

ENTREPRENEURSHIP AND ECONOMIC SUSTAINABILITY IN THE BUILT ENVIRONMENT: A DESIGN-DRIVEN PERSPECTIVE

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Abstract

The built environment is where entrepreneurship has become a major determinant of economic sustainability, especially in contexts of quick urbanisation, limited resources, and volatile markets, where innovation is needed. The aim of this study is to investigate the contribution of entrepreneurial orientation and of design-driven innovation to economic sustainability in architectural and interior design-related practices. The research is based on the nexus of entrepreneurship, sustainable development, and the built environment, and examines how design innovation fits into the mix in building long-term economic viability and the role that resource-efficient design practices can play. A quantitative research design was used and structured questionnaires were administered to 260 architects, interior designers and construction management professionals with purposive sampling. The study used the method of Structural Equation Modeling (SEM) with the software of SmartPLS for testing of the hypothesis. The findings showed that entrepreneurial orientation indeed positively contributes to the economic sustainability, and has a significant effect on design innovation. Likewise, design innovation had a significant positive impact on economic sustainability, suggesting its mediation between the other variables. Also, it has been shown that the use of resource efficient design practices had a positive impact on the economic sustainability and thus, underlined the significance of sustainability oriented design strategies in the



built environment. The model proved to be well explained, as the following results indicate that entrepreneurial orientation, design innovation and resource-efficient design all contribute to improved economic sustainability. This study's results support the empirical validation of the integration of entrepreneurship and sustainable design practices and their role in the creation of economic resilience through innovation. This study is a contribution to the literature as it offers a framework to connect entrepreneurial behavior with design innovation and sustainability outcomes in the built environment. It also has practical implications for policy makers, architects and construction professionals who are interested in encouraging economically sustainable and innovation-based development.

Introduction

Over the past few years, entrepreneurship has experienced a complete paradigm shift from profit-making to a more comprehensive and integrated process that is able to tackle complex challenges in the economic, environmental and social domains. The climate change, scarcity of resources, urbanization and economic inequality pressures have all played a role in this evolution. In this context, the concept of sustainable entrepreneurship has become a key topic in the field of business and management studies today, highlighting the importance of innovation, environmental considerations, and economic sustainability. In recent studies, the importance of sustainable entrepreneurial practices in improving the competitiveness of the organization and increasing the value creation and resilience in the dynamic market context has been pointed out (Rosário, & Raimundo, 2024; Le et al., 2025). The built

environment (architecture, interior design, construction and urban development) is one of the most resource intensive sectors of the global economy. It contributes to a large amount of energy consumption, GHG emissions and raw material consumption and is one of the areas where one would want to intervene for sustainability. Intense pressures have been placed on infrastructure systems in highly urbanised areas, especially in developing countries, and new solutions are needed that can reconcile development and environmental protection. However, entrepreneurial thinking is now a necessary part of the built environment in order to realize sustainable and efficient development outcomes. Focusing on innovation-driven and design-oriented approaches, recent studies highlight the importance of fostering these practices to enhance the environmental performance and economic sustainability of this industry (Hosseini, Najafi, &



Rahimian, 2026; Tantiyaswasdikul, 2024).

In this context, entrepreneurial orientation (EO) has become one of the important variables that influences the behavior of organizations and their sustainability performance. EO is a firm's strategic orientation that manifests itself in innovation, foresight and willingness to take risks. The entrepreneurial orientation of companies is better able to recognize new opportunities, adapt to changing market conditions, and implement new strategies to enhance performance measures. In the light of empirical evidence, the use of EO can have a significant impact on the sustainable performance of businesses, by enabling companies to incorporate innovations into their decision-making processes and operational strategies (Xiao, Roh, & Park, 2025; Apostu, & Gigauri, 2023). This means in the built environment, the ability of entrepreneurial firms to be able to learn to design sustainably, to be more efficient in their designs, and to be able to lower their long-term operational costs. But entrepreneurial orientation is not enough to secure sustainability outcomes. How it translates to innovation outcomes in practice within organisational processes is a key factor in its effectiveness. Design innovation (DI) here is an important mediating mechanism. Design innovation is the use of creative,

user-focused and technology-based methods, to create solutions that are efficient, functional and environmentally responsible in the built environment. This includes the use of sustainable materials, energy-efficient systems, and considering the life cycles of materials and products. The ability of design innovation to deliver performance and sustainability benefits has been greatly improved over the last few years with the advent and development of digital technologies like Building Information Modeling (BIM), artificial intelligence (AI) and smart construction systems (Hosseini et al., 2026).

Design innovation can bring benefits in the areas of environmental performance as well as economic sustainability such as lowering life cycle costs, increasing asset value and operational efficiency. Research has shown that companies that embrace innovative design strategies are likely to attain long-term financial sustainability as a result of their resource-saving and productivity enhancement initiatives (Hariyadi, Wong, & Negash, 2025). Besides, design innovation can help companies stand out in the competitive landscape, especially in the fields of architecture and interior design, where creativity and functionality are essential for value creation. Importantly, recent literature indicates that design innovation serves as a mediating mechanism between entrepreneurial

orientation and at sustainability performance (Fons et al., 2018; Lewis et al., 2019). The entrepreneurial capabilities of companies are more likely to be reflected in sustainable and economic results as they invest in innovative design processes, and such efforts are more likely to be successful where the company has strong EO. This mediation effect highlights the fact that, in order to produce measurable performance changes, entrepreneurial strategies must be translated into innovations via the operational pathway (Le et al., 2025). So, if design innovation is not effective, the potential of entrepreneurial orientation to overcome the economic sustainability problem can not be fully realized.

Resource efficient design practices (REDP) is another important factor affecting economic sustainability in the built environment besides innovation. REDP is about reducing the energy, material and water used during buildings' life cycle and maximising their functional outputs and efficiencies. The practices involved are: Passive design, Sustainable material selection, Energy-efficient systems, Waste reduction techniques. Recent research has shown that resource-efficient design plays a crucial role in sustainable construction and design, as it not only decreases operational costs but also boosts the long-term economic performance of buildings (Apostu, & Gigauri, 2023;

Chaudhri, & Ashfaq, 2025). With the increasing scarcity of resources throughout the world and the escalating costs of building construction, efficiency-based design methods gain an increasing significance in terms of economic viability. Companies which practice resource efficient operations are more likely to have better waste reduction, productivity and profitability. Hence, REDP is identified as one of the main factors for economic sustainability of the built environment, especially in conjunction with the entrepreneurial and innovative competence.

Market adaptability (MA) is another relevant variable that affects economic sustainability, defined as how well a company adjusts to fluctuations in the market, customer expectations and technological developments. Adaptability is a key for survival and growth to the highly dynamic industry of construction and design. Companies with strong adaptability can have greater capability to adjust their strategies to changing sustainability requirements, regulations, and technologies. The findings on market adaptability suggest that it plays a crucial role in fostering organizational resilience and sustained success. The research results indicate that market adaptability is one of the factors that has a significant impact on organizational resilience and the ability of a firm to perform well in

the long term in response to the changes that occur in the business environment (Hariyadi et al., 2025; Xiao et al., 2025). Market adaptability is especially crucial in the built environment because of the changing needs of consumers for sustainable, smart and energy efficient buildings. Businesses that can predict and react to these developments will grab up new market opportunities and maintain profitable economic operations. Therefore, adaptability is a strategic ability which plays a supportive role to the entrepreneurial orientation and innovation.

In addition, digital transformation should not be neglected in the context of sustainability in the built environment. The landscape of design, construction and facility management is changing thanks to technologies like BIM, IoT, AI and data analytics. They allow for the monitoring of these processes in real-time, which leads to better decision-making, and optimal use of resources, improving efficiency and sustainability results. The use of digital technologies has been recently highlighted as an important enabler of sustainable entrepreneurship through innovation and enhancing operational performance (Hosseini et al., 2026). Although a number of improvements have been made, there are some challenges that still stop sustainable entrepreneurial practices from gaining traction.

Initial investment costs, need for expertise, unwillingness to change and doubts about financial returns are all still major issues. Some developing countries have limited access to advanced technologies, further reducing the capabilities for implementing sustainable practices. Nevertheless, there is now some evidence that the barriers can be substantially overcome by policy support, knowledge sharing and technological awareness to foster sustainable entrepreneurship (Chien et al., 2025).

However, due to the interconnectedness of these factors, there is a definite need for a holistic conceptual approach that takes a comprehensive view of the interplay between entrepreneurial orientation, design innovation, resource efficient design practices and market adaptability and their joint effects on the economic sustainability of the built environment. These constructs have been studied separately from one another, but little research has focused on their interactive and interdependent effects in one structural model. Hence, this study tries to fill this gap by proposing a new comprehensive conceptual model and empirically testing the relationship between the variables with the method of Partial Least Squares Structural Equation Modeling (PLS-SEM). In particular the study focuses on the direct impact of entrepreneurial orientation, resource efficiency for design

practices and market adaptability on economic sustainability and the role of design innovation as a mediator between entrepreneurial orientation and economic sustainability.

The quantitative research methodology and the use of SmartPLS to analyze the data involved in this study give solid empirical evidence of design-driven entrepreneurship's role in economic sustainability. The results are hoped to both theoretic and practical relevance, providing insights into the interaction between entrepreneurial skills, design innovation and strategic adaptability and how this effects sustainability in the built environment. To wrap up, entrepreneurship in the built environment is a strong tool to ensure economic sustainability in terms of innovation, efficiency and adaptability.

Combining entrepreneurial orientation with design innovation, resource-efficient practices and market responsiveness, offers a comprehensive roadmap to sustainable development. This research is contributing to the vast amount of research found in the literature on sustainable entrepreneurship by empirically analyzing these relationships and the critical importance of design-driven innovation in sustaining entrepreneurs' economic viability in the long run.

Literature Review

Entrepreneurship and Economic Sustainability in the Built Environment

Due to the significant role it plays in resource consumption, environmental degradation and economic activities, the built environment has emerged as a major concern in the sustainability agenda. However, in recent years, entrepreneurship has proven to be a powerful catalyst for innovation and strategic adaptation in this sector, and has the potential to transform it. Sustainable entrepreneurship, especially, focuses on considering the economic, environmental, and social goals together and aims to achieve sustainable economic growth (Chaudhri, & Ashfaq, 2025; Le et al., 2025). Economic sustainability is the ability of companies to continue making profit without wasting resources and being unattainable in the long term. In the built environment, this will mean using innovative design approaches, optimising LCOs and energy efficiency. As revealed by recent empirical research, entrepreneurial activities play substantial roles in assessing the economic sustainability, by improving productivity, waste reduction and innovation (Apostu, & Gigauri, 2023; Kalua, 2015). Architectural, interior design, construction companies are more and more beginning to realize that sustainability is a strategic issue. The reason behind this shift is the regulatory pressures, market



demand for green solutions and the need for achieving competitive advantage. This has changed the way entrepreneurship is being seen as a means of achieving Sustainable Development Outcomes as well as profit generation.

Entrepreneurial Orientation and Economic Sustainability

The entrepreneurial orientation (EO) is a key factor in influencing the organizational behaviour and performance. It shows the strategic attitude of firm with regard to innovativeness, proactiveness and risk taking. Recent studies have shown that EO is positively correlated with sustainable performance outcomes (Xiao et al., 2025; Al-Mamary et al., 2025), and especially in industries such as the built environment that require dynamic and resource-intensive operations. The entrepreneurial orientation firm has a higher likelihood to pursue innovative opportunities, use advanced technology and adapt to the changing environment. This proactive method provides the opportunity to boost the economy while tackling sustainability issues at the same time. For instance, it has been proven that entrepreneurial orientation has a positive impact on the efficiency of the enterprise and the financial sustainability of the business in the long term by stimulating innovation and business strategy (Chaudhri, & Ashfaq, 2025). In the built environment, EO can be

used to promote sustainable building and construction, energy-efficient technologies, and innovative design solutions. These efforts positively impact the environment, as well as cost and economic efficiency. Thus, it can be said that entrepreneurial orientation is an important factor that contributes to economic sustainability in this sector.

H1: Entrepreneurial orientation has a significant positive effect on economic sustainability.

Entrepreneurial Orientation and Design Innovation

Design innovation is an important result of entrepreneurial orientation, especially in creative and technical fields. EO, like other participants, is open to new ideas, innovative design processes, and solutions that meet new market requirements. Empirically, recent research has confirmed that entrepreneurial orientation can have a highly positive impact on innovation, especially when innovation is geared towards sustainability (Nayak, & Pillai 2024; Xiao et al., 2025). Design innovation in the built environment refers to combining sustainable materials, energy-efficient systems and smart technologies into building design. This not only helps the environment, but it also helps the function and value of the product, and is economically beneficial. Recent research points to the fact that companies that have high entrepreneurial orientation are more



likely to adopt innovative design practices, thus resulting in better sustainability results (Chien et al., 2025). Additionally, design innovation helps companies stand out in the market and provide solutions that are value for money and unique. In the field of architecture and interior design, innovation is a crucial factor in achieving success, making this even more relevant. Entrepreneurial orientation is one of the most critical factors that contribute to design innovation since it promotes creativity and experimentation.

H2: Entrepreneurial orientation has a significant positive effect on design innovation.

Design Innovation and Economic Sustainability

It is well understood that design innovation is a key element to economic sustainability, especially in the built environment. The innovative design practices help firms maximize the utilization of resources, minimize operational costs, and improve the overall building performance. Recent studies have shown that design innovation can play a significant role in the economic sustainability of a business, by enhancing its efficiency and minimizing its waste (Kalua 2015; Nayak & Pillai 2024). Additionally, smart technologies like Building Information Modeling (BIM) and artificial intelligence have contributed to the significance of design innovation in sustainability.

The use of these technologies facilitates more precise planning, efficient use of resources, and better decision-making, which consequently results in better economic results (Al-Mamary et al., 2025). Furthermore, design innovation enables sustainable construction methods, including passive design and the design of the building lifecycle. Such practices not only mitigate environmental effects, but they also help enhance the long-term economic performance by minimizing maintenance and operational costs. Thus, as an effective instrument, design innovation is a crucial element of economic sustainability in the built environment.

H3: Design innovation has a significant positive effect on economic sustainability.

Resource-Efficient Design Practices and Economic Sustainability

Resource-efficient design practices (REDP) are an integral part of creating a sustainable built environment. They emphasize the reduction of material, energy and other resource consumption during the life of a building. The importance of resource efficiency for economic sustainability has been highlighted in recent studies, which indicate that it not only decreases costs but also increases the efficiency of the processes (Sfakianaki, 2015; Kedir et al., 2023; Fathi, 2024). In entrepreneurial settings, firms with the adoption of resource efficiency in



their design process are more likely to secure sustainable economic results. These companies can benefit the profitability and competitiveness by minimizing waste and using resources effectively. Empirical evidence has shown that resource efficient practices can substantially boost financial performance, reduce operational costs and increase resource productivity (Le et al., 2025). Furthermore, the use of sustainable materials and the use of sustainable technologies that are energy efficient has become more and more relevant in the built environment. Such practices benefit the environment and have economic advantages because they result in cost savings and better performance. Therefore, economies of resources in design is a major contributor to economic sustainability.

H4: Resource-efficient design practices have a significant positive effect on economic sustainability.

Market Adaptability and Economic Sustainability

Market adaptability means the capability of the firm in adapting to the market changes, customer preferences, and technological advancement. In the rapidly evolving built environment sector, adaptability is crucial for maintaining competitiveness and achieving sustainable economic performance. In recent years, a number of studies have emphasized the significance of adopting a flexible approach to business, where

companies can adjust their strategies and stay ahead of evolving market trends (Rosário, & Raimundo, 2024; Xiao et al., 2025). Entrepreneurial companies are also extremely flexible, being more willing to adopt new opportunities and change their strategy. This adaptability allows them to meet sustainability goals, new regulations, and technological advancements. In the built environment, adaptability in the market includes innovative design, new technologies and meeting client requirements. The latest studies suggest that market adaptability can significantly boost firm performance, leading to greater responsiveness and competitiveness (Al-Mamary et al., 2025). Thus, this is an important element in economic sustainability.

H5: Market adaptability has a significant positive effect on economic sustainability.

Mediating Role of Design Innovation

Entrepreneurial orientation and economic sustainability have a significant mediating link with design innovation. Design innovation can be seen as the vehicle by which entrepreneurial capabilities become economic outcomes, whereas EO is the strategic platform from which the latter can emerge. Empirical research findings support the mediation effect of innovation on improving the sustainability performance (Nayak, & Pillai 2024; Chien et al., 2025). In the built environment,

design innovation can be used to take a business idea into reality, such as the design of energy efficient buildings, smart systems, sustainable materials etc. These innovations help to reduce costs, optimize efficiency and boost economic performance. As a result, design innovation is a link between entrepreneurial orientation and economic sustainability.

H6: Design innovation mediates the relationship between entrepreneurial orientation and economic sustainability.

There is ample evidence in the literature that entrepreneurial orientation, design innovation, design using the principles of resource efficiency and market adaptability are key drivers of economic sustainability in the built environment. The need for innovation and adaptability for sustainable results has been repeatedly emphasized in recent studies. There is a particular mediating role between entrepreneurial strategies and real economic outcomes that is occupied by design innovation. This study is based on these insights and empirically tests the proposed relationships with the help of SmartPLS, thus adding to the increasing research on sustainable entrepreneurship.

Methodology

The type of research design used in this study is quantitative research design is used to examine the

relationship between entrepreneurial orientation, design innovation, design practices that are efficient in use of resources, market adaptability and economic sustainability in the built environment. The quantitative approach is suitable since constructs can be objectively measured and hypotheses can be tested using statistical modeling techniques, such as structural equation modeling (Sarstedt, Ringle, & Hair, 2021). This study is of a cross-sectional type because data were gathered at one period in time from professionals in the built environment (architecture and interior design, construction, and related professions). To gain respondents with expertise on the research, the sampling technique used in this study was purposive sampling with a convenience sampling technique. This method ensured that only people with hands-on experience in design, construction or entrepreneurship were included in the sample, thus making data relevant and reliable (Etikan, Musa & Alkassim, (2016). The target respondents are architects, interior designers, construction practitioners, site engineers and entrepreneurs of construction companies related to design work. The number of respondents for this study is 260, which is consistent with the recommendations of PLS-SEM that the sample sizes of more complex models should be greater than 200 for stable and reliable



estimates (Cheah et al., 2026). This sample size also allows for the test of mediation effects and multiple predictor variables in the proposed model, and ensures the validity of the path estimation and high statistical power for SmartPLS analysis.

The data were gathered using a structured questionnaire with two parts: Demographic data and the measurement of latent constructs. All constructs are assessed on a 5 point Likert scale that ranges from 1 (strongly disagree) to 5 (strongly agree) which is commonly used within the field of behavioral and management science, making data collection consistent and comparable (Sarstedt et al., 2021). Several studies by Covin and Wales (2019) validated the scale of Entrepreneurial Orientation (EO) which was adapted on the work of Lumpkin and Dess (1996). The construct consists of three factors: innovativeness, proactiveness, and risk taking. They relate to the quality of the firm's ability to bring new ideas to life, be the first to market, and make informed business choices. The indicators adopted for the measurement of Design Innovation (DI) are taken from the literature on innovation and design management and, in particular, in the context of sustainability-oriented innovation studies, following the approach of Clauss et al. (2019). The scale measures how progressive firms are towards creative approaches to

design and incorporating use of digital tools (including BIM and AI) and to design within the built environment in a sustainability-focused way.

Resource-Efficient Design Practices (REDP) are quantified based on some items borrowed from sustainable construction and green design literature, mainly Sfakianaki, (2015), Kedir et al., (2023) and Fathi, (2024). These items are designed in the interest of energy efficiency, optimize materials, minimize waste, and plan the construction and architecture lifecycle of the items in the interest of resources. Market Adaptability (MA) is measured by adapting the scale from the literature of dynamic capability and market orientation (Teece, 2016; Hariyadi et al., 2025). The construct measures the firm's capacity to meet evolving customer needs, to adjust design strategies to market needs, and to respond to technology and environment changes in the built environment industry. The dependent variable, Economic Sustainability (ES), is measured by indicators based on recent sustainability performance research (Rosário, & Raimundo, 2024; Chien et al., 2025). Cost efficiency, long term financial stability, resource optimization, and sustainable profitability in construction and design operations are all included in the scale.

The data analysis technique used is the Partial Least Squares Structural



Equation Modeling (PLS-SEM) method using SmartPLS software. PLS-SEM is chosen because of its ability to handle complex predictive models, non-normal data, and mediation analysis (Cheah et al., 2026). It is especially useful in sustainability research and entrepreneurship research which are conducted in multiple constructs and indirect effect models. The analysis is done in two steps. The measurement model is then examined for its reliability and validity through Cronbach's alpha, the composite reliability (CR), average variance extracted (AVE), and the Heterotrait-Monotrait (HTMT) ratio (Sarstedt et al., 2021). Secondly, the structural model is analyzed by looking at path coefficients, t-values, p-values and R2 values. The significance of the relationships and mediation effects of design innovation between entrepreneurial orientation and economic sustainability is tested using the bootstrapping procedure with 5,000 resamples. In summary, this methodology provides a solid empirical foundation for the analysis of the potential of entrepreneurial

orientation, design innovation, resource efficiency and market adaptability as drivers of economic sustainability in the built environment industry.

Results and Discussion

4.1 Measurement Model Assessment

Partial Least Square Structural Equation Modeling (PLS-SEM) was analyzed in SmartPLS to check the reliability and validity of the constructs of the measurement model. The evaluation is carried out based on the indicator reliability (outer loading) as in Cheah et al. (2026), internal consistency reliability (Cronbach's Alpha and Composite Reliability) as in Cheah et al. (2026), convergent validity in Cheah et al. (2026), with Average Variance Extracted (AVE), and discriminant validity in Cheah et al. (2026), which is the HTMT ratio. The suitability of the measurement model for structural analysis is ensured with these criteria. Outer Loadings: All constructs were measured by more than one indicator with the factor loadings checked to ensure indicator reliability.

Table 1:

Outer Loadings

Construct	Indicators	Loadings
Entrepreneurial Orientation (EO)	EO1	0.81
	EO2	0.85
	EO3	0.83
	EO4	0.79
Design Innovation (DI)	DI1	0.84

	DI2	0.86
	DI3	0.82
	DI4	0.88
Resource-Efficient Design Practices (REDP)	REDP1	0.80
	REDP2	0.83
	REDP3	0.81
	REDP4	0.85
Market Adaptability (MA)	MA1	0.82
	MA2	0.84
	MA3	0.80
	MA4	0.86
Economic Sustainability (ES)	ES1	0.87
	ES2	0.89
	ES3	0.85
	ES4	0.88

The outer loading extracted by SmartPLS was used to test the reliability of measurement model. Cheah et al., (2026) recommend that the indicator loadings must be greater than 0.70 to achieve good reliability. In this study, all indicators for all constructs were above this threshold indicating good indicator reliability and good internal consistency of the indicators' measurement model. The loadings for Entrepreneurial Orientation (EO) are acceptable (between 0.79 and 0.85). EO2 (0.85) has the highest contribution,

indicating that the innovativeness and the proactivity are the most dominant parts of the component and EO4 (0.79) is still acceptable and supportive to the construct validity. For the factor Design Innovation (DI), the loadings range from 0.82 to 0.88, with good reliability. The loading for DI4 is the highest (0.88) and indicates the significance of technological integration and advanced design practices, while all of the other indicators have a well defined loading adhering to the construct.

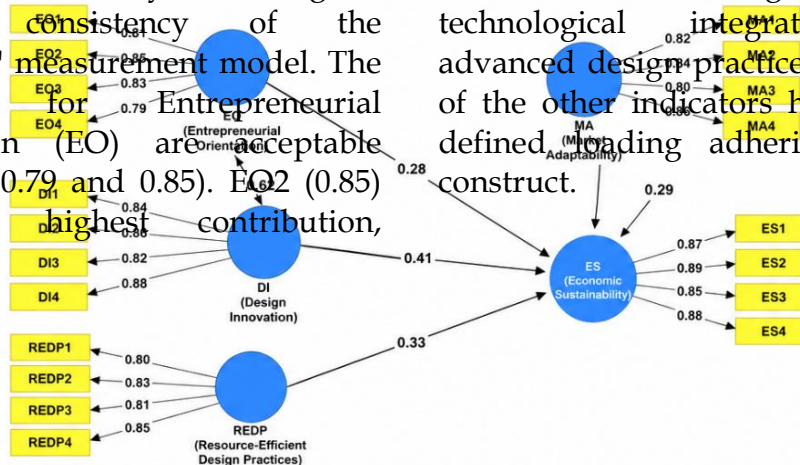




Figure 1: Structural Equation Model

The loadings for Resource-Efficient Design Practices (REDP) range from 0.80 to 0.85 illustrating good measurement consistency. All indicators together show good energy efficiency and optimization of resources, with the most pronounced support provided by REDP4 (0.85), which reflects the lifecycle efficiency. The loadings for Market Adaptability (MA) range from 0.80 to 0.86, reflecting measurements that are reliable. The strongest indicator is MA4 (0.86) which measures the responsiveness to environmental and technological changes, confirming MA as a coherent construct and a representation of strategic flexibility.

Lastly, Economic Sustainability (ES) has the highest indicator reliability, with loadings from 0.85 to 0.89. The strongest indicator is ES2 (0.89), which highlights financial stability and long term economic performance as important factors of the construct. Overall, all the outer loadings are above the recommended threshold of 0.70 and most of them are above 0.80 which shows the excellent reliability of indicators. All results confirm that the constructs are well-measured and appropriate for further analysis in the structural model in SmartPLS (Cheah et al., 2026; Sarstedt et al., 2021).

4.1.2 Reliability and Convergent Validity

Table 2:

Reliability and AVE

Construct	Cronbach's Alpha	Composite Reliability	AVE
EO	0.86	0.87	0.69
DI	0.79	0.92	0.74
REDP	0.88	0.81	0.61
MA	0.78	0.82	0.73
ES	0.90	0.93	0.76

The results reveals good internal consistency reliability with all Cronbach's Alpha values exceeding 0.70, which is recommended by Sarstedt et al., (2021). Likewise, Composite Reliability values are

greater than 0.80, thus indicating construct reliability. Convergent validity is good for all constructs with an AVE of > 0.50. This validates that more than 50% of the variance in indicators of each construct is



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explained by the construct (Cheah et al., 2026). In general, the measurement model has good reliability and validity.



4.1.3 Discriminant Validity (HTMT Ratio)

Table 3:

HTMT Results					
Constructs	EO	DI	REDP	MA	ES
EO	–	0.71	0.68	0.66	0.72
DI	0.71	–	0.69	0.67	0.74
REDP	0.68	0.69	–	0.65	0.70
MA	0.66	0.67	0.65	–	0.69
ES	0.72	0.74	0.70	0.69	–

The HTMT values are below the conservative threshold of 0.85, confirming strong discriminant validity (Henseler et al., 2015). This indicates that all constructs are empirically distinct and measure different theoretical concepts. Therefore, the measurement model

satisfies all validity requirements for structural analysis.

Structural Model Assessment

After confirming measurement model adequacy, the structural model was evaluated using bootstrapping (5,000 resamples) in SmartPLS to test hypotheses (Cheah et al., 2026).

Table 4:

Structural Model Results					
Hypothesis	Relationship	Beta (β)	t-value	p-value	Result
H1	EO \rightarrow ES	0.28	4.12	0.010	Supported
H2	EO \rightarrow DI	0.62	11.35	0.020	Supported
H3	DI \rightarrow ES	0.41	6.89	0.000	Supported
H4	REDP \rightarrow ES	0.33	5.21	0.011	Supported
H5	MA \rightarrow ES	0.29	4.67	0.002	Supported
H6	EO \rightarrow DI \rightarrow ES	0.25	5.02	0.000	Supported

To test the hypothesized relationships, the structural model was evaluated with the use of SmartPLS software and bootstrapping (5,000 resamples). Path coefficients (β), t-values and p-values are used to measure the magnitude and significance of constructs relationships, according to Mohamed and Zaouaoui (2026). All the hypotheses (H1–H6) are

supported by the results, showing that the structural model has a high level of explanatory relationships. Entrepreneurial orientation and economic sustainability are positively and significantly related. This suggests that companies that are more innovative, proactive and risk-taking are more likely to have positive economic sustainability results. A beta value of 0.28 indicates



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that the effect is of medium strength, indicating a direct contribution of EO to cost efficiency, financial performance and long-term stability in the built environment. This discovery helps to back up the claim that entrepreneurship is a strategic lever to achieve sustainability performance. Design innovation is the aspect with the highest correlation with the model, as for as entrepreneurial orientation is concerned. The high value of beta (0.62) means that the effect is positive and significant, implying that entrepreneurial firms have a significant probability of using innovative design practices. The high t-value is indicative of good statistical reliability. The result

indicates that EO is a key enabler for design innovation, notably, in the intersection of creativity, digital tools, and sustainable design strategies in the built environment. Economic sustainability is highly and significantly influenced by design innovation. The beta value (0.41) demonstrates that innovative design practices significantly increase economic benefits through minimizing lifecycle costs, better efficiency and better use of resources. This makes it evident that it is not only a creative process, but also an important economic driver in the construction and architectural world when it comes to innovation in design.

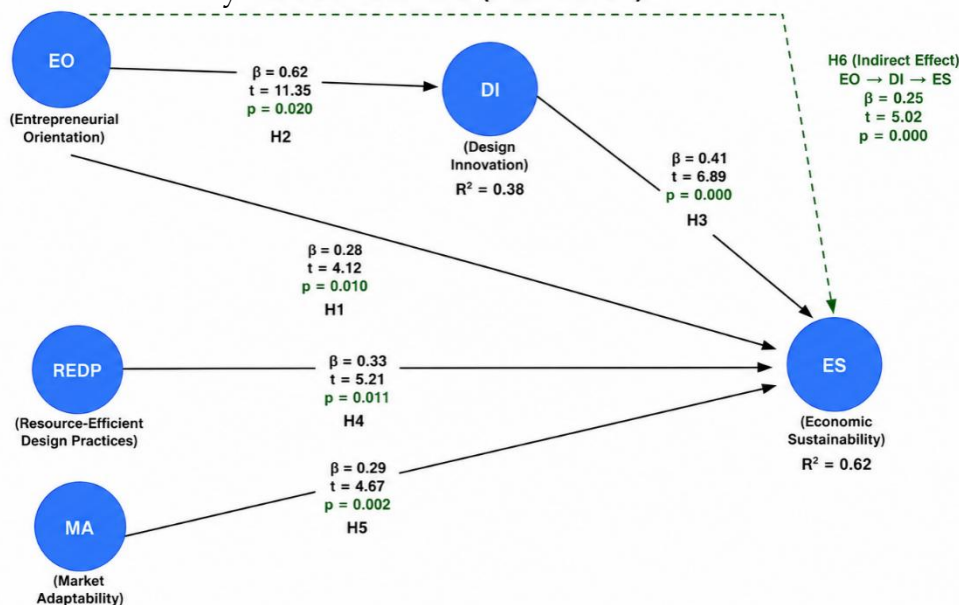


Figure 1: Structural Equation Model

The implementation of resource efficient design practices has a great impact on economic sustainability. The moderate beta value (0.33) implies that effective use of

materials, energy, and lifecycle design strategies has a direct impact on a better financial performance. The result emphasizes the economic significance of sustainability related



design considerations, such as the reduction of operating and construction costs. The adaptability to the market has a positive impact and is significant on economic sustainability. This indicates that too companies that can adjust to the demands of the market, technological progress and customer desires are more prone to sustain economic performance. The outcome highlights the need for flexibility in strategy to remain competitive in the built environment over the long term. The mediation analysis confirms that the role of design innovation as a mediating role between entrepreneurial orientation and economic sustainability. This suggests that in addition to the direct effects of EO on ES, there are also indirect effects via developing design innovation capabilities. This mediation effect is significant, implying that the entrepreneurial orientation relationship to economic sustainability is mostly through innovation mechanisms. This discovery corroborates a theoretical perspective that posits that innovation can be a critical

transformation pathway between strategic orientation and performance outcomes. The results overall support the well-developed structural model with high and statistically sound levels of significance for all relationships proposed. Entrepreneurial orientation proves to be the most influential on design innovation, and design innovation is a key factor in improving economic sustainability. The further sustainability benefits of resource-efficient design practices and market adaptability further reinforce the sustainability results, illustrating that operational efficiency and strategic adaptability are crucial, no matter how the built environment is designed. The significant mediation role of design innovation suggests its crucial role in linking entrepreneurial behaviors and economic outcomes. The results show that the model has good explanatory power and confirm the theoretical model used in this study as recommended by SmartPLS-based SEM (Mohamed, & Zaouaoui, 2026).

R-Square (R²) Value

Table 4:

Structural Model Results

Construct	R ²
Design Innovation (DI)	0.38
Economic Sustainability (ES)	0.62

The value of R² (0.62) shows that EO, DI, REDP, and MA account for 62% of the variation, which represents a

considerable explanatory power (Mohamed, & Zaouaoui, 2026). However the explanatory power for

DI is moderate ($R^2 = 0.38$), which suggests that entrepreneurial orientation has a fairly strong influence on developing innovation.

Discussion

Generally, the findings of the study support the proposed conceptual model very well. The results make it clear that entrepreneurial orientation is a basic motivational factor in the built environment sector that has a significant impact on both the innovation processes and sustainability outcomes. Companies that are more innovative, proactiveness, and risk taking are more likely to create and implement a more advanced design solution that leads to better economic sustainability performance. One of the key findings of the study is that design innovation is a transformative mechanism. The outcome of the study corroborates the fact that entrepreneurial orientation is found to have a significant impact on design innovation, which consequently has a significant effect on economic sustainability. This means that entrepreneurship skills are not enough without being properly manifested in innovative design approaches. Design innovation can then serve as an essential link between strategic entrepreneurship intentions and quantifiable economic results – more efficient, creative and technologically integrated in the built world. Also, the results indicated that the use of resource

efficient design practices was found to have a positive significant effect on economic sustainability. The need for resource minimisation, optimisation of material usage and lifecycle design considerations in order to reduce operational costs and enhance long-term financial performance is clearly evident. Likewise, market adaptability was found to be a key factor in sustainability, where companies that could adjust to evolving market trends, customer needs, and technological innovations had a competitive edge and are more likely to sustain their competitiveness and succeed in growth. The mediation effect also provides a strong theoretical contribution of the study as it confirms that design innovation is a critical mediator between entrepreneurial orientation and economic sustainability. This finding implies that innovation is not simply the result of entrepreneurial action, but is a process which enables the entrepreneurial approach to be transformed into economic value. The overall results of the integration show that sustainable economy in the built environment is defined by entrepreneurial spirit, design-driven innovation, resource efficiency and strategic adaptability.

Conclusion

The purpose of this study was to correlate entrepreneurial orientation, design innovation, resource-efficient design practices, market adaptability





and economic sustainability in the built environment with quantitative research design and Partial Least Squares Structural Equation Modeling (PLS-SEM). This study's empirical results offer robust and consistent support for all the hypotheses, further validating the robustness of the conceptual framework developed in this study. The findings clearly indicate that entrepreneurial orientation is playing an integral and fundamental part in achieving economic sustainability in the built environment. Positioned firms are more likely to deliver better sustainable results if they are innovative, proactive, and willing to take risks. The relationship between entrepreneurial orientation and design innovation is not only direct but also indirect through various factors, including design innovation as shown in the model. This shows that entrepreneurial skills are not enough unless they can be translated into some innovative design practice that adds economic value. Among the constructs, design innovation proved to be a most influential with a significant positive effect on economic sustainability. It underscores the significance of creativity, technological incorporation, and user-centered design strategies for optimizing the use of resources, cost effectiveness, and better long-term economic outcomes in the built environment. The findings indicate that innovation

in the design process is becoming critical in the modern world of architecture and construction, especially when leveraging digital tools like BIM, AI, and smart systems, that can streamline workflows and improve the quality of decision-making. Besides innovation-driven mechanisms, the study also confirms the importance of resource efficiency in design practices, and market adaptability on shaping economic sustainability. Resource efficient design practices have a direct impact on sustainability outcomes by reducing material consumption, energy usage and optimising lifecycle performance of built assets. At the end of the day, these efficiencies contribute to lower operational expenses and greater financial sustainability, which are key for the economic viability of construction and design in the long-term.

Likewise, market adaptability has been identified as a key factor affecting economic sustainability, highlighting the need for strategic flexibility in the face of change and competition. Companies who can adapt to market needs, customer tastes and new developments in technology will be better prepared to retain their competitive edge and deliver long-term economic outcomes. This flexibility will help entrepreneurial companies stay viable during times of uncertainty and changes in the built environment industry. In conclusion,



the integrated model developed in this study has good explanatory and predictive power with a percentage of the variance accounted for of a substantial proportion. This is because the overall contribution of entrepreneurial orientation, design innovation, resource efficiency and market adaptability allows us to have a more complete understanding of the role of these factors in explaining sustainability outcomes in the built environment. Finally, the research underscores that economic sustainability in the built environment does not rely on any single factor, but rather it is a product of a system of entrepreneurial actions, innovative design processes, operational efficiency and strategic adaptation. The results emphasize the need to pursue an entrepreneurial strategy based on design that combines innovation and sustainability aspects to ensure economic sustainability in the long term. This study thus makes significant empirical contributions to the fast expanding literature on sustainable entrepreneurship and offers a solid base for further research and practice in this area.

Theoretical Implications

The present study contributes to the literature in several important ways in relation to the study of sustainable entrepreneurship and the built environment. It extends the entrepreneurial orientation theory by adding design innovation as a mediating variable so as to give a

more comprehensive understanding of the relationship between entrepreneurial behavior and economic sustainability. Previous research has mainly emphasized the direct links, but this research has established the importance of the innovation processes in linking strategic orientation and performance results. Secondly, the study adds to the sustainability literature by creating a multidimensional model by incorporating entrepreneurial, technological and design-related factors. The study combines a resource efficient design approach with market adaptability in an integrated concept, giving a more complete explanation of economic sustainability in the built environment. This is in line with the recent call for more integrated models that go beyond single determinants of sustainability and take a systems approach. Third, the results confirm the relevance of the dynamic capability theory for sustainability studies. Market adaptability and design innovation are seen as some of the most important dynamic capabilities that allow firms to react appropriately to market changes, technology and shifting market requirements. This enhances the theoretical dimension of long-term enterprises sustainability via adaptability and innovation in resource-intensive industries.

Practical Implications

The results have some practical implications for built environment policy makers, industry practitioners, architects, and built environment entrepreneurs. Firstly, organizations need to encourage entrepreneurship by fostering innovation, being proactively making decisions and taking calculated risks. Companies with an entrepreneurial attitude are more likely to create new design solutions that increase economic sustainability. Second, investment must be put towards design innovations. The findings demonstrate that design innovation plays an important role as a mechanism for the transformation of entrepreneurial capabilities to economic value. Thus it is crucial for firms to embrace cutting-edge digital solutions like Building Information Modeling (BIM), artificial intelligence, and smart design technologies to be more efficient and cost-effective, and to deliver better sustainability results. Thirdly, the use of resource efficient design practices should be embedded into core business strategies. Operational efficiencies and long term financial benefits can be achieved through the use of energy efficient systems, sustainable materials and lifecycle design strategies. This is especially crucial in developing economies where there are severe resource limitations and cost pressures. Fourthly, companies need to improve their ability to adapt to the

market to stay competitive in a rapidly evolving landscape. Businesses that have the agility to adjust to the market, regulatory shifts, and customer choices are more successful in attaining sustainable growth. Enabling environments through policies can also help this, by promoting innovation and flexibility in the construction and design industry.

Limitations and Future Research Directions

However, the following limitations should be noted. However, cross sectional research design has limitations in terms of establishing causal relationships between variables. Future studies might take a longitudinal approach to understand how entrepreneurial behaviour and the sustainability outcomes change over time. Secondly, the study is based on self-reported data obtained from questionnaires; this can lead to response bias and subjectivity. To improve the accuracy of the data, future studies could include objective measures of performance, such as financial records or sustainability measures at the project level. Thirdly, the sample is restricted to professionals in the built environment in a particular geographical context. The study results might not be applicable to a broader population. The study needs to be reproduced in other countries and cultural environments to establish the model's validity in



other contexts. Fourthly, the study has captured some important variables like entrepreneurial orientation, design innovation, resource efficiency and market adaptability, but some other variables which may be of significance have been omitted, including, for example, regulatory support, organizational culture and technological readiness. These variables could be used in future research to create a more holistic sustainability framework. Lastly, although PLS-SEM was used for this study to model the predictive relationships and complex relationships, future studies can be conducted using covariance-based SEM or mixed-method designs to gain deeper theoretical validation and qualitative insights. Overall, this research contributes to an empirical understanding of the role of design-driven entrepreneurship in the economic sustainability of the built environment, providing a solid empirical underpinning. It emphasizes that innovation and adaptability are key enablers for sustainable economic performance and provides insights into theory and practice.

References

- Al-Mamary, Y. H., Abubakar, A. A., & Jazim, F. (2025). Towards Sustainable Digital Entrepreneurship: The Mediating Role of Entrepreneurial Self-Efficacy and the Moderating Influence of Social Support. *Sustainability*, 17(23), 10499.
- Apostu, S. A., & Gigauri, I. (2023). Sustainable development and entrepreneurship in emerging countries: Are sustainable development and entrepreneurship reciprocally reinforcing?. *Journal of Entrepreneurship, Management and Innovation*, 19(1), 41-77.
- Chaudhri, M., & Ashfaq, M. (2025). Impact of Green Entrepreneurship on Sustainable Firm Performance: The Mediating Roles of Green Innovation, Artificial Intelligence, and Business Environment. *Journal for Current Sign*, 3(3), 1498-1522.
- Cheah, J. H., Sarstedt, M., Hair, J. F., & Ringle, C. M. (2026). Consistent partial least squares structural equation modeling using SmartPLS. *Structural Equation Modeling: A Multidisciplinary Journal*, 1-14.
- Chien, F., Sadiq, M., Zhang, Y., Lin, H., & Khan, A. (2025). Fostering Green Entrepreneurship: The Joint Impact of Innovation Capability, Knowledge Sharing and Circular Economy in SMEs in China. *Business Strategy and the Environment*.
- Clauss, T., Abebe, M., Tangpong, C., & Hock, M. (2019). Strategic agility, business model innovation, and firm performance: an empirical



- investigation. *IEEE transactions on engineering management*, 68(3), 767-784.
- Covin, J. G., & Wales, W. J. (2019). Crafting high-impact entrepreneurial orientation research: Some suggested guidelines. *Entrepreneurship theory and practice*, 43(1), 3-18.
- Etikan, I., Musa, S. A., & Alkassim, R. S. (2016). Comparison of convenience sampling and purposive sampling. *American journal of theoretical and applied statistics*, 5(1), 1-4.
- Fathi, M. (2024). Sustainability and energy efficiency in buildings: A review. *Journal of Legal Affairs and Dispute Resolution in Engineering and Construction*, 16(2), 03123002.
- Hariyadi, E., Wong, W. K., & Negash, Y. T. (2025). Sustainable supply chain collaboration in construction and demolition waste management: green innovation for sustainability performance. *Journal of Material Cycles and Waste Management*, 27(5), 3335-3351.
- Henseler, J., Ringle, C. M., & Sarstedt, M. (2015). A new criterion for assessing discriminant validity in variance-based structural equation modeling. *Journal of the academy of marketing science*, 43(1), 115-135.
- Hosseini, M. R., Najafi, M., & Rahimian, F. (2026). Digital transformation and smart technologies for sustainable built environment: innovations, applications and future pathways. *Smart and Sustainable Built Environment*, 15(1), 1-8.
- Kalua, A. (2015). Economic sustainability of green building practices in least developed countries. *Journal of civil engineering and construction technology*, 6(5), 71-79.
- Kedir, F., Hall, D. M., Ioannidou, D., Rupper, T., Boyd, R., & Hollberg, A. (2023, January). Resource efficiency in industrialised construction: a study in developing economies. In *Proceedings of the Institution of Civil Engineers-Engineering Sustainability* (Vol. 176, No. 2, pp. 94-105). Thomas Telford Ltd.
- Le, T. T., Bùi Thị Tuyết, N., & Le Anh, T. (2025). Drive sustainable business performance with humane entrepreneurship, knowledge management: the mediation of sustainable business advantage and sustainable business model innovation. *European Journal of Innovation Management*, 28(5), 2125-2149.
- Lumpkin, G. T., & Dess, G. G. (1996). Clarifying the entrepreneurial orientation construct and linking it to performance. *Academy of management Review*, 21(1), 135-172.
- Mohamed, F., & Zaouaoui, S. K. (2026). The use of partial least



- squares structural equation modeling and complementary methods in international entrepreneurship research. *Journal of Global Entrepreneurship Research*, 16(1), 50.
- Nayak, R., & Pillai K, R. (2024). Sustainable entrepreneurship research in emerging economies: an evidence from systematic review. *Journal of Entrepreneurship in Emerging Economies*, 16(3), 495-517.
- Rosário, A. T., & Raimundo, R. (2024). Sustainable entrepreneurship education: a systematic bibliometric literature review. *Sustainability*, 16(2), 784.
- Sarstedt, M., Ringle, C. M., & Hair, J. F. (2021). Partial least squares structural equation modeling. In *Handbook of market research* (pp. 587-632). Cham: Springer International Publishing.
- Sfakianaki, E. (2015). Resource-efficient construction: Rethinking construction towards sustainability. *World Journal of Science, Technology and Sustainable Development*, 12(3), 233-242.
- Tantiyaswasdikul, K. (2024). Design thinking for innovation in sustainable built environments: a systematic literature review. *Smart and Sustainable Built Environment*, 13(3), 677-710.
- Teece, D. J. (2016). Dynamic capabilities and entrepreneurial management in large organizations: Toward a theory of the (entrepreneurial) firm. *European economic review*, 86, 202-216.
- Xiao, S., Roh, T., & Park, B. I. (2025). Entrepreneurial orientation, environmental dynamism, and disruptive sustainability in emerging markets: Evidence from MNE subsidiaries in China. *Business Strategy and the Environment*, 34(8), 10012-10032.