

Review

Theoretical Framework for Carbon Trading in Construction Industry: A PROMISE Framework and System Dynamics (SD) Causal Loop Diagram (CLD) Approach

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Abstract

Carbon emissions trading from past studies has been recommended as effective in minimizing future levels of carbon emissions. The aim of this paper is to develop a theoretical framework for a construction industry carbon trading system by identifying the categorizations in the system and their influences. The theoretical framework in this study was developed using the PROMISE Framework. PROMISE is an acronym representing Personal, Relational, Organizational, Market, Institutional, Social, and Environmental. The Scopus database was used in the selection of articles. Using the System Dynamics (SD) Causal Loop Diagram (CLD) approach, the positive and negative influences among the variables in the seven categories were evaluated and illustrated. This study is significant and provides a foundation for future researchers to develop conceptual frameworks and models for carbon mitigation strategies. For policy makers, the proposed carbon trading framework assists in evaluating the key legal, economic, environmental, and political policies that can improve carbon trading projects in the built environment. When policy makers place significant emphasis on the influences identified in this study, it will contribute to them supporting regulations and policies that effectively mitigate these emissions.

Keywords: theoretical framework; construction industry; carbon emissions trading; system dynamics; causal loop diagram; PROMISE framework



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1. Introduction

Carbon trading has been identified to be a significant solution in the fight against climate change through reducing the quantity of greenhouse gas emissions [1]. Carbon trading is both a policy-based and market-based instrument that is critical in the attainment of carbon neutrality targets and achieving net zero carbon [2]. Governments and other major stakeholders are the active participants in sustainability projects through carbon trading. The main aim of carbon emissions trading is to assign a price to carbon, and through market forces, transform these emissions into paid factor of production [3]. Carbon emissions trading policies have led carbon markets to receive increased attention as a solution to addressing climate change. The construction industry is a large contributor and source of global carbon emissions, and it faces constraints in meeting its carbon emissions reduction targets [4–7]. Application of carbon trading and carbon trading policies are expected to help the construction industry achieve its carbon mitigation targets [8].

Carbon emissions trading offers a global response in the fight against climate change [9]. Since it allows for offsets to be used, this leads to low compliance costs and helps jurisdictions in fighting climate change [10]. The Paris Agreement makes provisions for countries to work together in minimizing greenhouse gas emissions, and carbon trading is a market-based instrument that facilitates this [11]. Another important aspect of carbon trading is its ability to provide incentives in reducing emissions [12].

Carbon trading has been applied in different countries and sectors [13]. The main sectors that have applied carbon trading include oil and gas, manufacturing power, agriculture, aviation, and maritime [14–16]. In the United States, carbon trading was implemented through the acid rain program. It contributed to reducing pollution levels at lower costs than estimated [17]. In the European Union (EU), carbon trading has been used to create prices for carbon, thereby reducing emissions [18].

Even though carbon trading has been identified as a panacea for reducing greenhouse gases and subsequently mitigating the threats of climate change, past studies have shown that when the current carbon trading systems were developed, they did not focus on the construction sector [19–23]. The largest carbon trading system that has been implemented globally is the European Union Emissions Trading System. However, a cursory analysis of the trading scheme shows it does not cover much of the construction industry [24,25]. Other major trading systems have not focused much on the construction sector, which is a major gap. This study seeks to enhance knowledge by developing a theoretical framework for carbon trading in the construction industry based on the PROMISE Framework and systems dynamics.

2. Methodology

2.1. PROMISE Framework

The theoretical framework in this study was developed based on the PROMISE Framework. The PROMISE framework is a systems thinking approach to sustainability strategy developed by Massachusetts Institute of Technology (MIT) Sloan School of Management researchers John D. Sterman, Jayson Jay and Roberto Rigobon [26]. It is an acronym representing Personal, Relational, Organizational, Market, Institutional, Social and Environmental [27].

“Personal” and “relational” category input variables of carbon trading involve personal and relational aspects, respectively, of carbon trading in construction. Personal carbon trading underscores the rights and roles of consumers through household use of energy [28]. It operates on the idea that individuals are allocated a carbon quota. The quota can be used entirely or partially sold to others [29]. Relational category explains the relationship between stakeholders in the carbon trading scheme [30]. Stakeholders for carbon trading in the construction industry include central government, local government, construction firms, individuals, environmental protection departments, non-governmental organizations, financial institutions, etc. [31].

“Organizational” category in carbon trading describes elements that influence the way organizations/firms work and behave. According to [32], organizational factors in carbon trading include corporate culture, environmental attitudes of organization, historical engagement, leadership abilities, innovation adoption, research and development, and technology use.

“Market” category input variables explain where buying and selling takes place. Market category variables encompass economic trends that affect demand and supply. Market category explains the elements where parties engage in exchange. In carbon trading, market mainly relates to the production and buying and selling of carbon credits [33].

“Institutional” category input variables include the irreplaceable role of government in carbon emissions reduction through carbon trading schemes [34]. Institutional factors include executive orders, laws, penalties, rewards, incentives, and compensations related to carbon trading for construction [35]. Carbon emission targets and policy tools based on these emissions targets for the construction industry are encompassed in the category called institutional [36].

“Social” category input variables are the elements of carbon trading that affect people within a society. Variables in carbon trading under social category include population, urbanization, social cost, etc. [37]. “Environmental” categorization variables in carbon trading relate to the environmental considerations of carbon trading including emissions of carbon dioxide.

Incorporating these seven categories in sustainability projects leads to better and successful projects. At each level of the framework, variables can be optimized [27]. The PROMISE framework, however, demonstrates at each level the qualities of a system: inter-dependencies, uncertainty, and feedback loops [26]. Some recent studies on sustainability have adopted the PROMISE framework for classifying their variables in sustainability-related projects. A notable example is the study by [38]. The study conducted research on sustainability adoption in universities.

2.2. Search for Articles

Scopus was chosen as the database for this literature review due to its advantages over other databases. Scopus has 20 percent more documents than Web of Science and a higher index rate than Google Scholar and PubMed [39]. The title, abstract and keywords were used for the search. Search queries were created for all the seven categorizations of the framework. The next stage was the exclusion criterion where the search was subsequently refined and limited to specific parameters. Language was restricted to English, and publications in German, Chinese, Italian, French, Spanish, Russian, Finnish, Korean and Portuguese were excluded. There were no restrictions in the document types, and hence journals, book chapters, books, conference proceedings, technical notes and reviews were all included. Subsequently there was no restriction in the document sources, and therefore, this study included journals, conference proceedings, books, book series and trade reports. Inclusion criteria included articles published from the year 2010 to 2025. After filtering, the final number of documents that were used for reviewing the variables in the framework included 67 documents, 82 documents, 58 documents, 123 documents, 89 documents, 35 documents, and 54 documents, respectively, for personal, relational, organizational, market, institutional, social, and environmental categories. Content analysis was then undertaken on the selected articles to identify the variables and assess the relationships among them.

2.3. Systems Dynamic—Causal Loop Diagram (CLD)

System Dynamics (SD) was adopted for evaluating the relationships among the variables in the theoretical framework. This was chosen due to its advantages as compared to the other techniques. System dynamics (SD) is a methodology utilized for systems modelling and dynamic simulation. It analyzes the dynamic complexities that are involved in socio-economic systems. SD assists decision makers in understanding the dynamics and structure of complex situations. SD also designs influential policies to facilitate change, sustained improvement and successful implementation of projects [40]. SD has increasingly been adopted by researchers and academicians to better appreciate different environmental, economic and social systems through a holistic lens.

SD modelling is an appropriate modelling technique for dynamic environments with multi-dimensional size that have variables which are time-dependent such as energy and power systems [41]. Carbon trading is a multi-faceted area and cuts across the research areas of economic, ecosystems, transportation, and energy management. This study's theoretical framework adopted Causal Loop Diagrams to illustrate the positive and negative influences among the variables. Causal loop diagrams in the model were used in describing the conceptual model structure obtained from the researchers' /modelers' understanding of the system. According to Park, Nepal and Dulaimi [42] and Xia, Chen, Walliah, Buys, Skitmore and Susilawati [43], causal loop diagram (CLD) is used to illustrate the dynamic nature of variables in a study. For this study, diagrams were sketched to indicate the architecture and boundary of the model causal loop. Model causal loop diagrams provide an understanding of how variables relate with one another in the system.

Stella Architect version 3.7.1 was the software adopted for the Causal Loop System Dynamic Modelling. Stella is an abbreviation for Systems Thinking Experimental Learning Laboratory with Animation [44]. This software enables its users to run models in the form of graphical diagrams of a system [45]. As compared to other major system dynamic software such as Vensim and Insightmaker, Stella Architect has better presentations, and speed for simulation is fast [46,47].

3. Analysis and Discussion

3.1. Influence of "Personal" Variables on Variables in Same Category/Other Categories

Awareness of the role of carbon trading in mitigating emissions in the construction industry influences support for carbon trading initiatives in the construction industry [48,49]. As awareness increases, there is stimulation in policy adoption, public engagement, and emissions reductions, thereby creating a reinforcing loop of support for the initiatives that relate to carbon trading in construction [50,51].

Public doubts have an influence on support for carbon trading in the construction industry. Increased public doubts lead to reduced support for carbon trading initiatives in the construction industry [52]. Certain individuals or groups may have doubts about carbon trading schemes for the construction industry [53]. This can lead to the dissemination of false or misleading information on claims about the effectiveness or costs of carbon trading in the construction industry [54].

Ethical individuals influence adoption of carbon trading in construction. Ethical individuals encourage the prioritization of trust building among stakeholders regarding carbon trading [55]. They do so by ensuring ethical and transparent carbon trading activities in the construction industry [56]. The commitment by ethical individuals to honesty and integrity leads to credibility and trust [57,58]. This improves confidence of stakeholders in carbon reduction efforts by organizations, as well as their willingness to partake in carbon trading [59].

Accountability by stakeholders influences integrity in carbon trading. When stakeholders are accountable for any action they take, it motivates them to enhance transparency, which causes a positive increase in integrity [60]. This leads to the stakeholders disclosing relevant information openly without hiding it [61,62]. This results in increased credibility and trust in carbon trading system, thereby strengthening the commitment of stakeholders to transparency and accountability [63,64].

Personal capacity influences adoption of carbon trading. Personal capacity has an influence on the adoption of carbon trading. Personal capacity is the ability of individuals to access skills, resources, time, and finances that promote how they engage in carbon trading [65,66]. Personal capacity leads to increased participation in carbon

trading, since individuals become actively involved in carbon trading initiatives in the construction industry [67].

Attitudes of individuals influence reduction in carbon emissions. Attitudes of individuals have an influence on the overall reduction in carbon emissions [68]. Individuals' attitudes represent the values, beliefs, and perceptions that individuals have concerning carbon trading [69]. Positive attitudes regarding carbon trading do encourage individuals to actively partake in related activities like purchase of carbon credits and investment in emissions reduction projects [70,71].

Table 1 and Figure 1 below show the influences “personal” variables have on variables in same category/other categories.

Table 1. Influence of “Personal” variables on variables in same category/other categories.

Preceding Factor	Categorization of Preceding Factor	Influence (+/−) →	Succeeding Factor	Categorization of Succeeding Factor	References
Ethical individuals	Personal	+	Adoption of carbon trading	Personal	[72,73]
Level of accountability by stakeholders	Personal	+	Integrity in carbon trading	Personal	[60,74]
Ethical individuals	Personal	+	Innovation in carbon trading	Organizational	[75,76]
Level of awareness of carbon trading	Personal	+	Adoption of carbon trading	Personal	[23,77]
Level of personal experience	Personal	+	Adoption of carbon trading	Personal	[78]
Level of awareness of carbon emissions	Personal	+	Energy consumption reduction actions	Personal	[3,79]
Level of personal capacity	Personal	+	Adoption of carbon trading	Personal	[80–82]
Individuals' attitudes towards carbon trading	Personal	−	Carbon emissions	Environmental	[83,84]
Individual perception of risks	Personal	−	Adoption of carbon trading	Personal	[83,85]
Level of awareness of role of carbon trading	Personal	+	Support for carbon trading initiatives	Relational	[23,86]
Level of public doubts	Personal	−	Support for carbon trading initiatives	Relational	[54,64]
Personal networks	Personal	+	Adoption of carbon trading	Personal	[79,83]
Personal motivation	Personal	+	Adoption of carbon trading	Personal	[87,88]

3.2. Influence of “Relational” Variables on Variables in Same Category/Other Categories

Level of collaboration in carbon trading influences technological innovation. Level of collaboration in carbon trading in the construction industry has a significant impact on technological innovation within the construction industry. Collaboration in carbon trading facilitates exchange and knowledge sharing among stakeholders in the construction industry [89]. These include sharing of lessons learnt, best practices, and innovative technologies that relate to reduction in carbon emissions and trading [90,91].



Figure 1. Causal loop diagram (CLD) for influence of “personal” variables on variables in same category/other categories.

Stakeholder engagement influences participation in carbon trading. Stakeholder engagement denotes the interaction, involvement, and commitment of different parties such as government agencies, construction firms, local communities, and non-governmental organizations (NGOs) in carbon trading projects [92]. It also depicts the level to which stakeholders actively partake in collaborative efforts, decision-making processes, and discussions that relate to carbon emissions reduction projects [93].

Knowledge sharing influences capacity building. As knowledge sharing increases in the construction sector, stakeholders have access to valuable experiences, information and insights that concern carbon trading practices [94,95]. Increased knowledge stimulates the understanding of stakeholders regarding carbon trading mechanisms, market trends, regulatory requirements, and technological innovations [96,97]. As stakeholders become more informed and knowledgeable on carbon trading, they are better equipped to engage in capacity building activities that develop their competencies, skills, and capabilities in the field [93].

Table 2 and Figure 2 below show the influences “relational” variables have on variables in same category/other categories.

Table 2. Influence of “Relational” variables on variables in same category/other categories.

Preceding Factor	Categorization of Preceding Factor	Influence (+/−) ➡	Succeeding Factor	Categorization of Succeeding Factor	References
Level of knowledge sharing	Relational	+	Capacity building	Organizational	[98]
Level of collaboration in carbon trading	Relational	+	Technological innovation	Organizational	[89,99]
Level of community engagement	Relational	+	Social impact of carbon trading	Social	[100,101]
Level of stakeholder engagement	Relational	+	Participation in carbon trading	Institutional	[85]
Willingness to collaborate in carbon trading	Relational	+	Carbon price	Market	[102]

lifecycle [51,110]. These include sustainable construction methods, advancements in materials that are energy-efficient, and integration of renewable energy [111].

Positive influence exists between subsidies and investment in energy efficiency. Subsidies have a significant influence on energy efficiency in carbon trading in the construction industry [112,113]. Subsidies provide financial incentives for construction companies to invest in energy-efficient materials, technologies, and practices [114,115]. These subsidies offset upfront costs that are associated in the implementation of energy-efficient projects, making these investments more financially attractive [116,117].

The number of carbon trading projects by construction firms influences certification of emissions reduction costs. The number of carbon trading projects undertaken by construction firms has an influence on certification of emissions reduction costs [118,119]. As the number of projects increase, there exist more opportunities in generating carbon credits through emissions mitigation activities [120,121].

Table 3 and Figure 3 below show the influences “organizational” variables have on variables in same category/other categories.

Table 3. Influence of “Organizational” variables on variables in same category/other categories.

Preceding Factor	Categorization of Preceding Factor	Impact (+/−) →	Succeeding Factor	Categorization of Succeeding Factor	References
Research and development (R&D)	Organizational	+	Innovation capability of construction firms	Organizational	[99,122]
Incentives	Organizational	+	Investment in energy efficiency	Institutional	[123]
Subsidies	Organizational	+	Investment in energy efficiency	Institutional	[124]
Level of complexity of project	Organizational	+	Transaction costs	Market	[125]
Technological innovation	Organizational	+	Participation in carbon sequestration projects	Organizational	[99]
Incentives	Organizational	−	CO ₂ emissions	Environmental	[126,127]
Size of construction projects	Organizational	+	CO ₂ emissions	Environmental	[128–130]
Number of carbon trading projects by construction firms	Organizational	+	Certification of emissions reduction costs	Institutional	[131]
Number of carbon trading projects by firms	Organizational	+	Verification of emissions reduction costs	Institutional	[76,132]
Carbon quotas by firms	Organizational	+	Demand for carbon credits	Market	[33,109,126]
Standardization of documents for carbon trading	Organizational	−	Transaction costs	Market	[133]
Technology transfer	Organizational	+	Economic viability of carbon trading projects	Market	[134,135]
Technological innovation	Organizational	+	R&D of low-carbon technologies	Organizational	[136,137]
Technological innovation	Organizational	+	Clean energy	Environmental	[99]
R&D	Organizational	+	Demand for carbon credits	Market	[109,135,138]
R&D investment	Organizational	+	Energy efficiency	Organizational	[109,135,138]
Incentives	Organizational	+	Investment in energy efficiency	Institutional	[127,139]

Table 3. Cont.

Preceding Factor	Categorization of Preceding Factor	Impact (+/−)	Succeeding Factor	Categorization of Succeeding Factor	References
Technological innovation	Organizational	+	Participation in carbon sequestration projects	Environmental	[140]
Incentives	Organizational	+	Carbon reduction projects	Environmental	[127,141]

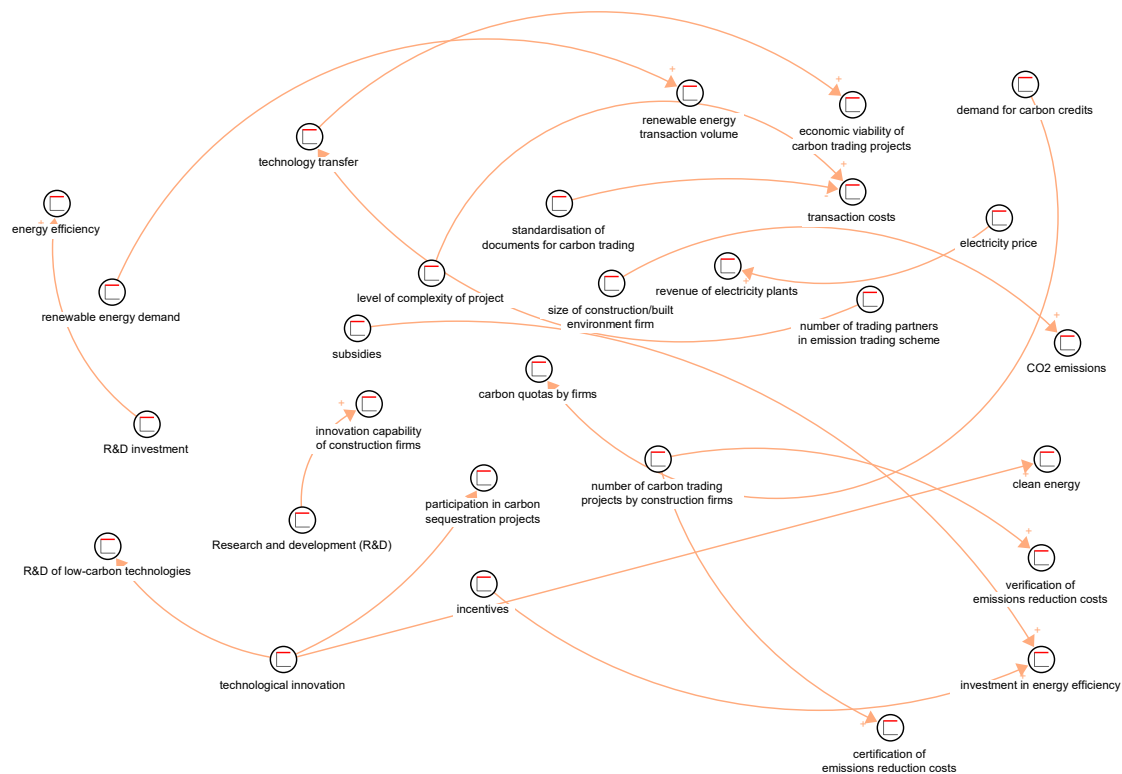


Figure 3. Causal loop diagram (CLD) for Influence of “organizational” variables on variables in same category/other categories.

3.4. Influence of “Market” Variables on Variables in Same Category/Other Categories

Economic growth rate influences carbon emissions. According to Wang, Qu, Wang and Xie [142], higher growth rate in the economy translates to corresponding higher emissions in carbon dioxide by the construction industry. The influence that economic growth rate has on carbon emissions by the construction industry is significant [143]. As economic growth rate increases, there is corresponding increase in demand for construction activities, as well as new infrastructure like residential buildings and commercial properties [144]. Increased construction activities lead to higher carbon emissions levels, arising from construction processes like transportation, material extraction and on-site activities [145,146]. There is influence between economic growth and technological innovation. Economic growth influences technological innovation in the construction industry [147]. This occurs through adopting energy-efficient and sustainable practices [148]. Investments in Research and Development (R&D) by the construction industry lead to developing renewable energy technologies, green building materials and construction techniques that are energy efficient [149–151].

Demand for carbon credits influences transaction costs. High demand for carbon credits in the construction sector influences transaction costs [152,153]. This arises from competition among purchasers and regulatory requirements [54,154]. Increased demand for carbon credits causes more transaction activities, since construction companies seek to

purchase carbon credits in order to achieve their compliance obligations and also offset their emissions [155,156].

Profit of firms in carbon trading influences GDP. When firms involved in carbon trading derive high profits, it leads to a positive impact on productivity and economic performance [153,157]. Increased profits translate into more investments by construction companies leading to economic growth and better GDP [144]. Increase in GDP is reflected in the total economic output that arises from the construction sector and from carbon trading [158,159]. As GDP increases, the right environment is provided for companies to make more profits, further leading to more carbon trading investments [160,161].

Table 4 and Figure 4 below show the influences “market” variables have on variables in same category/other categories.

Table 4. Influence of “Market” variables on variables in same category/other categories.

Preceding Factor	Categorization of Preceding Factor	Impact (+/−) →	Succeeding Factor	Categorization of Succeeding Factor	References
Economic Growth Rate	Market	+	Carbon emissions	Environmental	[162]
GDP	Market	+	Investment in energy-reduction technology	Institutional	[134]
GDP	Market	+	Energy consumption	Organizational	[163,164]
GDP growth rate	Market	+	GDP	Market	[136]
Carbon quota price	Market	+	Revenue of carbon quota	Market	[33,126,165]
Number of trading entities	Market	−	Monopolistic behavior	Market	[162,166]
Carbon credits	Market	+	Use of renewable energy	Organizational	[136,138]
Purchasing Power Parity (PPP)	Market	+	Energy demand	Market	[167]
Carbon allowance demand	Market	+	Carbon allowance price	Market	[134]
Carbon allowance price	Market	+	Carbon allowance demand	Market	[134,168]
Revenue of firms in carbon trading	Market	+	Profit of firms in carbon trading	Market	[169]
Carbon credit price	Market	−	Demand for carbon credits	Market	[165]
Demand for carbon credits	Market	+	Level of carbon credit consumption	Market	[138,165]
Carbon credit price	Market	+	Producer price index for construction industry	Market	[170]
Carbon credit price	Market	+	Prices of building and construction materials	Market	[168,171]
Energy gap	Market	+	Energy policies	Institutional	[172]
Energy supply	Market	−	Energy gap	Market	[172]
Electricity demand	Market	+	GDP	Market	[138]
Number of trading partners in emissions trading scheme	Market	−	Transaction costs	Market	[152]
Demand for carbon credits	Market	+	Carbon credit price	Market	[33,165]
Quantity of carbon allowances	Market	+	Cost of legal transactions	Institutional	[134]

Table 4. Cont.

Preceding Factor	Categorization of Preceding Factor	Impact (+/−)	Succeeding Factor	Categorization of Succeeding Factor	References
Demand for carbon credits	Market	+	Transaction costs	Markets	[173]
Profit of firms in carbon trading	Market	+	GDP	Market	[171,172,174]
Profit of firms in carbon trading	Market	+	R&D investment	Organizational	[109,173]
Carbon trading volume	Market	+	Non-performing quota	Market	[126,138,175]
Carbon emissions costs of firms	Market	−	Profit of firms in carbon trading	Market	[134]
Carbon credit supply	Market	−	Carbon credit price	Market	[33,134,165,176,177]
Demand for carbon credits	Market	+	Purchase of carbon credits	Market	[33,178]
Economic growth	Market	+	Energy consumption	Institutional	[20,179]
GDP	Market	+	Per capita GDP	Market	[180,181]

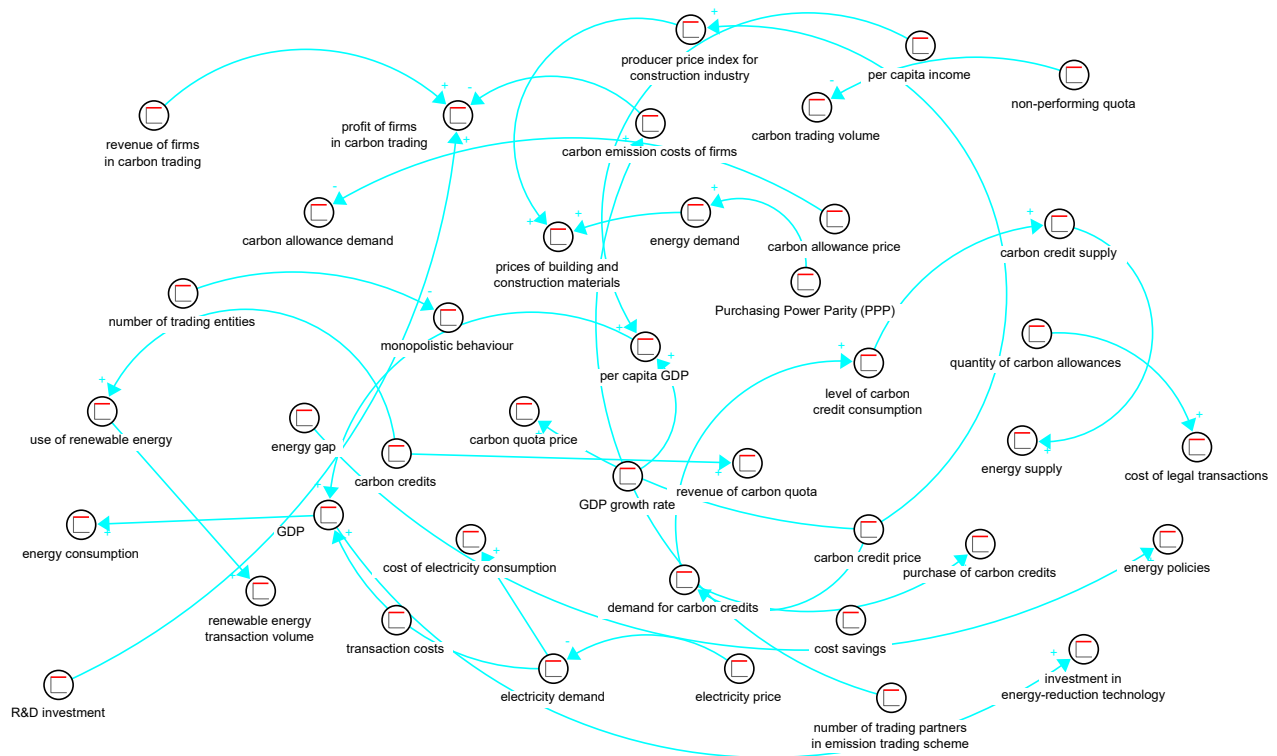


Figure 4. Causal loop diagram (CLD) for influence of “market” variables on variables in same category/other categories.

3.5. Influence of “Institutional” Variables on Variables in Same Category/Other Categories

Investment in carbon offsetting projects influences generation of carbon credits. When construction companies invest in projects that remove or reduce carbon dioxide (CO₂) emissions from the atmosphere, it leads to generation of carbon credits [182]. Carbon offsetting projects include methane capture, afforestation, reforestation, renewable energy installations and energy efficiency initiatives [183,184]. Depending on the scale and type of offset project as well its compliance with recognized standards like Clean Development Mechanism (CDM) or Verified Carbon Standard (VCS), it can generate carbon credits [185,186].

Government investment influences subsidies. Increase in government subsidies during carbon trading serves as a source of financial provision for construction firms that engage in carbon emissions reduction projects or for firms that purchase carbon credits [89,187,188]. The presence of subsidies serves as an incentive in the adoption of cleaner technologies, participation in carbon trading schemes, and investment in emissions reduction initiatives that result in carbon emissions [189,190].

Free allocation of permits influences profits by firms trading. Free allocation of permits in carbon trading enables firms to receive specific amounts of carbon emissions allowances for free [126]. This permits these firms to emit certain quantities of carbon without having to purchase additional permits [191]. In carbon trading, free allocation of permits minimizes operational costs that come with compliance with regulations [192,193]. This positively impacts the profits accrued by firms that partake in carbon trading [194,195].

Table 5 and Figure 5 below show the influences “institutional” variables have on variables in same category/other categories.

Table 5. Influence of “Institutional” variables on variables in same category/other categories.

Preceding Factor	Categorization of Preceding Factor	Impact (+/−) ➡	Succeeding Factor	Categorization of Succeeding Factor	References
Technology investment	Institutional	−	CO ₂ emissions	Environmental	[134,138]
CO ₂ emissions reduction target	Institutional	−	CO ₂ emissions	Environmental	[126,136,196]
Government investment	Institutional	+	Subsidies	Organizational	[122,197]
Level of free allocation of permits	Institutional	+	Profits by firms trading	Market	[107]
Unit subsidy	Institutional	−	Participation in carbon trading	Personal	[198]
Level of government intervention	Institutional	−	CO ₂ emissions	Environmental	[197,199]
Fines	Institutional	+	Compliance to carbon trading	Institutional	[200]
Auction allocation	Institutional	+	Demand for carbon credits	Market	[134]
Level of government commitment to decarbonization	Institutional	+	Renewable energy adoption	Organizational	[108,201]
Carbon offset monitoring	Institutional	+	Decarbonization in built environment	Environment	[136]
Carbon allowance price cap	Institutional	−	Demand for carbon credits	Market	[135,177]
Level of political acceptability	Institutional	+	Carbon trading efficiency	Organizational	[126,136]
Level of government investment	Institutional	+	Demand for carbon credits	Market	[108]
Emissions cap	Institutional	+	Carbon credit price	Market	[105]
Carbon trading regulatory frameworks	Institutional	+	Transaction costs	Market	[200,202]
CO ₂ emissions reduction target	Institutional	−	Energy consumption	Organizational	[136,163]
Free quotas	Institutional	+	Carbon trading participation	Personal	[33,202]
Cap on offsets	Institutional	+	Cost savings	Market	[134]
Investment in energy-reduction technology	Institutional	−	CO ₂ emissions	Environmental	[126,134]

Table 5. Cont.

Preceding Factor	Categorization of Preceding Factor	Impact (+/−) ➡	Succeeding Factor	Categorization of Succeeding Factor	References
Level of government monitoring	Institutional	+	Non-compliance penalties	Institutional	[203]
Level of government credibility during carbon trading	Institutional	+	Rate of government regulatory success	Institutional	[25]
Non-compliance penalties	Institutional	+	Enforcement costs of carbon trading	Institutional	[108,203]
Verification capacity of third-party agents	Institutional	+	Rate of government regulatory success	Institutional	[25]
Non-performing quota	Institutional	+	Fines of firms	Institutional	[33,134]
Fines of firms	Institutional	+	Carbon emissions costs of firms	Market	[3,204]
Free quota	Institutional	−	Carbon credit price	Market	[33,138,165]
Emissions tax income	Institutional	+	Government income	Market	[160]
Level of regulatory compliance	Institutional	−	Carbon emissions profile	Environmental	[202]
Level of Monitoring Reporting and Verification (MRV)	Institutional	+	Capacity Building	Organizational	[136,204]
Investment in carbon offsetting projects	Institutional	+	Generation of carbon credits	Market	[160]

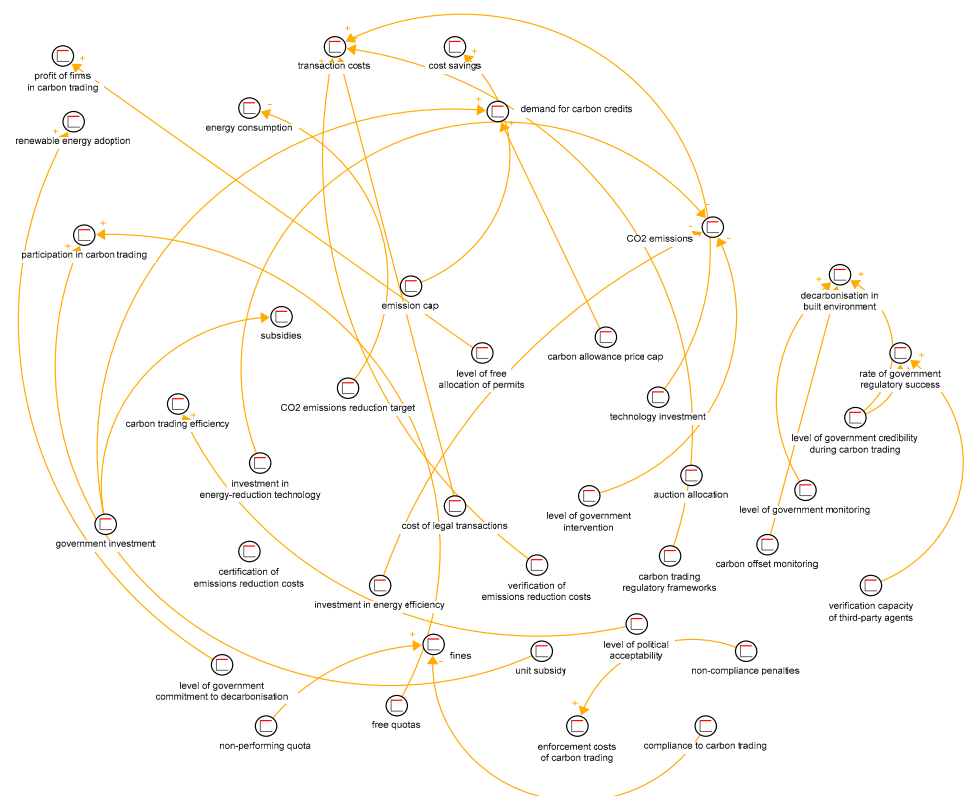


Figure 5. Causal loop diagram (CLD) for influence of “institutional” variables on variables in same category/other categories.

3.6. Influence of “Social” Variables on Variables in Same Category/Other Categories

Population influences population growth rate. Population growth rate also has an influence on population [205]. High population growth rate causes increased demand for

buildings and housing. This causes construction activities to increase to accommodate the increasing population [206]. This results in increased levels of carbon emissions arising from transportation, energy use and building materials [207].

Increasing population growth rate is often associated with urbanization as people move from rural communities to urban towns and cities for better living conditions [208,209]. Urbanization causes increased expansion in amenities such as roads, buildings, and utilities [210]. This ultimately increases emissions arising from construction activities.

Population growth rate influences per capita GDP [211,212]. Population growth rate is the extent to which a country or area's population increase with time [213]. Population growth rate is often measured as percentage change in population size from a period to another [214]. Population growth has an effect on demand and supply for construction labor [215]. Increasing population will cause high demand for construction activities leading to high levels of employment and high wages [216]. Population growth also has an influence on demand for infrastructure, buildings, and houses by consumers [206].

Table 6 and Figure 6 below show the influences “social” variables have on variables in same category/other categories.

Table 6. Influence of “Social” variables on variables in same category/other categories.

Preceding Factor	Categorization of Preceding Factor	Impact (+/−)	Succeeding Factor	Categorization of Succeeding Factor	References
Household size	Social	+	Energy consumption	Organizational	[217,218]
Population growth rate	Social	+	Population	Social	[136,181]
Urbanization	Social	+	Energy consumption	Organizational	[163]
Urbanization	Social	+	Per capita income	Market	[217]
Population growth rate	Social	+	Per capita GDP	Market	[180,181]
Social networks	Social	+	Adoption of carbon trading	Personal	[219]
Social networks	Social	+	Community impact of carbon trading	Social	[219]

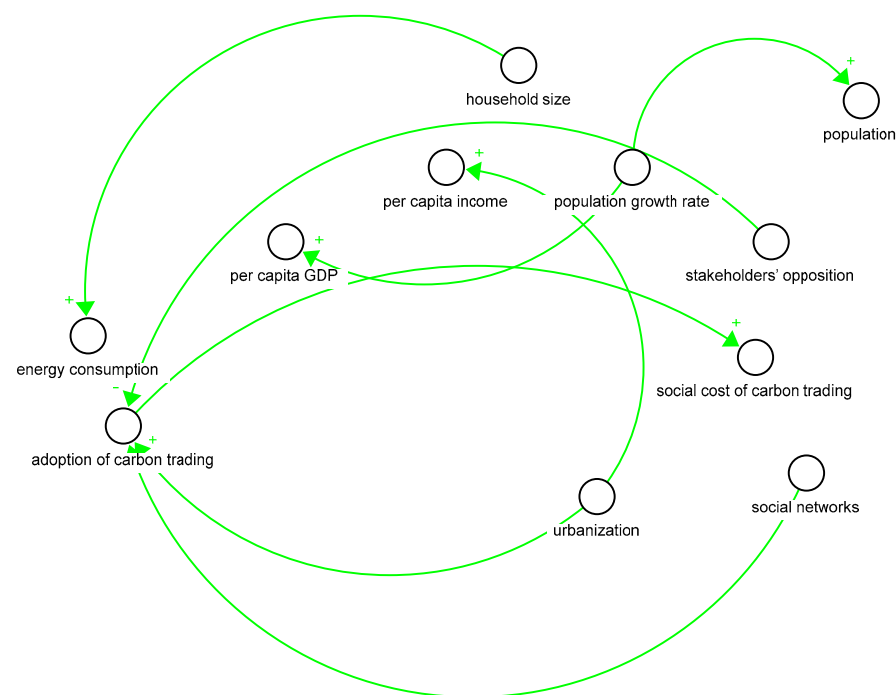


Figure 6. Causal loop diagram (CLD) for influence of “social” variables on variables in same category/other categories.

3.7. Influence of “Environmental” Variables on Variables in Same Category/Other Categories

There exists influence between fossil fuel and CO₂ emissions. Global energy supply for the built environment still mainly relies on fossil energy sources, which are mainly coal, oil, and gas [220]. As construction is one of the most energy consuming sectors in the world, it uses a lot of fossil fuels, thereby contributing to increased CO₂ emissions [107].

Carbon emissions reduction influences cost savings. Adoption of sustainability practices results in lower carbon emissions as material waste and energy consumption are reduced [221]. Construction companies obtain cost savings over time since they consume lower energy, use less resources and incur lower expenses that are related to carbon offset purchases or emissions allowances [222,223].

CO₂ emissions influence carbon trading volume. Influence of CO₂ emissions on the carbon trading volume in the construction industry is diverse and there are both direct and indirect effects. When there are higher levels of CO₂ emissions arising from the construction industry, this triggers very strict regulatory requirements towards reduction in emissions [224]. Regulatory bodies or governments will impose targets and caps on carbon emissions, thereby leading to increased carbon trading participation in compliance with the regulations [202].

Table 7 and Figure 7 below show the influences “environmental” variables have on variables in same category/other categories.

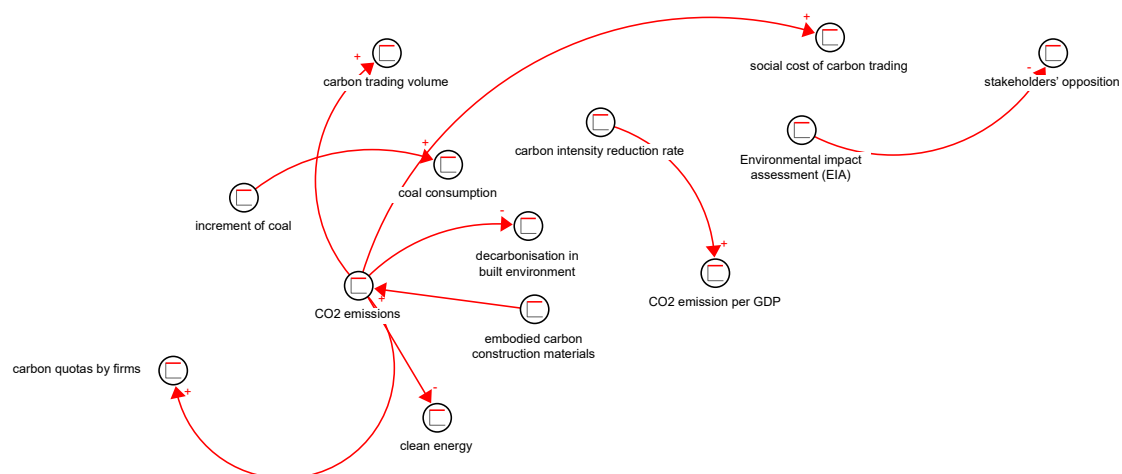


Figure 7. Causal loop diagram (CLD) for influence of “environmental” variables on variables in same category/other categories.

Table 7. Influence of “Environmental” variables on variables in same category/other categories.

Preceding Factor	Categorization of Preceding Factor	Impact (+/−)	Succeeding Factor	Categorization of Succeeding Factor	References
Increment of coal	Environmental	+	Coal consumption	Environmental	[138,220]
Embodied carbon construction materials	Environmental	+	CO ₂ emissions	Environmental	[225,226]
CO ₂ emissions	Environmental	−	Carbon quotas by firms	Organizational	[33,136,163, 227]
CO ₂ emissions	Environmental	+	Social cost of carbon trading	Social	[160,219]
Fossil energy consumption	Environmental	+	CO ₂ emissions	Environmental	[164,220]
CO ₂ emissions	Environmental	+	Carbon trading volume	Market	[138,163]

Table 7. Cont.

Preceding Factor	Categorization of Preceding Factor	Impact (+/−) ➡	Succeeding Factor	Categorization of Succeeding Factor	References
Environmental impact assessment (EIA)	Environmental	−	Stakeholders' opposition	Relational	[197,228]
Construction activities	Environmental	+	Carbon emissions profile	Environmental	[20,160,229]
CO ₂ emissions	Environmental	+	Carbon intensity in the construction industry	Environmental	[230]
CO ₂ emissions reduction	Environmental	+	Cost savings	Market	[230]

4. Theoretical Framework for Carbon Trading Based on PROMISE Framework

The theoretical framework was developed by explaining the interactions in all seven categories, and how they were combined to show the relationships among the variables in their categories and with other categories. In this study, the framework was based on the interaction and influences among the categorization of all the seven categories using the PROMISE framework. The foremost process in carbon trading is setting a cap. The cap implies the uppermost limit of greenhouse gas that is allowed in the trading scheme. It also represents the total number of allowances that covered entities can have access to. The setting of the cap corresponds with the baseline against which emissions must be reduced. In setting the cap, historical emissions are set against a base year or projected future emissions. A maximum cap is set by the government on the number of permits. These trading permits can be bought from other firms in the trading market or they can be purchased from the government [229]. The allowances from government are either free or auctioned. These variables have interactions among other variables in their categories and other categories. Some of the variables include emissions cap, carbon allowance price cap, free quota, carbon intensity reduction rate, CO₂ emissions, auction allocation, level of free allocation of permits [3,126,181,231].

Purchasing of economic carbon credits or carbon offsets is another major process of carbon trading through which buildings in the construction industry can minimize their net environmental impact. These carbon credits come in the form of tradable certificates awarded to firms to lower the content of carbon released in the atmosphere. This can come in the form of carbon capture and sequestration. From the PROMISE framework categorization, the majority of the variables for purchasing carbon credits fall under market categorization. However, they have an influence on other factors in the market categorization and variables in the other categories. Some of these variables include carbon credit price, demand for carbon credits, level of carbon credit consumption, quantity of carbon allowances, profit of firms in carbon trading, carbon trading volume, transaction costs [8,33,136,165,169,188].

A further major process is Monitoring, Reporting and Verification (MRV). MRV consists of multiple steps involved in measuring emissions removed by polluting firms and certifying that the removals are truly real, additional, permanent, and verifiable. This is then reported to a third-party agent that is accredited to certify that the removal was completed according to the right MRV protocols. The verification of carbon credits is a rigorous process, and the end goal is to ensure legitimacy of the credits. This verification process starts with the project developers and firms that implement activities that reduce carbon emissions. The developers/firms must provide evidence of reduction in carbon through the monitoring of data, project reports and other required documents.

Figure 8 below shows the theoretical framework based on the PROMISE framework that is developed for construction industry carbon trading.

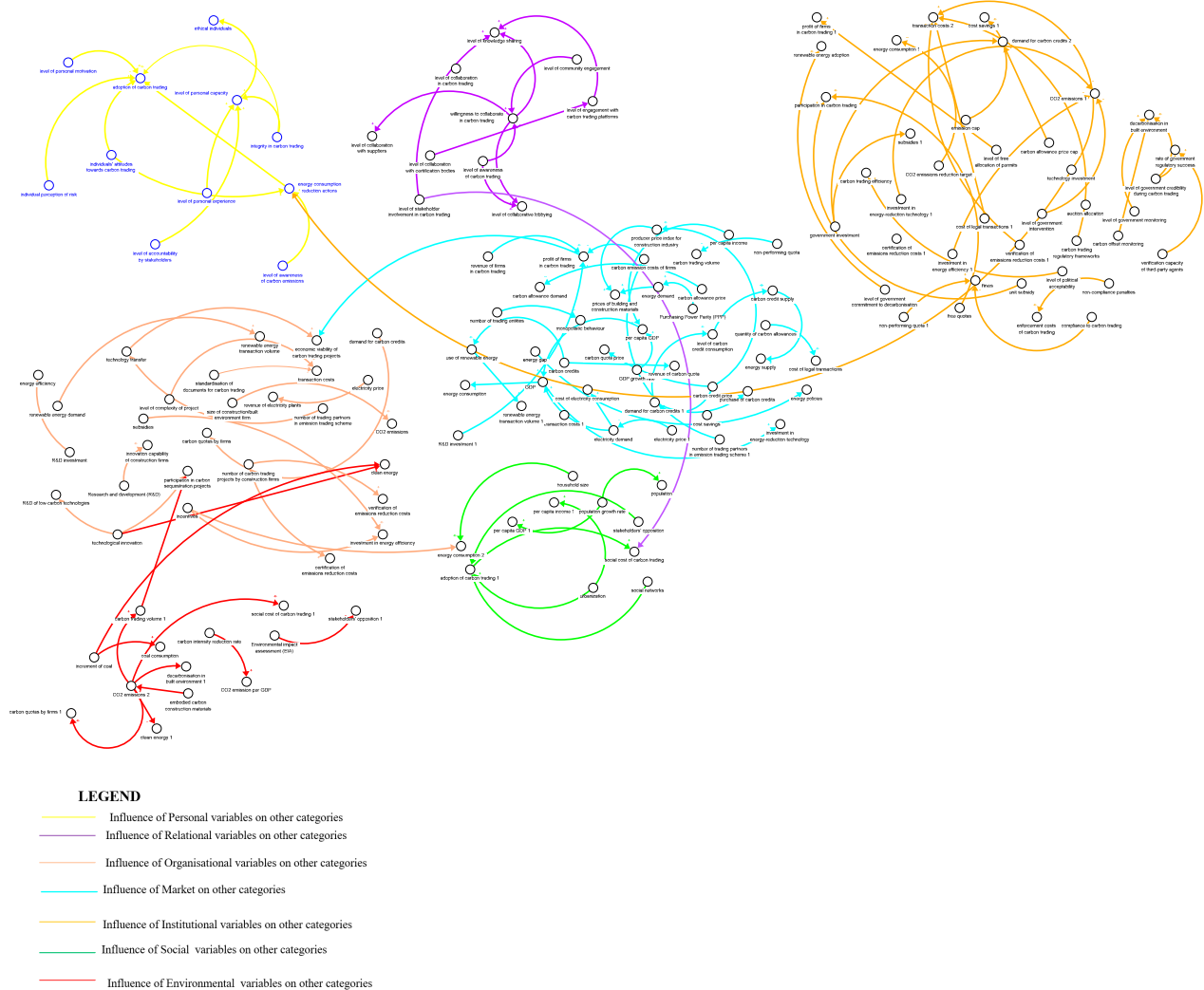


Figure 8. Theoretical framework for carbon trading system based on PROMISE framework.

5. Validation of Theoretical Framework

5.1. Expert Forum Validation of Framework

To validate the theoretical framework for construction industry carbon trading, an expert forum was consulted. This was to seek expert opinions on the suitability of the framework. Ethics approval was sought from the University Human Research Ethics Committee (HREC). Twenty experts knowledgeable in system dynamics and carbon trading as well as sustainability were contacted from the Australian construction industry. The inclusion criterion was that they should have been working for at least ten years. Out of twenty expert forum guides sent out, twelve were returned, representing a response rate of sixty percent. Ten of the respondents had postgraduate degrees, with the remaining two having a first degree. For professional bodies they belonged to, these comprised Australian Institute of Project Management (AIPM), Australian Institute of Quantity Surveyors (AIQS), Australian Sustainable Built Environment Council (ASBEC), Royal Institution of Chartered Surveyors (RICS) and Engineers Australia (EA).

They were asked to rank four validation questions on a Likert scale of 1 to 5 with 1 being strongly disagree and 5 being strongly agree. They were also provided a box to provide any further comments they may have on the framework. The results are presented in Table 8 below. All respondents agreed on the suitability of the theoretical framework. When asked for further comments, one expert recommended all the colors in the framework

be made black to ensure consistency. However, authors believe it is best to maintain the different colors since they represent different groups in the framework. Another expert suggested only initials of variables be used in the theoretical framework to keep things simple. The authors, however, believe that using only initials would make it difficult for the components of the framework to be understood, and hence, words should rather be maintained. The remaining experts indicated the framework was okay.

Table 8. Expert validation of framework results.

Nr.	Validation Questions	Mean	Standard Deviation
1	The theoretical framework developed is reasonable	3.98	0.896
2	The theoretical framework is feasible to be applied during stock and flow equation stage of system dynamics	4.39	0.713
3	The theoretical framework supports decision making regarding carbon trading	4.08	0.804
4	The theoretical framework is sufficient to be implemented	4.12	0.987

5.2. Databases for Stock and Flow Equations and Mathematical Modelling

The next stage after the theoretical framework is the quantitative modelling using stock and flow diagrams in system dynamics. Table 9 below presents some of the databases that will be adopted in deriving secondary data for the mathematical modelling. The predominant ones will be Australian Bureau of Statistics (ABS), Australian Renewable Energy Agency (ARENA), Australian National Environment Protection Council, Climate Change Authority, Bureau of Meteorology, Clean Energy Finance Corporation, Nationwide House Energy Rating Scheme (NatHERS), Carbon Footprint Factsheet, Centre for Climate and Energy Solutions, Green Building Council Australia (GBCA), CSIRO Energy, New South Wales State of Environment, Built Environment Carbon Database (BECD), Environmental Protection Agency (EPA), United Nations Framework Convention on Climate Change (UNFCCC).

Table 9. Databases for secondary data to be used for modelling.

Nr.	Variable	Database
1	CO ₂ emissions reduction target	United Nations Framework Convention on Climate Change (UNFCCC), Green Building Council Australia (GBCA)
2	Population growth rate	Australian Bureau of Statistics (ABS)
3	Monitoring, Reporting and Verification	International Carbon Action Partnership (ICAP), Australian National Environment Protection Council (NEPC)
4	Penalties for non-compliance	Centre for Climate and Energy Solutions, Carbon Market Institute (CMI)
5	Carbon trading incentives	Clean Energy Finance Corporation (CEFC)
6	Allocation of carbon credits	Clean Energy Regulator (CER)
7	Carbon trading profit	Carbon Market Institute (CMI)
8	Transfer of technology	CSIRO Energy
9	Carbon trading projects by construction firms	National Australian Built Environment Rating System (NABERS)
10	Collaboration with certification bodies	Centre for Climate and Energy Solutions

5.3. Modelling Tests to Be Adopted During System Dynamic Simulations

Model testing is important since it checks for flaws in models and sets the tone for improving them [232]. Following the recommendation of Forrester [233], this study will perform several model tests such as boundary adequacy test, structural and behavior tests, dimensional consistency tests, extreme conditions test and behavior reproduction test.

Structural and behavior tests will check if the system model under-predicts or over-predicts the inherent behaviors and patterns in the carbon trading model. Dimensional consistency tests will check if the equations used in the models are consistent and correspond to the linkages depicted in the causal loop diagrams. Boundary adequacy tests will check for dynamic changes in endogenous and exogenous variables. Behavior reproduction tests will check different modes of model behavior that are inherent in real systems. Extreme conditions test will involve ascertaining the validity of model equations by giving extreme values to the input factors.

6. Conclusions and Recommendations

This study sought to fill the gap of current trading schemes not focusing on construction by developing a theoretical framework based on the PROMISE framework. The developed framework in the study explains the mechanisms and relationships behind the constructs in a carbon trading framework. Carbon trading projects that are sustainability-oriented start with people (personal) and the interactions among stakeholders (relational). Firms are involved in these projects (organizational), and they are influenced by market conditions (market). The governments as well as other major stakeholders partake in the carbon trading projects (institutional). A broader group of stakeholders involves the society that is affected by these projects (social). Natural resources further have a role to play in sustainability-related projects (environment). The variables in these seven categories have an influence on each other. Causal loop diagrams (CLDs) were used to evaluate and illustrate the influences (positive and negative) among the relationships.

This research on carbon emissions trading has varying implications ranging from policy, theoretical, practical, and empirical contributions. This theoretical study contributes methodologically to investigating carbon reduction research. This theoretical technique minimizes subjectivities and biases that are often associated with purely systematic literature reviews. This study formulates sound policies and best practices to ensure the construction industry meets its carbon emissions reduction targets. Furthermore, the study provides a foundation for future researchers to develop conceptual frameworks and models for carbon mitigation strategies. For policy makers, the proposed carbon trading framework assists in evaluating the key legal, economic, environmental, and political policies that improve carbon trading projects in the built environment. When policy makers place significant emphasis on the influences identified in this study, it will contribute to them supporting regulations and policies that effectively mitigate these emissions.

In the next stage of this ongoing research, the remaining steps involved in the system dynamics (SD) technique will be used to model the relationship among the various components. Stock and flow diagrams will be developed next. The interactions in these models will comprise model verification, model development, model testing and model simulations.

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References

1. Kukah, A.S.K.; Jin, X.; Osei-Kyei, R.; Perera, S. Theoretical framework for carbon trading in the built environment. *J. Eng. Des. Technol.* **2024**, *23*, 1573–1591. [\[CrossRef\]](#)
2. Lan, J.; Li, W.; Zhu, X. The road to green development: How can carbon emission trading pilot policy contribute to carbon peak attainment and neutrality? Evidence from China. *Front. Psychol.* **2022**, *13*, 962084. [\[CrossRef\]](#)
3. Lin, B.; Huang, C. Analysis of emission reduction effects of carbon trading: Market mechanism or government intervention? *Sustain. Prod. Consum.* **2022**, *33*, 28–37. [\[CrossRef\]](#)
4. Hu, S.; Zhang, Y.; Yang, Z.; Yan, D.; Jiang, Y. Challenges and opportunities for carbon neutrality in China's building sector—Modelling and data. In Proceedings of the Building Simulation, Copenhagen, Denmark, 22–23 August 2022; pp. 1–23.
5. Liu, Z.; Deng, Z.; He, G.; Wang, H.; Zhang, X.; Lin, J.; Qi, Y.; Liang, X. Challenges and opportunities for carbon neutrality in China. *Nat. Rev. Earth Environ.* **2022**, *3*, 141–155. [\[CrossRef\]](#)
6. Meena, C.S.; Kumar, A.; Jain, S.; Rehman, A.U.; Mishra, S.; Sharma, N.K.; Bajaj, M.; Shafiq, M.; Eldin, E.T. Innovation in Green Building Sector for Sustainable Future. *Energies* **2022**, *15*, 6631. [\[CrossRef\]](#)
7. Thompson, N.M.; Hughes, M.N.; Nuworsu, E.K.; Reeling, C.J.; Armstrong, S.; Mintert, J.; Langemeier, M.; DeLay, N.; Foster, K. Opportunities and challenges associated with “carbon farming” for US row-crop producers. *Choices* **2022**, *37*, 1–10.
8. Lin, B.; Jia, Z. What are the main factors affecting carbon price in Emission Trading Scheme? A case study in China. *Sci. Total Environ.* **2019**, *654*, 525–534. [\[CrossRef\]](#) [\[PubMed\]](#)
9. Fang, G.; Tian, L.; Liu, M.; Fu, M.; Sun, M. How to optimize the development of carbon trading in China—Enlightenment from evolution rules of the EU carbon price. *Appl. Energy* **2018**, *211*, 1039–1049. [\[CrossRef\]](#)
10. Michaelowa, A.; Shishlov, I.; Brescia, D. Evolution of international carbon markets: Lessons for the Paris Agreement. *Wiley Interdiscip. Rev. Clim. Change* **2019**, *10*, e613. [\[CrossRef\]](#)
11. Bodansky, D.M.; Hoedl, S.A.; Metcalf, G.E.; Stavins, R.N. Facilitating linkage of climate policies through the Paris outcome. *Clim. Policy* **2016**, *16*, 956–972. [\[CrossRef\]](#)
12. Keohane, N.; Peterson, A.; Hanafi, A. Toward a club of carbon markets. *Clim. Change* **2017**, *144*, 81–95. [\[CrossRef\]](#)
13. Bayer, P.; Aklın, M. The European Union emissions trading system reduced CO₂ emissions despite low prices. *Proc. Natl. Acad. Sci. USA* **2020**, *117*, 8804–8812. [\[CrossRef\]](#) [\[PubMed\]](#)
14. Hood, C. *Reviewing Existing and Proposed Emissions Trading Systems*; International Energy Agency: Paris, France, 2010.
15. Nong, D.; Nguyen, T.H.; Wang, C.; Van Khuc, Q. The environmental and economic impact of the emissions trading scheme (ETS) in Vietnam. *Energy Policy* **2020**, *140*, 111362. [\[CrossRef\]](#)
16. Yu, Z.; Geng, Y.; Dai, H.; Wu, R.; Liu, Z.; Tian, X.; Bleischwitz, R. A general equilibrium analysis on the impacts of regional and sectoral emission allowance allocation at carbon trading market. *J. Clean. Prod.* **2018**, *192*, 421–432. [\[CrossRef\]](#)
17. Xu, H.; Pan, X.; Li, J.; Feng, S.; Guo, S. Comparing the impacts of carbon tax and carbon emission trading, which regulation is more effective? *J. Environ. Manag.* **2023**, *330*, 117156. [\[CrossRef\]](#)
18. Rannou, Y.; Barneto, P.; Boutabba, M.A. Green Bond market vs. Carbon market in Europe: Two different trajectories but some complementarities. In *Recent Trends in Financial Engineering: Towards More Sustainable Social Impact*; World Scientific: Singapore, 2023; pp. 67–94.
19. Koriko, O. Appraisal of Carbon Trading Practices in the Construction Industry in Lagos State, Nigeria. Master's Thesis, Federal University of Technology, Akure, Nigeria, 2021.
20. Kukah, A.S.K.; Jin, X.; Osei-Kyei, R.; Perera, S. Towards developing a carbon trading system for the construction industry: Identification of major components. In Proceedings of the EC3 Conference, Crete, Greece, 10–12 July 2023; pp. 1–8.
21. Ng, S.T.; Luk, W.S. Applicability of existing carbon trading schemes to the construction industry. In Proceedings of the CESB 2013 PRAGUE-Central Europe Towards Sustainable Building, Prague, Czech Republic, 26–28 June 2013; pp. 753–756.
22. Oke, A.E.; Aliu, J.; Ebekozi, A.; Akinpelu, T.M.; Olatunde, T.M.; Ogunsanya, O.A. Strategic drivers for the deployment of energy economics principles in the developing construction industry: A Nigerian perspective. *Environ. Prog. Sustain. Energy* **2024**, *43*, e14351. [\[CrossRef\]](#)
23. Oke, A.E.; Oyediran, A.O.; Koriko, G.; Tang, L.M. Carbon trading practices adoption for sustainable construction: A study of the barriers in a developing country. *Sustain. Dev.* **2023**, *32*, 1120–1136. [\[CrossRef\]](#)

24. Song, X.; Lu, Y.; Shuai, C. Optimal Carbon Reduction Strategies in the Building Sector with Emission Trading System. *Energy Procedia* **2017**, *143*, 307–312. [\[CrossRef\]](#)
25. Song, X.; Shen, M.; Lu, Y.; Shen, L.; Zhang, H. How to effectively guide carbon reduction behavior of building owners under emission trading scheme? An evolutionary game-based study. *Environ. Impact Assess. Rev.* **2021**, *90*, 106624. [\[CrossRef\]](#)
26. Jay, J. PROMISE: A Systems Approach to Sustainability Strategy. MIT Sloan School of Management. PowerPoint Slides by Jason Jay, Webinar. 2012. Available online: <https://s3.amazonaws.com/sbweb/slideshow/SB+webinar+SSB+exec+ed+preview.pdf> (accessed on 20 September 2022).
27. Fischhoff, M.; Jay, J.; Sterman, J. *How to Handle Complexity*; Network for Business Sustainability: Toronto, ON, Canada, 2018.
28. Dally, D.; Rohayati, Y.; Kazemian, S. Personal carbon trading, carbon-knowledge management and their influence on environmental sustainability in Thailand. *Int. J. Energy Econ. Policy* **2020**, *10*, 609–616. [\[CrossRef\]](#)
29. Jiang, J.; Xie, D.; Ye, B.; Shen, B.; Chen, Z. Research on China's cap-and-trade carbon emission trading scheme: Overview and outlook. *Appl. Energy* **2016**, *178*, 902–917. [\[CrossRef\]](#)
30. Yang, Z.; Ju, M.; Zhou, Y.; Wang, Q.; Ma, N. An Analysis of Greenhouse Gas Emission Trading System from the Perspective of Stakeholders. *Procedia Environ. Sci.* **2010**, *2*, 82–91. [\[CrossRef\]](#)
31. Nidhin, B.K.S.N.; Domingo, N.; Bui, T.T.P.; Wilkinson, S. Construction stakeholders' knowledge on zero carbon initiatives in New Zealand. *Int. J. Build. Pathol. Adapt.* **2023**, *43*, 512–527. [\[CrossRef\]](#)
32. Wade, B.; Dargusch, P.; Griffiths, A. Defining best practice carbon management in an Australian context. *Australas. J. Environ. Manag.* **2014**, *21*, 52–64. [\[CrossRef\]](#)
33. Chi, Y.-y.; Zhao, H.; Hu, Y.; Yuan, Y.-k.; Pang, Y.-x. The impact of allocation methods on carbon emission trading under electricity marketization reform in China: A system dynamics analysis. *Energy* **2022**, *259*, 125034. [\[CrossRef\]](#)
34. Tang, D.; Gong, X.; Liu, M. The Impact of Government Behaviors on the Transition Towards Carbon Neutrality in the Construction Industry: A Perspective of the Whole Life Cycle of Buildings. *Front. Environ. Sci.* **2022**, *10*, 945921. [\[CrossRef\]](#)
35. Saka, N.; Olanipekun, A.O.; Omotayo, T. Reward and compensation incentives for enhancing green building construction. *Environ. Sustain. Indic.* **2021**, *11*, 100138. [\[CrossRef\]](#)
36. Liu, J.; Li, X.; Wang, S. What have we learnt from 10 years of fintech research? A scientometric analysis. *Technol. Forecast. Soc. Change* **2020**, *155*, 120022. [\[CrossRef\]](#)
37. Tebourbi, I.; Thi Truc Nguyen, A.; Yuan, S.-F.; Huang, C.-Y. How do social and economic factors affect carbon emissions? New evidence from five ASEAN developing countries. *Econ. Res.-Ekon. Istraživanja* **2023**, *36*, 2120038. [\[CrossRef\]](#)
38. Dumitriu, C. Sustainable development at universities as viewed through the lens of the PROMISE framework for sustainability. In *Handbook of Theory and Practice of Sustainable Development in Higher Education*; Springer: Berlin/Heidelberg, Germany, 2017; Volume 2, pp. 35–48.
39. Kukah, A.S.K.; Owusu-Manu, D.-G.; Edwards, D. Critical review of emotional intelligence research studies in the construction industry. *J. Eng. Des. Technol.* **2022**, *21*, 1925–1947. [\[CrossRef\]](#)
40. Sterman, J.D. System dynamics modeling: Tools for learning in a complex world. *Calif. Manag. Rev.* **2001**, *43*, 8–25. [\[CrossRef\]](#)
41. Shih, Y.-H.; Tseng, C.-H. Cost-benefit analysis of sustainable energy development using life-cycle co-benefits assessment and the system dynamics approach. *Appl. Energy* **2014**, *119*, 57–66. [\[CrossRef\]](#)
42. Park, M.; Nepal, M.P.; Dulaimi, M.F. Dynamic modeling for construction innovation. *J. Manag. Eng.* **2004**, *20*, 170–177. [\[CrossRef\]](#)
43. Xia, B.; Chen, Q.; Walliah, J.; Buys, L.; Skitmore, M.; Susilawati, C. Understanding the dynamic behaviour of the Australian retirement village industry: A causal loop diagram. *Int. J. Strateg. Prop. Manag.* **2021**, *25*, 346–355. [\[CrossRef\]](#)
44. Naimi, B.; Voinov, A. StellaR: A software to translate Stella models into R open-source environment. *Environ. Model. Softw.* **2012**, *38*, 117–118. [\[CrossRef\]](#)
45. McGlacken-Byrne, D.; Larkan, F.; Mannan, H.; Vallières, F.; Kodate, N. An Introduction to Systems Thinking. In *Systems Thinking for Global Health: How Can Systems-Thinking Contribute to Solving Key Challenges in Global Health?* Oxford University Press: Oxford, UK, 2022; Volume 1.
46. De Souza, R.; Huynh, R.; Chandrashekar, M.; Thevenard, D. A comparison of modelling paradigms for manufacturing line. In Proceedings of the 1996 IEEE International Conference on Systems, Man and Cybernetics, Information Intelligence and Systems, Beijing, China, 14–17 October 1996; pp. 1253–1258.
47. Patonai, K.; Fábán, V.A. Comparison of three modelling frameworks for aquatic ecosystems: Practical aspects and applicability. *Community Ecol.* **2022**, *23*, 439–451. [\[CrossRef\]](#)
48. Ahmed Ali, K.; Ahmad, M.I.; Yusup, Y. Issues, impacts, and mitigations of carbon dioxide emissions in the building sector. *Sustainability* **2020**, *12*, 7427. [\[CrossRef\]](#)
49. Chen, X.; Lin, B. Towards carbon neutrality by implementing carbon emissions trading scheme: Policy evaluation in China. *Energy Policy* **2021**, *157*, 112510. [\[CrossRef\]](#)
50. Lingegård, S.; Olsson, J.A.; Kadefors, A.; Uppenberg, S. Sustainable public procurement in large infrastructure projects—Policy implementation for carbon emission reductions. *Sustainability* **2021**, *13*, 11182. [\[CrossRef\]](#)

51. Mustaffa, N.K.; Abdul Kudus, S.; Abdul Aziz, M.F.H.; Anak Joseph, V.R. Strategies and way forward of low carbon construction in Malaysia. *Build. Res. Inf.* **2022**, *50*, 628–645. [\[CrossRef\]](#)
52. Aldy, J.E.; Stavins, R.N. The promise and problems of pricing carbon: Theory and experience. *J. Environ. Dev.* **2012**, *21*, 152–180. [\[CrossRef\]](#)
53. Jackson Inderberg, T.H.; Bailey, I. Changing the record: Narrative policy analysis and the politics of emissions trading in New Zealand. *Environ. Policy Gov.* **2019**, *29*, 409–421. [\[CrossRef\]](#)
54. Zheng, M.; Yu, F.; Guo, S. Discussion on the effects of carbon trading for construction-related activities based on hybrid defuzzification strategy. *Sustain. Prod. Consum.* **2022**, *34*, 412–439. [\[CrossRef\]](#)
55. Crane, B. Revisiting who, when, and why stakeholders matter: Trust and stakeholder connectedness. *Bus. Soc.* **2020**, *59*, 263–286. [\[CrossRef\]](#)
56. Blumberg, G.; Sibilla, M. A Carbon Accounting and Trading Platform for the UK Construction Industry. *Energies* **2023**, *16*, 1566. [\[CrossRef\]](#)
57. Engelbrecht, A.S.; Heine, G.; Mahembe, B. Integrity, ethical leadership, trust and work engagement. *Leadersh. Organ. Dev. J.* **2017**, *38*, 368–379. [\[CrossRef\]](#)
58. Li, F.; Zhang, S.; Yang, X. Moral integrity and relationship commitment: An empirical examination in a cross-cultural setting. *J. Bus. Ethics* **2018**, *151*, 785–798. [\[CrossRef\]](#)
59. Yang, L.; Li, F.; Zhang, X. Chinese companies' awareness and perceptions of the Emissions Trading Scheme (ETS): Evidence from a national survey in China. *Energy Policy* **2016**, *98*, 254–265. [\[CrossRef\]](#)
60. Gardner, T.A.; Benzie, M.; Börner, J.; Dawkins, E.; Fick, S.; Garrett, R.; Godar, J.; Grimard, A.; Lake, S.; Larsen, R.K. Transparency and sustainability in global commodity supply chains. *World Dev.* **2019**, *121*, 163–177. [\[CrossRef\]](#)
61. Beckmann, M.; Hielscher, S.; Pies, I. Commitment strategies for sustainability: How business firms can transform trade-offs into win–win outcomes. *Bus. Strategy Environ.* **2014**, *23*, 18–37. [\[CrossRef\]](#)
62. Luo, L.; Tang, Q. Corporate governance and carbon performance: Role of carbon strategy and awareness of climate risk. *Account. Financ.* **2021**, *61*, 2891–2934. [\[CrossRef\]](#)
63. Mason, M. Transparency, accountability and empowerment in sustainability governance: A conceptual review. *J. Environ. Policy Plan.* **2020**, *22*, 98–111. [\[CrossRef\]](#)
64. Ying, J.J.; Sovacool, B.K. A fair trade? Expert perceptions of equity, innovation, and public awareness in China's future Emissions Trading Scheme. *Clim. Change* **2021**, *164*, 31. [\[CrossRef\]](#)
65. Owen, A.; Mitchell, G.; Gouldson, A. Unseen influence—The role of low carbon retrofit advisers and installers in the adoption and use of domestic energy technology. *Energy Policy* **2014**, *73*, 169–179. [\[CrossRef\]](#)
66. Tompkins, E.L.; Adger, W.N. Defining response capacity to enhance climate change policy. *Environ. Sci. Policy* **2005**, *8*, 562–571. [\[CrossRef\]](#)
67. Middlemiss, L.; Parrish, B.D. Building capacity for low-carbon communities: The role of grassroots initiatives. *Energy Policy* **2010**, *38*, 7559–7566. [\[CrossRef\]](#)
68. Li, J.; Zhang, D.; Su, B. The impact of social awareness and lifestyles on household carbon emissions in China. *Ecol. Econ.* **2019**, *160*, 145–155. [\[CrossRef\]](#)
69. Gao, L.; Jiang, J.; He, H.; Zhou, Q.; Wang, S.; Li, J. Uncertainty or trust? Political trust, perceived uncertainty and public acceptance of personal carbon trading policy. *Environ. Geochem. Health* **2022**, *44*, 3157–3171. [\[CrossRef\]](#)
70. Gao, L.; He, H.; Wang, S.; Li, J. What drives resident acceptance of personal carbon trading policy in China? *Environ. Geochem. Health* **2022**, *44*, 3007–3020. [\[CrossRef\]](#)
71. Guo, D.; Chen, H.; Long, R.; Zou, S. Determinants of residents' Approach–avoidance responses to the personal carbon trading scheme: An empirical analysis of urban residents in Eastern China. *Int. J. Environ. Res. Public Health* **2021**, *18*, 822. [\[CrossRef\]](#)
72. Westlake, S. The Power of Leading by Example with High-Impact Low-Carbon Behaviour: Emulation, Trust, Credibility, Justice. Ph.D. Thesis, Cardiff University, Wales, UK, 2022.
73. Droz, L. *The Concept of Milieu in Environmental Ethics: Individual Responsibility Within an Interconnected World*; Routledge: Oxfordshire, UK, 2021.
74. Wong, C.W.; Wong, C.Y.; Boon-Itt, S.; Tang, A.K. Strategies for building environmental transparency and accountability. *Sustainability* **2021**, *13*, 9116. [\[CrossRef\]](#)
75. Galbreath, J. Drivers of green innovations: The impact of export intensity, women leaders, and absorptive capacity. *J. Bus. Ethics* **2019**, *158*, 47–61. [\[CrossRef\]](#)
76. Chen, Z.; Zhang, X.; Chen, F. Do carbon emission trading schemes stimulate green innovation in enterprises? Evidence from China. *Technol. Forecast. Soc. Change* **2021**, *168*, 120744. [\[CrossRef\]](#)
77. Woo, J.; Fatima, R.; Kibert, C.J.; Newman, R.E.; Tian, Y.; Srinivasan, R.S. Applying blockchain technology for building energy performance measurement, reporting, and verification (MRV) and the carbon credit market: A review of the literature. *Build. Environ.* **2021**, *205*, 108199. [\[CrossRef\]](#)

78. Oakes, V.; Bronstone, A. The ‘interesting’ case of EU Commission leadership and the emission trading scheme. In *Rethinking Leadership for a Green World*; Routledge: Oxfordshire, UK, 2022; pp. 261–281.
79. Haonan, H.; Wei, R.; Zuohang, W.; Chenyong, Z.; Shanyong, W.; Fei, M. Effect of personal carbon trading on EV adoption behavior based on a stochastic Petri net. *J. Univ. Sci. Technol. China* **2021**, *51*, 53–64.
80. Zhang, Y.-h.; Feng, T.-t. How does the design of personal carbon trading system affect willingness to participate under carbon neutrality goal?—Evidence from a choice experiment. *Environ. Sci. Pollut. Res.* **2022**, *29*, 81970–81992. [\[CrossRef\]](#)
81. Zhao, X.; Ma, X.; Chen, B.; Shang, Y.; Song, M. Challenges toward carbon neutrality in China: Strategies and countermeasures. *Resour. Conserv. Recycl.* **2022**, *176*, 105959. [\[CrossRef\]](#)
82. Dahlmann, F.; Branicki, L.; Brammer, S. Managing carbon aspirations: The influence of corporate climate change targets on environmental performance. *J. Bus. Ethics* **2019**, *158*, 1–24. [\[CrossRef\]](#)
83. Liu, Y. Residents’ willingness and influencing factors on action personal carbon trading: A case study of metropolitan areas in Tianjin, China. *Sustainability* **2019**, *11*, 369. [\[CrossRef\]](#)
84. Tan, X.; Wang, X.; Zaidi, S.H.A. What drives public willingness to participate in the voluntary personal carbon-trading scheme? A case study of Guangzhou Pilot, China. *Ecol. Econ.* **2019**, *165*, 106389. [\[CrossRef\]](#)
85. Hao, J.; Ye, X.; Yu, C.; Liu, J.; Ruan, Y.; Zhang, Y.; Hong, F.; Zhang, D. A Novel Individual Carbon Emission Evaluation and Carbon Trading Model for Low-Carbon University Campuses. *Sustainability* **2023**, *15*, 15928. [\[CrossRef\]](#)
86. Wei, Y.; Gong, P.; Zhang, J.; Wang, L. Exploring public opinions on climate change policy in “Big Data Era”—A case study of the European Union Emission Trading System (EU-ETS) based on Twitter. *Energy Policy* **2021**, *158*, 112559. [\[CrossRef\]](#)
87. Lou, J.; Hultman, N.; Patwardhan, A.; Mintzer, I. Corporate motivations and co-benefit valuation in private climate finance investments through voluntary carbon markets. *npj Clim. Action* **2023**, *2*, 32. [\[CrossRef\]](#)
88. Du, Q.; Wang, Y.; Pang, Q.; Hao, T.; Zhou, Y. The dynamic analysis on low-carbon building adoption under emission trading scheme. *Energy* **2023**, *263*, 125946. [\[CrossRef\]](#)
89. Liu, J.; Xu, H.; Lyu, Y. Emission reduction technologies for shipping supply chains under carbon tax with knowledge sharing. *Ocean Coast. Manag.* **2023**, *246*, 106869. [\[CrossRef\]](#)
90. Abdmouleh, Z.; Alammari, R.A.; Gastli, A. Review of policies encouraging renewable energy integration & best practices. *Renew. Sustain. Energy Rev.* **2015**, *45*, 249–262. [\[CrossRef\]](#)
91. Khan, Z.; Ali, M.; Kirikkaleli, D.; Wahab, S.; Jiao, Z. The impact of technological innovation and public-private partnership investment on sustainable environment in China: Consumption-based carbon emissions analysis. *Sustain. Dev.* **2020**, *28*, 1317–1330. [\[CrossRef\]](#)
92. Jetoo, S. Stakeholder engagement for inclusive climate governance: The case of the city of Turku. *Sustainability* **2019**, *11*, 6080. [\[CrossRef\]](#)
93. Falana, J.; Osei-Kyei, R.; Tam, V.W. Towards achieving a net zero carbon building: A review of key stakeholders and their roles in net zero carbon building whole life cycle. *J. Build. Eng.* **2023**, *82*, 108223. [\[CrossRef\]](#)
94. Giesekam, J.; Barrett, J.; Taylor, P.; Owen, A. The greenhouse gas emissions and mitigation options for materials used in UK construction. *Energy Build.* **2014**, *78*, 202–214. [\[CrossRef\]](#)
95. Pothalkar, A. Mapping the Process: Stakeholder Perspective on Implementing Key Performance Indicators in Sustainable Building Construction: Case Study on Low Carbon Design of Buildings. Master’s Thesis, Mälardalen University, Västerås, Sweden, 2024.
96. Braun, M. The evolution of emissions trading in the European Union—The role of policy networks, knowledge and policy entrepreneurs. *Account. Organ. Soc.* **2009**, *34*, 469–487. [\[CrossRef\]](#)
97. Stoerk, T.; Dudek, D.J.; Yang, J. China’s national carbon emissions trading scheme: Lessons from the pilot emission trading schemes, academic literature, and known policy details. *Clim. Policy* **2019**, *19*, 472–486. [\[CrossRef\]](#)
98. Wang, F.; Li, H.; Cao, Y.; Zhang, C.; Ran, Y. Knowledge sharing strategy and emission reduction benefits of low carbon technology collaborative innovation in the green supply chain. *Front. Environ. Sci.* **2022**, *9*, 783835. [\[CrossRef\]](#)
99. Liu, M.; Shan, Y.; Li, Y. Study on the effect of carbon trading regulation on green innovation and heterogeneity analysis from China. *Energy Policy* **2022**, *171*, 113290. [\[CrossRef\]](#)
100. Damert, M.; Feng, Y.; Zhu, Q.; Baumgartner, R.J. Motivating low-carbon initiatives among suppliers: The role of risk and opportunity perception. *Resour. Conserv. Recycl.* **2018**, *136*, 276–286. [\[CrossRef\]](#)
101. Lai, X.; Liu, J.; Shi, Q.; Georgiev, G.; Wu, G. Driving forces for low carbon technology innovation in the building industry: A critical review. *Renew. Sustain. Energy Rev.* **2017**, *74*, 299–315. [\[CrossRef\]](#)
102. Kreibich, N.; Hermwille, L. Caught in between: Credibility and feasibility of the voluntary carbon market post-2020. *Clim. Policy* **2021**, *21*, 939–957. [\[CrossRef\]](#)
103. Oldfield, E.E.; Lavallee, J.M.; Kyker-Snowman, E.; Sanderman, J. The need for knowledge transfer and communication among stakeholders in the voluntary carbon market. *Biogeochemistry* **2022**, *161*, 41–46. [\[CrossRef\]](#)

104. Ma, X.-W.; Wang, M.; Lan, J.-K.; Li, C.-D.; Zou, L.-L. Influencing factors and paths of direct carbon emissions from the energy consumption of rural residents in central China determined using a questionnaire survey. *Adv. Clim. Change Res.* **2022**, *13*, 759–767. [\[CrossRef\]](#)
105. Heiskanen, E.; Hyvönen, K.; Laakso, S.; Laitila, P.; Matschoss, K.; Mikkonen, I. Adoption and use of low-carbon technologies: Lessons from 100 Finnish pilot studies, field experiments and demonstrations. *Sustainability* **2017**, *9*, 847. [\[CrossRef\]](#)
106. Sharma, M.; Kumar, A.; Luthra, S.; Joshi, S.; Upadhyay, A. The impact of environmental dynamism on low-carbon practices and digital supply chain networks to enhance sustainable performance: An empirical analysis. *Bus. Strategy Environ.* **2022**, *31*, 1776–1788. [\[CrossRef\]](#)
107. Hu, B.; Pickl, S. International Emissions Trading: A Pricing Model Based on System Dynamical Simulations. In *Emissions Trading: Institutional Design, Decision Making and Corporate Strategies*; Springer: Berlin/Heidelberg, Germany, 2011; pp. 33–43.
108. Hafner, S.; Speich, M.; Bischofberger, P.; Ulli-Beer, S. Governing industry decarbonisation: Policy implications from a firm perspective. *J. Clean. Prod.* **2022**, *375*, 133884. [\[CrossRef\]](#)
109. Wu, Q. Power play in carbon trading market: How status of executives with R&D background incentives companies' low-carbon innovation. *Energy Policy* **2024**, *188*, 114049.
110. Karlsson, I.; Rootzén, J.; Johnsson, F. Reaching net-zero carbon emissions in construction supply chains—Analysis of a Swedish road construction project. *Renew. Sustain. Energy Rev.* **2020**, *120*, 109651. [\[CrossRef\]](#)
111. Fokaides, P.A.; Apanaviciene, R.; Černeckiene, J.; Jurelionis, A.; Klumbyte, E.; Kriauciunaite-Neklejonoviene, V.; Pupeikis, D.; Rekus, D.; Sadauskiene, J.; Seduikyte, L. Research challenges and advancements in the field of sustainable energy technologies in the built environment. *Sustainability* **2020**, *12*, 8417. [\[CrossRef\]](#)
112. Hong, Q.; Cui, L.; Hong, P. The impact of carbon emissions trading on energy efficiency: Evidence from quasi-experiment in China's carbon emissions trading pilot. *Energy Econ.* **2022**, *110*, 106025. [\[CrossRef\]](#)
113. Tan, X.; Liu, Y.; Dong, H.; Zhang, Z. The effect of carbon emission trading scheme on energy efficiency: Evidence from China. *Econ. Anal. Policy* **2022**, *75*, 506–517. [\[CrossRef\]](#)
114. Rodriguez, N.; Katooziani, A.; Jeelani, I. Barriers to energy-efficient design and construction practices: A comprehensive analysis. *J. Build. Eng.* **2023**, *82*, 108349. [\[CrossRef\]](#)
115. Yeatts, D.E.; Auden, D.; Cooksey, C.; Chen, C.-F. A systematic review of strategies for overcoming the barriers to energy-efficient technologies in buildings. *Energy Res. Soc. Sci.* **2017**, *32*, 76–85. [\[CrossRef\]](#)
116. Bertoldi, P.; Economidou, M.; Palermo, V.; Boza-Kiss, B.; Todeschi, V. How to finance energy renovation of residential buildings: Review of current and emerging financing instruments in the EU. *Wiley Interdiscip. Rev. Energy Environ.* **2021**, *10*, e384. [\[CrossRef\]](#)
117. Gouldson, A.; Kerr, N.; Millward-Hopkins, J.; Freeman, M.C.; Topi, C.; Sullivan, R. Innovative financing models for low carbon transitions: Exploring the case for revolving funds for domestic energy efficiency programmes. *Energy Policy* **2015**, *86*, 739–748. [\[CrossRef\]](#)
118. Chapple, L.; Clarkson, P.M.; Gold, D.L. The cost of carbon: Capital market effects of the proposed emission trading scheme (ETS). *Abacus* **2013**, *49*, 1–33. [\[CrossRef\]](#)
119. Feng, T.-t.; Li, R.; Zhang, H.-m.; Gong, X.-l.; Yang, Y.-s. Induction mechanism and optimization of tradable green certificates and carbon emission trading acting on electricity market in China. *Resour. Conserv. Recycl.* **2021**, *169*, 105487. [\[CrossRef\]](#)
120. Cacho, O.J.; Lipper, L.; Moss, J. Transaction costs of carbon offset projects: A comparative study. *Ecol. Econ.* **2013**, *88*, 232–243. [\[CrossRef\]](#)
121. Simon, G.L.; Bumpus, A.G.; Mann, P. Win-win scenarios at the climate–development interface: Challenges and opportunities for stove replacement programs through carbon finance. *Glob. Environ. Change* **2012**, *22*, 275–287. [\[CrossRef\]](#)
122. Liu, D.; Xiao, B. Exploring the development of electric vehicles under policy incentives: A scenario-based system dynamics model. *Energy Policy* **2018**, *120*, 8–23. [\[CrossRef\]](#)
123. Charlier, D. Energy efficiency investments in the context of split incentives among French households. *Energy Policy* **2015**, *87*, 465–479. [\[CrossRef\]](#)
124. Li, Z.; Solaymani, S. Effectiveness of energy efficiency improvements in the context of energy subsidy policies. *Clean Technol. Environ. Policy* **2021**, *23*, 937–963. [\[CrossRef\]](#)
125. Phan, T.-H.D.; Brouwer, R.; Davidson, M.D. A global survey and review of the determinants of transaction costs of forestry carbon projects. *Ecol. Econ.* **2017**, *133*, 1–10. [\[CrossRef\]](#)
126. Shi, B.; Li, N.; Gao, Q.; Li, G. Market incentives, carbon quota allocation and carbon emission reduction: Evidence from China's carbon trading pilot policy. *J. Environ. Manag.* **2022**, *319*, 115650. [\[CrossRef\]](#)
127. Wei, J.; Zhang, L.; Yang, R.; Song, M. A new perspective to promote sustainable low-carbon consumption: The influence of informational incentive and social influence. *J. Environ. Manag.* **2023**, *327*, 116848. [\[CrossRef\]](#)
128. Nasih, M.; Harymawan, I.; Paramitasari, Y.I.; Handayani, A. Carbon emissions, firm size, and corporate governance structure: Evidence from the mining and agricultural industries in Indonesia. *Sustainability* **2019**, *11*, 2483. [\[CrossRef\]](#)

129. Sun, Y.; Hao, S.; Long, X. A study on the measurement and influencing factors of carbon emissions in China's construction sector. *Build. Environ.* **2023**, *229*, 109912. [\[CrossRef\]](#)
130. Weigert, M.; Melnyk, O.; Winkler, L.; Raab, J. Carbon emissions of construction processes on urban construction sites. *Sustainability* **2022**, *14*, 12947. [\[CrossRef\]](#)
131. Hu, J.; Pan, X.; Huang, Q. Quantity or quality? The impacts of environmental regulation on firms' innovation—Quasi-natural experiment based on China's carbon emissions trading pilot. *Technol. Forecast. Soc. Change* **2020**, *158*, 120122. [\[CrossRef\]](#)
132. Kukah, A.S.K.; Owusu-Manu, D.-G.; Badu, E.; Asamoah, E. Structural equation model (SEM) for evaluating interrelationships among risks inherent in Ghanaian public–private partnership (PPP) power projects. *Eng. Constr. Archit. Manag.* **2022**, *31*, 327–2352. [\[CrossRef\]](#)
133. Warnecke, C.; Wartmann, S.; Höhne, N.; Blok, K. Beyond pure offsetting: Assessing options to generate Net-Mitigation-Effects in carbon market mechanisms. *Energy Policy* **2014**, *68*, 413–422. [\[CrossRef\]](#)
134. Yu, S.-m.; Fan, Y.; Zhu, L.; Eichhammer, W. Modeling the emission trading scheme from an agent-based perspective: System dynamics emerging from firms' coordination among abatement options. *Eur. J. Oper. Res.* **2020**, *286*, 1113–1128. [\[CrossRef\]](#)
135. Zakari, A.; Khan, I.; Alvarado, R. The impact of environmental technology innovation and energy credit rebate on carbon emissions: A comparative analysis. *J. Int. Dev.* **2023**, *35*, 2609–2625. [\[CrossRef\]](#)
136. Zhang, Y.; Zhang, J. Estimating the impacts of emissions trading scheme on low-carbon development. *J. Clean. Prod.* **2019**, *238*, 117913. [\[CrossRef\]](#)
137. Adinyira, E.; Agyekum, K.; Danku, J.C.; Addison, P.; Kukah, A.S. Influence of subcontractor risk management on quality performance of building construction projects in Ghana. *J. Constr. Dev. Ctries.* **2020**, *25*, 175–197. [\[CrossRef\]](#)
138. Yu, X.; Wu, Z.; Wang, Q.; Sang, X.; Zhou, D. Exploring the investment strategy of power enterprises under the nationwide carbon emissions trading mechanism: A scenario-based system dynamics approach. *Energy Policy* **2020**, *140*, 111409. [\[CrossRef\]](#)
139. Akomea-Frimpong, I.; Kukah, A.S.; Jin, X.; Osei-Kyei, R.; Pariafsai, F. Green finance for green buildings: A systematic review and conceptual foundation. *J. Clean. Prod.* **2022**, *356*, 131869. [\[CrossRef\]](#)
140. Wang, N.; Akimoto, K.; Nemet, G.F. What went wrong? Learning from three decades of carbon capture, utilization and sequestration (CCUS) pilot and demonstration projects. *Energy Policy* **2021**, *158*, 112546. [\[CrossRef\]](#)
141. Blay Jnr, A.V.K.; Kukah, A.S.K.; Opoku, A.; Asiedu, R. Impact of competitive strategies on achieving the sustainable development goals: Context of Ghanaian construction firms. *Int. J. Constr. Manag.* **2023**, *23*, 2209–2220. [\[CrossRef\]](#)
142. Wang, X.; Qu, L.; Wang, Y.; Xie, H. Dynamic Scenario Predictions of Peak Carbon Emissions in China's Construction Industry. *Sustainability* **2023**, *15*, 5922. [\[CrossRef\]](#)
143. Su, Y.; Zou, Z.; Ma, X.; Ji, J. Understanding the relationships between the development of the construction sector, carbon emissions, and economic growth in China: Supply-chain level analysis based on the structural production layer difference approach. *Sustain. Prod. Consum.* **2022**, *29*, 730–743. [\[CrossRef\]](#)
144. Barbosa, F.; Woetzel, J.; Mischke, J. *Reinventing Construction: A Route of Higher Productivity*; McKinsey Global Institute: New York, NY, USA, 2017.
145. Hong, J.; Shen, G.Q.; Feng, Y.; Lau, W.S.-t.; Mao, C. Greenhouse gas emissions during the construction phase of a building: A case study in China. *J. Clean. Prod.* **2015**, *103*, 249–259. [\[CrossRef\]](#)
146. Li, L.; Chen, K. Quantitative assessment of carbon dioxide emissions in construction projects: A case study in Shenzhen. *J. Clean. Prod.* **2017**, *141*, 394–408. [\[CrossRef\]](#)
147. Gambatese, J.A.; Hallowell, M. Factors that influence the development and diffusion of technical innovations in the construction industry. *Constr. Manag. Econ.* **2011**, *29*, 507–517. [\[CrossRef\]](#)
148. Zhu, W.; Zhang, Z.; Li, X.; Feng, W.; Li, J. Assessing the effects of technological progress on energy efficiency in the construction industry: A case of China. *J. Clean. Prod.* **2019**, *238*, 117908. [\[CrossRef\]](#)
149. Havensvid, M.I. Competition versus interaction as a way to promote innovation in the construction industry. *IMP J.* **2015**, *9*, 46–63. [\[CrossRef\]](#)
150. Wen, Q.; Chen, Y.; Hong, J.; Chen, Y.; Ni, D.; Shen, Q. Spillover effect of technological innovation on CO₂ emissions in China's construction industry. *Build. Environ.* **2020**, *171*, 106653. [\[CrossRef\]](#)
151. Xue, H.; Zhang, S.J. Relationships between engineering construction standards and economic growth in the construction industry: The case of China's construction industry. *KSCE J. Civ. Eng.* **2018**, *22*, 1606–1613. [\[CrossRef\]](#)
152. Baudry, M.; Faure, A.; Quemin, S. Emissions trading with transaction costs. *J. Environ. Econ. Manag.* **2021**, *108*, 102468. [\[CrossRef\]](#)
153. Marin, G.; Marino, M.; Pellegrin, C. The impact of the European Emission Trading Scheme on multiple measures of economic performance. *Environ. Resour. Econ.* **2018**, *71*, 551–582. [\[CrossRef\]](#)
154. Dunford, E.; Niven, R.; Neidl, C. Deploying low carbon public procurement to accelerate carbon removal. *Front. Clim.* **2021**, *3*, 686787. [\[CrossRef\]](#)
155. Bose, A.; Cohen, J.; Fattouh, B.; Johnson, O.; Spilker, G. *Voluntary Markets for Carbon Offsets: Evolution and Lessons for the LNG Market*; OIES Paper: ET; Oxford Institute for Energy Studies: Oxford, UK, 2021.

156. Trouwloon, D.; Streck, C.; Chagas, T.; Martinus, G. Understanding the use of carbon credits by companies: A review of the defining elements of corporate climate claims. *Glob. Chall.* **2023**, *7*, 2200158. [\[CrossRef\]](#)
157. Dechezleprêtre, A.; Nachtigall, D.; Venmans, F. *The Joint Impact of the European Union Emissions Trading System on Carbon Emissions and Economic Performance*; OECD: Paris, France, 2018.
158. Alaloul, W.S.; Musarat, M.A.; Rabbani, M.B.A.; Iqbal, Q.; Maqsoom, A.; Farooq, W. Construction sector contribution to economic stability: Malaysian GDP distribution. *Sustainability* **2021**, *13*, 5012. [\[CrossRef\]](#)
159. Wu, Y.; Chau, K.; Lu, W.; Shen, L.; Shuai, C.; Chen, J. Decoupling relationship between economic output and carbon emission in the Chinese construction industry. *Environ. Impact Assess. Rev.* **2018**, *71*, 60–69. [\[CrossRef\]](#)
160. Jia, Z.; Lin, B. Rethinking the choice of carbon tax and carbon trading in China. *Technol. Forecast. Soc. Change* **2020**, *159*, 120187. [\[CrossRef\]](#)
161. Wang, H.; Chen, Z.; Wu, X.; Nie, X. Can a carbon trading system promote the transformation of a low-carbon economy under the framework of the porter hypothesis?—Empirical analysis based on the PSM-DID method. *Energy Policy* **2019**, *129*, 930–938. [\[CrossRef\]](#)
162. Zhang, G.; Bi, S. Inhibition or promotion: The impact of carbon emission trading on market structure: Evidence from China. *Front. Energy Res.* **2023**, *11*, 1238416. [\[CrossRef\]](#)
163. Lin, B.; Jia, Z. Energy, economic and environmental impact of government fines in China's carbon trading scheme. *Sci. Total Environ.* **2019**, *667*, 658–670. [\[CrossRef\]](#) [\[PubMed\]](#)
164. Guo, X.; Guo, X. China's photovoltaic power development under policy incentives: A system dynamics analysis. *Energy* **2015**, *93*, 589–598. [\[CrossRef\]](#)
165. Lin, B.; Jia, Z. Impacts of carbon price level in carbon emission trading market. *Appl. Energy* **2019**, *239*, 157–170. [\[CrossRef\]](#)
166. Jnr, A.V.K.B.; Kukah, A.S.K.; Akotia, J. Assessing perception and practice of corporate social responsibility (CSR) by energy sector firms in Ghana. *Int. J. Real Estate Stud.* **2021**, *15*, 83–94. [\[CrossRef\]](#)
167. Zhuang, Y. A System Dynamics Approach to Integrated Water and Energy Resources Management. Ph.D. Thesis, University of South Florida, Tampa, FL, USA, 2014.
168. Zeng, S.; Nan, X.; Liu, C.; Chen, J. The response of the Beijing carbon emissions allowance price (BJC) to macroeconomic and energy price indices. *Energy Policy* **2017**, *106*, 111–121. [\[CrossRef\]](#)
169. Vega, C.; Miller, C.S. Market MicrostructureMarket microstructure. In *Complex Systems in Finance and Econometrics*; Springer: Berlin/Heidelberg, Germany, 2009.
170. Yao, Q.; Shao, L. Research on emission reduction strategies of building materials manufacturers and real estate developers in the context of carbon trading. *Front. Environ. Sci.* **2022**, *10*, 848260. [\[CrossRef\]](#)
171. Xu, Y.; Xu, Z.; Zhou, Y.; Su, C.; Guo, L. Interactions between carbon prices and the construction industry in China: Evidence based on Network-SVAR. *Build. Environ.* **2022**, *215*, 108936. [\[CrossRef\]](#)
172. Fang, G.; Lu, L.; Tian, L.; Yin, H. Research on the influence mechanism of carbon trading on new energy—A case study of ESER system for China. *Phys. A Stat. Mech. Its Appl.* **2020**, *545*, 123572. [\[CrossRef\]](#)
173. Thapa, S.; Morrison, M.; Parton, K.A. Willingness to pay for domestic biogas plants and distributing carbon revenues to influence their purchase: A case study in Nepal. *Energy Policy* **2021**, *158*, 112521. [\[CrossRef\]](#)
174. Seidu, S.; Owusu-Manu, D.-G.; Kukah, A.S.K.; Adesi, M.; Oduro-Ofori, E.; Edwards, D.J. An assessment of the implications of disruptive technologies on the performance of energy infrastructure projects in Ghana. *Int. J. Energy Sect. Manag.* **2022**, *17*, 887–903. [\[CrossRef\]](#)
175. Möst, D.; Genoese, M.; Eßer-Frey, A.; Rentz, O. Design of emission allocation plans and their effects on production and investment planning in the electricity sector. In *Emissions Trading: Institutional Design, Decision Making and Corporate Strategies*; Springer: Berlin/Heidelberg, Germany, 2011; pp. 71–84.
176. Gao, M. The impacts of carbon trading policy on China's low-carbon economy based on county-level perspectives. *Energy Policy* **2023**, *175*, 113494. [\[CrossRef\]](#)
177. Kukah, A.S.K.; Anafo, A.; Abdul, L.H.; Jnr, A.V.K.B.; Korda, D.N.; Sinsa, D.B.; Kukah, R.M.K. Relationship between challenges militating against mortgage finance and benefits of mortgage acquisition in Ghana: Case of SSNIT. *Int. J. Real Estate Stud.* **2021**, *15*, 55–65. [\[CrossRef\]](#)
178. Poudyal, N.C.; Bowker, J.; Siry, J.P. Factors influencing buyers' willingness to offer price premiums for carbon credits sourced from urban forests. *Int. J. Sustain. Soc.* **2015**, *7*, 205–220. [\[CrossRef\]](#)
179. Osobajo, O.A.; Otitoju, A.; Otitoju, M.A.; Oke, A. The impact of energy consumption and economic growth on carbon dioxide emissions. *Sustainability* **2020**, *12*, 7965. [\[CrossRef\]](#)
180. Wu, Z.; Xu, J. Predicting and optimization of energy consumption using system dynamics-fuzzy multiple objective programming in world heritage areas. *Energy* **2013**, *49*, 19–31. [\[CrossRef\]](#)
181. Li, Q.; Zhang, W.; Li, H.; He, P. CO₂ emission trends of China's primary aluminum industry: A scenario analysis using system dynamics model. *Energy Policy* **2017**, *105*, 225–235. [\[CrossRef\]](#)

182. Kumar, P.; Khare, D. Carbon credit assessment in selected hydro power projects of India: A step towards environmentally sustainable development. *Water Energy Int.* **2023**, *66*, 60–66.
183. Ferreyra Marinucci, X. Carbon Offsetting in the Framework of Net Zero Carbon Buildings. Master's Thesis, Politecnico di Torino, Torino, Italy, 2023.
184. Probst, B.; Toetzke, M.; Kontoleon, A.; Diaz Anadon, L.; Hoffmann, V.H. *Systematic Review of the Actual Emissions Reductions of Carbon Offset Projects Across All Major Sectors*; ETH Zurich: Zurich, Switzerland, 2023.
185. Johnson, B. An Assessment of Clean Development Mechanism Projects in the Energy Sector in India. Ph.D. Thesis, Department of Commerce and Management Studies, University of Calicut, Tenhipalam, India, 2023.
186. Kuronen, O. Co-Benefits in Voluntary Carbon Offset Projects: Developing and Testing a Co-Benefit Comparison Tool. Master's Thesis, Lappeenranta University of Technology, Lappeenranta, Finland, 2023.
187. Amran, A.; Zainuddin, Z.; Zailani, S.H.M. Carbon trading in Malaysia: Review of policies and practices. *Sustain. Dev.* **2013**, *21*, 183–192. [\[CrossRef\]](#)
188. Song, X.-H.; Han, J.-J.; Zhang, L.; Zhao, C.-P.; Wang, P.; Liu, X.-Y.; Li, Q.-C. Impacts of renewable portfolio standards on multi-market coupling trading of renewable energy in China: A scenario-based system dynamics model. *Energy Policy* **2021**, *159*, 112647. [\[CrossRef\]](#)
189. Hou, Q.; Sun, J. Investment strategy analysis of emission-reduction technology under cost subsidy policy in the carbon trading market. *Kybernetes* **2020**, *49*, 252–284. [\[CrossRef\]](#)
190. Xuan, D.; Ma, X.; Shang, Y. Can China's policy of carbon emission trading promote carbon emission reduction? *J. Clean. Prod.* **2020**, *270*, 122383. [\[CrossRef\]](#)
191. Xiong, L.; Shen, B.; Qi, S.; Price, L.; Ye, B. The allowance mechanism of China's carbon trading pilots: A comparative analysis with schemes in EU and California. *Appl. Energy* **2017**, *185*, 1849–1859. [\[CrossRef\]](#)
192. Ji, J.; Zhang, Z.; Yang, L. Comparisons of initial carbon allowance allocation rules in an O₂O retail supply chain with the cap-and-trade regulation. *Int. J. Prod. Econ.* **2017**, *187*, 68–84. [\[CrossRef\]](#)
193. Pope, J.; Owen, A.D. Emission trading schemes: Potential revenue effects, compliance costs and overall tax policy issues. *Energy Policy* **2009**, *37*, 4595–4603. [\[CrossRef\]](#)
194. Wang, W.; Zhang, Y.-J. Does China's carbon emissions trading scheme affect the market power of high-carbon enterprises? *Energy Econ.* **2022**, *108*, 105906. [\[CrossRef\]](#)
195. Yu, P.; Hao, R.; Cai, Z.; Sun, Y.; Zhang, X. Does emission trading system achieve the win-win of carbon emission reduction and financial performance improvement?—Evidence from Chinese A-share listed firms in industrial sector. *J. Clean. Prod.* **2022**, *333*, 130121. [\[CrossRef\]](#)
196. Kukah, A.S.K.; Jin, X.; Osei-Kyei, R.; Perera, S. A conceptual framework for carbon trading in the construction industry. In Proceedings of the 45th Australasian Universities Building Education Association (AUBEA) Conference, Global Challenges in a Disrupted World: Smart, Sustainable and Resilient Approaches in the Built Environment, Sydney, Australia, 23–25 November 2022.
197. Patil, N.A.; Thounaojam, N.; Laishram, B. Enhancing sustainability of Indian PPP procurement process using system dynamics model. *J. Public Procure* **2021**, *21*, 345–369. [\[CrossRef\]](#)
198. Zhang, Y.; Guo, C.; Wang, L. Supply chain strategy analysis of low carbon subsidy policies based on carbon trading. *Sustainability* **2020**, *12*, 3532. [\[CrossRef\]](#)
199. Kukah, A.S.K. Investigating the Causal Relationships and Effects of Moral Hazard and Adverse Selection on Public-Private-Partnership Construction Projects. Master's Thesis, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana, 2016.
200. Mundaca, L.; Mansoz, M.; Neij, L.; Timilsina, G.R. *Transaction Costs of Low-Carbon Technologies and Policies: The Diverging Literature. World Bank Policy Research Working Paper*; World Bank: Washington, DC, USA, 2013.
201. Kukah, A.S.; Anafo, A.; Kukah, R.M.K.; Blay Jnr, A.V.K.; Sinsa, D.B.; Asamoah, E.; Korda, D.N. Exploring innovative energy infrastructure financing in Ghana: Benefits, challenges and strategies. *Int. J. Energy Sect. Manag.* **2022**, *16*, 248–264. [\[CrossRef\]](#)
202. Narassimhan, E.; Gallagher, K.S.; Koester, S.; Alejo, J.R. Carbon pricing in practice: A review of existing emissions trading systems. *Clim. Policy* **2018**, *18*, 967–991. [\[CrossRef\]](#)
203. Stranlund, J.K. The regulatory choice of noncompliance in emissions trading programs. *Environ. Resour. Econ.* **2007**, *38*, 99–117. [\[CrossRef\]](#)
204. Owusu-Manu, D.-G.; Edwards, D.J.; Kukah, A.; Parn, E.A.; El-Gohary, H.; Hosseini, M.R. An empirical examination of moral hazards and adverse selection on PPP projects: A case study of Ghana. *J. Eng. Des. Technol.* **2018**, *16*, 910–924. [\[CrossRef\]](#)
205. Maestas, N.; Mullen, K.J.; Powell, D. The effect of population aging on economic growth, the labor force, and productivity. *Am. Econ. J. Macroecon.* **2023**, *15*, 306–332. [\[CrossRef\]](#)
206. Santamouris, M.; Vasilakopoulou, K. Present and future energy consumption of buildings: Challenges and opportunities towards decarbonisation. *e-Prime-Adv. Electr. Eng. Electron. Energy* **2021**, *1*, 100002. [\[CrossRef\]](#)

207. Min, J.; Yan, G.; Abed, A.M.; Elattar, S.; Khadimallah, M.A.; Jan, A.; Ali, H.E. The effect of carbon dioxide emissions on the building energy efficiency. *Fuel* **2022**, *326*, 124842. [\[CrossRef\]](#)
208. Busso, M.; Chauvin, J.P.; Herrera, N. Rural-urban migration at high urbanization levels. *Reg. Sci. Urban Econ.* **2021**, *91*, 103658. [\[CrossRef\]](#)
209. Castells-Quintana, D.; Wenban-Smith, H. Population dynamics, urbanisation without growth, and the rise of megacities. *J. Dev. Stud.* **2020**, *56*, 1663–1682. [\[CrossRef\]](#)
210. Sakketa, T.G. *Urbanisation and Rural Development in Developing Countries: A Review of Pathways and Impacts*; Discussion Paper; German Institute of Development and Sustainability: Bonn, Germany, 2022.
211. Ali, S.S.S.; Razman, M.R.; Awang, A. The nexus of population, GDP growth, electricity generation, electricity consumption and carbon emissions output in Malaysia. *Int. J. Energy Econ. Policy* **2020**, *10*, 84–89. [\[CrossRef\]](#)
212. Wang, Q.; Li, L. The effects of population aging, life expectancy, unemployment rate, population density, per capita GDP, urbanization on per capita carbon emissions. *Sustain. Prod. Consum.* **2021**, *28*, 760–774. [\[CrossRef\]](#)
213. Simon, J.L. *The Economics of Population Growth*; Princeton University Press: Oxford, UK, 2019; Volume 5403.
214. Gu, D.; Andreev, K.; Dupre, M.E. Major trends in population growth around the world. *China CDC Wkly.* **2021**, *3*, 604. [\[CrossRef\]](#) [\[PubMed\]](#)
215. Notowidigdo, M.J. The incidence of local labor demand shocks. *J. Labor Econ.* **2020**, *38*, 687–725. [\[CrossRef\]](#)
216. Musarat, M.A.; Alaloul, W.S.; Liew, M. Impact of inflation rate on construction projects budget: A review. *Ain Shams Eng. J.* **2021**, *12*, 407–414. [\[CrossRef\]](#)
217. Feng, Y.; Chen, S.; Zhang, L. System dynamics modeling for urban energy consumption and CO₂ emissions: A case study of Beijing, China. *Ecol. Model.* **2013**, *252*, 44–52. [\[CrossRef\]](#)
218. Owusu-Manu, D.; Kukah, A. Motivation factors of public and private sectors engaging in public-private-partnership (PPP) construction projects in Ghana. *J. Built Environ.* **2017**, *1*, 57–85.
219. Tsai, W.-H. Carbon emission reduction—Carbon tax, carbon trading, and carbon offset. *Energies* **2020**, *13*, 6128. [\[CrossRef\]](#)
220. Xiao, B.; Niu, D.; Guo, X. Can China achieve its 2020 carbon intensity target? A scenario analysis based on system dynamics approach. *Ecol. Indic.* **2016**, *71*, 99–112. [\[CrossRef\]](#)
221. Fernando, Y.; Hor, W.L. Impacts of energy management practices on energy efficiency and carbon emissions reduction: A survey of Malaysian manufacturing firms. *Resour. Conserv. Recycl.* **2017**, *126*, 62–73. [\[CrossRef\]](#)
222. Kats, G. *Greening our Built World: Costs, Benefits, and Strategies*; Island Press: Washington, DC, USA, 2013.
223. Zinzi, M.; Mattoni, B. Assessment of construction cost reduction of nearly zero energy dwellings in a life cycle perspective. *Appl. Energy* **2019**, *251*, 113326. [\[CrossRef\]](#)
224. Wu, H.; Xu, L.; Ren, S.; Hao, Y.; Yan, G. How do energy consumption and environmental regulation affect carbon emissions in China? New evidence from a dynamic threshold panel model. *Resour. Policy* **2020**, *67*, 101678. [\[CrossRef\]](#)
225. Zhu, W.; Feng, W.; Li, X.; Zhang, Z. Analysis of the embodied carbon dioxide in the building sector: A case of China. *J. Clean. Prod.* **2020**, *269*, 122438. [\[CrossRef\]](#)
226. Loizou, L.; Barati, K.; Shen, X.; Li, B. Quantifying advantages of modular construction: Waste generation. *Buildings* **2021**, *11*, 622. [\[CrossRef\]](#)
227. Owusu-Manu, D.-G.; Kukah, A.S.K.; Edwards, D.J.; Ameyaw, E.E. Fuzzy synthetic evaluation of moral hazard and adverse selection of public private partnership projects. *Int. J. Constr. Manag.* **2023**, *23*, 1805–1814. [\[CrossRef\]](#)
228. Owusu-Manu, D.-G.; Kukah, A.; Edwards, D.J.; Pärn, E.A.; El-Gohary, H.; Aigbavboa, C. Causal relationships of moral hazard and adverse selection of Ghanaian Public-Private-Partnership (PPP) construction projects. *J. Eng. Des. Technol.* **2018**, *16*, 439–460. [\[CrossRef\]](#)
229. Kukah, A.S.K.; Xiaohua, J.; Osei-Kyei, R.; Perera, S. How carbon trading contributes to reduction in emission of greenhouse gases: A narrative literature review. *J. Facil. Manag.* **2024**, *23*, 463–479. [\[CrossRef\]](#)
230. Alexeeva, V.; Anger, N. The globalization of the carbon market: Welfare and competitiveness effects of linking emissions trading schemes. *Mitig. Adapt. Strateg. Glob. Change* **2016**, *21*, 905–930. [\[CrossRef\]](#)
231. Gao, Y.; Li, M.; Xue, J.; Liu, Y. Evaluation of effectiveness of China's carbon emissions trading scheme in carbon mitigation. *Energy Econ.* **2020**, *90*, 104872. [\[CrossRef\]](#)
232. Agha, G.; Palmkog, K. A survey of statistical model checking. *ACM Trans. Model. Comput. Simul. (TOMACS)* **2018**, *28*, 1–39. [\[CrossRef\]](#)
233. Forrester, J.W. From the ranch to system dynamics. In *Management Laureates*; Routledge: Oxford, UK, 2018; pp. 335–370.

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