance	Environmental indicators should be retained as core selection criteria but extended across the full asset life cycle
Social criteria are visible but less measurable	Policy documents emphasize livability, public service, safety, and digital convenience, but these are often broad objectives rather than operational indicators	Project selection should include measurable social-value indicators such as accessibility, service reliability, public safety, and inclusion
Governance is essential but uneven	Smart-city infrastructure depends on data sharing, cybersecurity, transparency, and cross-departmental coordination, but project-level governance metrics are less explicit	Bidding and feasibility documents should include data governance, cybersecurity, reporting, and accountability requirements
Corporate ESG and project ESG are not the same	Firm-level ESG reports provide legitimacy signals but do not prove project-level implementation	Project-specific ESG evaluation should supplement corporate ESG screening
Life-cycle monitoring remains a weakness	Environmental and technical criteria are stronger at planning and construction stages than at operation and maintenance stages	Selection criteria should require long-term operational reporting, maintenance indicators, and performance verification

Table 6 presents the results that evidence in project-selection is skewed in the representation of stakeholder interests. There is a firm institutionalization of the environmental goals since they are in concert with the national carbon goals and can be articulated by technical standards. Nevertheless, social and governance indicators are rarely exhibited visibly unless there is a clear specification of social and governance indicators on citizens, service users, vulnerable groups and data subjects. Stakeholder Theory thus concludes that an alternative method of prioritizing smart city projects should take into account not only the will of municipal agencies and financiers, but also of the people living in the area, who will rely on the infrastructure and could be influenced by the data-intensive governance regimes.

The Shenzhen case is beneficial as it demonstrates advancement and restraint. The city has a good policy environment of low-carbon and digital urbanization, although even in this high-tech environment, social and governance standards are to be further enhanced through measurement. This implies that the next generation of ESG frameworks to be used to design smart-city infrastructure must go beyond an environmental compliance paradigm and be balanced to add service equity, privacy, accountability, cybersecurity, and long-term performance validation to the principle.

5. Discussion

This Shenzhen case indicates that policy cues in this context shape ESG-based project selection in Shenzhen. Smart-city and low-carbon development plans create a governance environment in which project selection is expected to respond to carbon ambitions, digital-government goals, green-finance priorities, and public-service improvement. This is unlike settings where ESG is primarily fueled by institutional investor decision or voluntary corporate approaches. The result can be explained by the Institutional Theory: the use of ESG criteria in the selection of projects in Shenzhen is associated with regulatory and normative pressures and market incentives.

ESG awareness is not the prime weakness but rather the lack of balance in implementation. The policy environment of the city can be seen in environmental protection, low-carbon development, improving of the public services, and digital governance. The question is, can these principles be quantified into project-selection criteria and is it visible when the project is running and in maintenance? The prevalence of environmental criteria symbolizes the institutional form of ESG implementation in China. Carbon targets and energy-efficiency standards may be connected to environmental indicators such as green-construction specifications. The social and governance indicators are less measurable since they tend to deal with the long-term results, user experience, digital rights, accountability, and institutional coordination.

These results have theoretical and practical implications. In theory, they demonstrate why ESG ratings of corporations and evidence of ESG projects should not be considered the same. The dissimilarity of the ESG rating and the issue of greenwashing implies that the disclosure report of any firm is unable to substitute the asset-specific valuation [10][11][13]. In practice, project-selection documents ought to stipulate what an environmental, social, and governance impacts the project must produce. The environment indicators must be spread over the life cycle of asset. The social indicators need to be transformed into quantifiable measures of societal value like accessibility, safety, service reliability and inclusion. The data security, cybersecurity, transparency, accountability, and independent monitoring data should be regarded as governance indicators.

Considering the outcomes that AEC firms and infrastructure investors face, the findings show that corporate ESG reporting ought to be related more closely to the ability to deliver. Companies interested in contracting smart cities must show their general ESG obligations as well as specific project-related skills, including, e.g., green construction management, data safety, data-governance procedures, performance monitoring in operations. This would render ESG more plausible and minimize a threat of greenwashing and ESG washing.

In practice, the implication is as follows: ESG has to be written into project-selection documents in a form that can be verified, compared and traced. Environmental criteria (carbon and energy reporting), social criteria (measurable accessibility, safety, reliability and inclusion indicators) and governance criteria (cybersecurity, data accountability, transparency and auditability) should be handled. These measures would contribute to making ESG an instrument of project selection, but not an overall sustainability tag.

6. Conclusion

This study examined how ESG investment criteria are reflected in smart-city infrastructure project-selection documentation in Shenzhen, China. Based on qualitative document analysis of 56 publicly available secondary sources, the study shows that ESG criteria are visible in Shenzhen's project-selection environment, but their translation into measurable project-level requirements remains uneven. The most common and easiest to measure were the environmental indicators, among which the most popular were energy efficiency, carbon reduction, green construction, and smart mobility. Policy objectives touching on social criteria were observable in the form of community service, safety, livability and inclusion but were less frequently deemed as quantifiable goals. The governance criteria played a central role in digital infrastructure due to data sharing, cybersecurity, transparency, and coordination, but it was not well defined in project-selection documents.

The results respond to the research questions of the given study. In terms of RQ1, the concept of ESG is adopted primarily in the form of environmental demands and selection signals that are based on policy. Concerning RQ2, the indicators that are best translated into measurable project needs are the environmental indicators, whereas the social and the governance indicators are not as well translated. The key gap as far as RQ3 is concerned is the disclosure of ESGs at the corporate level as opposed to the real implementation at the asset level, particularly in the areas of governance accountability, data security, social inclusion and life-cycle monitoring.

The research demonstrates that ESG is to be considered at the project level but not based on corporate ESG disclosure, in particular. Corporate reports and ratings can furnish background information, but cannot prove a particular asset in smart-city infrastructure can actually give any quantifiable environmental, social and governance value. This research is constrained by the use of publicly-available secondary data and the use of single city case-designed study and qualitative coding by one researcher. Further studies are required to gather bigger data in several cities, compare among various projects chosen and not chosen, and use document analysis in combination with interviews. After the availability of structured indicator scores, AHP, entropy weighting, or any other methods of multi-criteria-based decisions could be used in a more rigorous manner.

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