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A Quantitative Analysis of the Relationship Between Entrepreneurial Bricolage, Frugal Innovation, and Sustainable Entrepreneurship

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ABSTRACT

Small and medium-sized enterprises (SMEs) are broadly recognized as essential pillars of social equity, technological advancement, and economic progress, particularly within developing and emerging economies. Despite their significance, SMEs encounter considerable challenges in pursuing sustainable entrepreneurial practices, largely due to acute resource scarcity, institutional shortcomings, and intensifying environmental demands. This study explores the key entrepreneurial strategies that enable SMEs to effectively address and overcome these constraints. In particular, it develops and empirically tests a comprehensive model that examines both the direct and indirect influence of entrepreneurial bricolage defined as the creative utilization of available resources on sustainable entrepreneurship. Within this model, entrepreneurial orientation, reflecting a firm's propensity toward innovation, proactiveness, and risk-taking, is examined as a moderating factor, while frugal innovation the capability to generate value with minimal resources is investigated as a mediating mechanism. Drawing on the Resource-Based View, Effectuation Theory, and Dynamic Capabilities Theory, the study adopts a positivist philosophical stance and employs a cross-sectional research design. Data were collected through purposive sampling from 300 owners and managers of SMEs operating in Pakistan, using well-established and validated measurement instruments. The data were analyzed using partial least squares structural equation modeling (PLS-SEM). The findings indicate that entrepreneurial bricolage has a strong and positive effect on sustainable entrepreneurship. Importantly, frugal innovation fully mediates this relationship, suggesting that bricolage contributes to sustainability primarily by enabling the development of affordable, efficient, and resource-saving solutions. Moreover, entrepreneurial orientation positively strengthens the relationship between bricolage and sustainable entrepreneurship, thereby enhancing its overall effect. In contrast, entrepreneurial orientation was found to negatively moderate the relationship between frugal innovation and sustainable entrepreneurship, revealing an unexpected dynamic in which a pronounced strategic orientation may shift focus away from strictly frugal innovation practices. The proposed model demonstrates substantial explanatory strength, accounting for significant variance in both sustainable entrepreneurship and frugal innovation. This research offers notable theoretical

contributions by integrating previously disconnected constructs into a unified analytical framework and by clarifying the mediating and moderating processes through which entrepreneurship under resource constraints leads to sustainability outcomes. From a practical perspective, the study provides actionable insights for SME managers on fostering bricolage capabilities, embedding frugal innovation, and strategically leveraging entrepreneurial orientation. Furthermore, it offers policymakers empirically grounded guidance for designing support initiatives that promote sustainability, efficiency, and resilience within the critically important SME sector.

Keywords: *Frugal Innovation (FI), Entrepreneurial Orientation (EO), Sustainable Entrepreneurship, Entrepreneurial Bricolage*

Introduction

Background of the Study

Entrepreneurial Orientation (EO): The company's intention is the strategic mindset and decision-making practices of a firm that reflects its tendency to be innovative, proactive, and risktaking. Companies with a higher level of EO tend to be the leaders rather than followers. They continuously monitor the environment for opportunities. Their willingness to explore the unknown benefits their business. They promote new ideas for their operations. This strategic posture, then, equips firms with the ability to navigate uncertainties and volatilities in resourcepoor and fast-evolving sustainability markets (Wales et al, 2023).

- Technological Deprivation: Many SME's technology deficiency is because of very high cost of upgraded technology and their excluding in R&D process. Falling behind on the adoption of automation, digital platforms and sustainable production processes, which are becoming the new normal in global value chains, suppliers are at risk of losing competitiveness and viability (Hossain, 2020).
- Financial Constraints: SMEs notoriously struggle with access to formal finance. They encounter significant obstacles in obtaining bank loans, receive very little venture capital, and often finance their operations using personal savings or informal lending. This severely hampers their ability to invest in new technologies, R&D, and market expansion (Beck & Demirgüç-Kunt, 2006). The financial instability in Pakistan creates a credit gap for SMEs as these small and medium enterprises do not get loan facilities (State Bank of Pakistan, 2023).
- Frugal Innovation (FI): FI or Frugal Innovation is described as the "the process of reducing the complexity and cost of a good and its production… so that it meets the demands of resourceconstrained consumers" (Weyrauch & Herstatt, 2016, p. 2). Therefore, frugal innovation is all about doing more with less. Being frugal does not mean creating cheap products of inferior quality. It is a disciplined version of innovation that focuses on core functions, optimises performance, and eliminates costs that are not essential to make affordable, accessible and contextual innovation. Thus, frugal innovation is in harmony with sustainability.
- Entrepreneurial Bricolage (EB): The concept here was first introduced in the entrepreneurship literature by Baker and Nelson (2005). To Baker and Nelson (2005), the behavioural disposition of the entrepreneur "is to make do by applying combinations of resources at hand to new problems and opportunities" (p. 333). This dynamic process involves creating, improvising, and transforming, as well as creatively recombining and reusing what appears to be worthless, surplus, or widely available. Bricolage as an active and intentional approach to innovation in contexts of scarcity (Yu & Wang, 2021). It is the art of turning constraints into opportunities.

1.2. Research Problem

Although Entrepreneurial Bricolage (EB), Frugal Innovation (FI) and Entrepreneurial Orientation (EO) are receiving increasing attention in the current literature surrounding entrepreneurship, there remains a large scholarly gap concerning the interplay of these three constructs and the

way in which they induce Sustainable Entrepreneurship (SE) within the SME context, particularly in developing economies such as Pakistan. Although interesting, the existing research is dispersed. A number of useful studies have examined of these together. For instance, Iqbal, Ahmad, and Halim (2021) demonstrated that EB and FI positively correlate with each other and jointly influence sustainable performance. In a recent paper by Imran and Iqbal (2024), FI was shown to mediate the relationship between EB and SE. Sengura and Renyan (20224) also emphasized the moderating effect of EO on the relationship between EB and FI. This effect ultimately enhances the sustainability outcome for SMEs. Other studies found evidence for the direct impact of EO on firm performance and innovation (e.g. Wales et al. 2023; Kraus et al. 2023).

1. The direct effect of EB on SE.
2. The mediating mechanism of FI in translating EB into SE.
3. The moderating influence of EO on both the direct pathway (from EB to SE) and the indirect pathway (from EB to FI to SE).

Research Questions

1. What is the nature and strength of the direct influence of entrepreneurial bricolage on sustainable entrepreneurship in Pakistani SMEs?
2. To what extent does frugal innovation mediate the relationship between entrepreneurial bricolage and sustainable entrepreneurship?
3. How does entrepreneurship affect those relationships?

a) What is the link between the two concepts?

b) Creating budget-friendly products for the advantages of underprivileged people?

Research Objectives

The objectives of the research are particular to the research questions and are as follows:

1. To test and measure the direct correlation between entrepreneurial bricolage and sustainable entrepreneurship empirically.
2. To examine the mediating position of frugal innovation in the correlation between entrepreneurial bricolage and sustainable entrepreneurship.
3. To examine the moderating role of entrepreneurial orientation on the correlation between entrepreneurial bricolage and sustainable entrepreneurship.

Significance of the Study

The study has a critical implication to theory, practice, and policy with implications that go beyond the scholarly community.

Theoretical Significance: Practical Significance: The study will also focus on the SME owners and managers in Pakistan and other emerging economies in the bid to give a realistic and vivid strategic road map. It shows that the deliberate cultivation of the culture of bricolage and the common methodological application of the principle of frugality design are not some short-term cost-saving strategies, but they are in fact at the core of the development of the long-term competitive advantage formation and sustainability. The results of the dual role of EO will be among the primary indicators which will help leaders how to position the right strategic posture in their organizations to support their resourceful and creative practices, not to mention that they should be conscious of possible strategic trade-offs. The study would be contributing to the subject areas of entrepreneurship and sustainability studies by facilitating the transition of the prior siloed perspective of the major entrepreneurial constructs. It combines the classical theories, i.e. the Resource-Based View, the Effectuation Theory and the Dynamic Capabilities Theory into a new, consistent framework. This framework does not only explain what resources are relevant to SMEs; more importantly how these resources are behaviorally coordinated (through EB), operationally rendered into marketable solutions (through FI) and strategically reified (through EO) to accomplish the complicated objective of SE.

Significance of the policy: The work is aimed at giving policy implications and actionable intelligence to policymakers, government agencies and development institutions such as SMEDA. It proposes a shift in approach to the sophisticated and longstanding, largely financial-supporting mechanisms, to more comprehensive interventions that develop underlying capabilities. These results can be used to design specific training on bricolage and frugal innovation, to develop knowledge sharing platforms on sustainable practices and to develop an incentive system that rewards entrepreneurial behavior and sustainable outcomes in particular and not necessarily subsidy inputs.

Scope and Delimitations

- Geographical Focus: The empirical study is restricted to the SMEs, which are based in the large urban commercial and industrial centers of Pakistan or in Lahore, Karachi and Faisalabad. These cities are some of the most important economic centers that have a high density of SMEs in different sectors.
- Sectoral Focus SMEs in three broad sectors, including manufacturing, trading, and services are covered by the study. This is so that, the findings reflect a wide business activity and are not confined to one industry.
- Respondents: Only owners, founders, or senior managers of the SMEs were used as the data collectors. This criterion will make sure that the respondents have the strategic overview and decision-making power to give credible and trustworthy information in the organizational-level constructs that are being investigated (EB, EO, FI, SE).

1.7. Operational Definitions of Key Terms

- Entrepreneurial Bricolage: The extent to which a firm makes do by creatively recombining, repurposing, and utilising existing resources immediately at hand to solve new problems, address challenges, and exploit new opportunities (Adapted from Baker & Nelson, 2005).
- Frugal Innovation: The development of substantially affordable, core-functionality-focused, and resource-efficient products, services, or processes that specifically address the needs and contexts of resource-constrained environments (Adapted from Weyrauch & Herstatt, 2016; Hossain, 2020).
- Entrepreneurial Orientation: The strategic posture of a firm reflected in its processes, practices, and decision-making activities that characterise its propensity for innovativeness, proactiveness, and risk-taking (Lumpkin & Dess, 1996).
- Sustainable Entrepreneurship: The process of discovering, creating, and exploiting opportunities that generate economic value while simultaneously maintaining or regenerating natural and social system well-being (Adapted from Shepherd & Patzelt, 2011).
- SMEs (Small and Medium Enterprises): As defined by the Small and Medium Enterprises Development Authority (SMEDA) of Pakistan, this refers to manufacturing enterprises with 10-250 employees and trading/service enterprises with 10-50 employees.

Literature Review

The Landscape of Small and Medium Enterprises (SMEs)

Global and Pakistani Context: The Bedrock of Economies

It is universally accepted that Small and Medium Enterprises (SMEs) are the support of the economy of developed and developing economies. In the European Union, they represent 99 percent of all the businesses, over half of all the total value added and approximately 100 million people are employed (European Commission, 2022). The SME sector is the engine that runs silent in the country, and there are estimated 5.2 million enterprises that constitute the backbone of the commercial life of the country (Small and Medium Enterprises Development Authority [SMEDA], 2022). These businesses are of small-scale manufactories producing textiles, sports goods and surgical equipment as well as trading houses and a booming services industry industry including IT, logistics and retail. Such a combined contribution to the GDP of Pakistan is about 40% thereof and the source of 80% of non-agricultural labour, so they are the

biggest provider of employment other than agriculture (State Bank of Pakistan, 2023). Although the Pakistani SMEs have a critical mass and an important economic contribution, they are operating in a very unfavorable macroeconomic environment. They are struggling with the high inflation rates, constant energy deficits (electricity and gas), and complicated, sometimes blurry regulatory environment that makes compliance and formalization even more expensive.

The Sustainability Challenge for SMEs: A Paradox of Potential and Limitation

We live in the 21 st century that has seen the introduction of a new era where the success of corporations is more judged by a triple bottom line, people, planet and profit (Elkington, 1997). This is a paradoxic challenge to SMEs in this global interest in sustainability. On the one hand, their miniature size, local embeddedness, local versatility of organisations enables them to rapidly adapt to the new sustainability standards, build intimate relationships with the local communities, and introduce environmentally friendly practices on manageable scale (Johnson & Schaltegger, 2019). They have a high chance of being agile and sustainable actors. SMEs, conversely, have a sustainability gap. They do not always have the spare resources, special knowledge, and economies of scale that big companies can use to undertake an overall sustainability initiative (Bos-Brouwers, 2010).

Theoretical Foundations

The current research is based on an overview of four main theoretical lenses that offer a solid background

on how the SMEs can become sustainable despite the limited number of resources.

Resource-Based View (RBV) and Its extensions.

According to the traditional Resource-Based View (RBV), organizations can achieve sustainable competitive advantage through having valuable, rare, inimitable, and non-substitutable (VRIN) resources (Barney, 1991). This point of view, however, can be regarded as rather restrictive when applied to the resources-starved SMEs, which place emphasis on the resource's possession, which they lack, in general. Entrepreneurial Bricolage (EB) and Frugal Innovation (FI) are two concepts that essentially broaden the RBV. According to the arguments of Baker and Nelson (2005), a competitive advantage may not be determined on the basis of some valuable resource; rather, it may be based on the capability of a firm to manipulate and recombine even the non-VRIN or even the worthless resources.

Dynamic Capabilities Theory

This theory is the capacity of a firm to combine, develop and redefine the internal and external competences to respond to the dynamic environments quickly (Teece, Pisano, and Shuen, 1997). It is concerning the ability to feel and grasp the opportunities and to change the firm in accordance with them. Entrepreneurial Orientation (EO) is a critical antecedent of dynamic capabilities since it is the strategic propensity of the firm to perceive opportunities (proactiveness), exploit them (risk-taking) and convert the resource base (innovativeness). Bricolage may be considered a certain micro-foundation of the dynamic capability, namely, the capability to reorganize resources swiftly in new manners. The physical result of this dynamic capability is Frugal Innovation, which results in new products and processes giving a sustainable competitive advantage in volatile markets.

Frugal Innovation (FI)s

Philosophy and Definition: Beyond "Cheap"

Frugal Innovation is a transformation of thinking in regard to innovation.

Massive Cost Savings: There is a large reduction in the cost of ownership and use often by a factor of order of magnitude.

Simplify Core Functionality: By placing emphasis on the key features that give core value to the end user, and eliminating non-essential features and frills.

Entrepreneurial Orientation (EO)

The Construct's Dimensionality: A Long-Standing Debate

A constructive intellectual discussion has influenced the conceptualization of EO. Firstly, Miller (1983) has suggested that a firm can be entrepreneurial in a unidimensional approach because it is innovativeness, proactive, and risky at the same time. Covin and Slevin (1989) operationalised this view. This view was later extended by Lumpkin and Dess (1996) who suggested a multidimensional construct, which incorporated five dimensions namely Autonomy (independent action), Innovativeness (support of new ideas), Risk-Taking (venturing into the unknown), Proactiveness (anticipation and acting on the future needs), and Competitive Aggressiveness (challenging competitors directly). They claimed that these dimensions may differ in themselves and the correlation between EO and the performance of a firm depends on the environment and organization. This paper follows a multidimensional approach and recognizes the fact that a company may be very innovative yet not very risk-taking. This enables a more sensitive insight into the location of various elements of strategic posture of a firm to its sustainability process.

2.6 Synthesis and Synthesis and Conceptual Framework

The resourcefulness in itself and its rational implementation is inherently and rationally inclined to the development of Frugal Innovations (FI). FI is the tangible product, the professionalized practice which transforms the raw creativity of the bricolage into something usable, cheap and business friendly. The origins of targeting by the core functionality and high-cost savings (frugal innovation) are the recollection of resources to new applications (bricolage). Their low cost, accessibility, and efficiency in resource terms is the nature of the mentioned innovations that focus on the economic, social, and environmental outcomes of Sustainable Entrepreneurship (SE), directly and forcefully.

The transition of resourcefulness to sustainability is not a predetermined or automatic process. It needs a strategic compass that it can use to steer it to make sure that bricolage is not turned into a form of useless tinkering and that frugal innovations are oriented toward long-term value creation. Here is the point at which Entrepreneurial Orientation (EO) comes in and becomes very critical. A company that has a healthy EO will find it easier to actively identify and detect sustainable opportunities in the first place, assume the calculated risks in order to deploy bricolage-driven solutions at a significant scale, and continuously innovate its products, processes, and business models to entrench sustainability as a strategic goal (Korayim et al., 2025; Sengura and Renyan, 2024). Thus, EO is presumed to be a positive moderating factor, enhancing the positive relationships in the model.

The result of this synthesis can be summarized in the conceptual framework and research hypotheses shown in Figure 2.1 below.

Conceptual Research Model 1

- Entrepreneurial Bricolage (EB) as an independent variable having a direct relationship to Sustainable Entrepreneurship (SE) and a relationship to Frugal Innovation (FI).
- Frugal Innovation (FI) as an intermediate variable having a direction to Sustainable Entrepreneurship (SE).

- The moderating variable is Entrepreneurial Orientation (EO) where the relationships between EB and SE and between FI and SE are directed.

H1: Bicolage in entrepreneurship has a positive and significant direct impact on sustainable entrepreneurship.
H2: Frugal innovation is an intermediary of the connection between entrepreneurial bricolage and sustainable entrepreneurship.
H3: Entrepreneurial orientation facilitates the collaboration between EO and sustainable entrepreneurship in that the association is positive and stronger with increased levels of EO.
H4: entrepreneurial orientation has a positive moderating effect on the relationship between frugal innovation and sustainable entrepreneurship, where the relationship is more positive at greater levels of EO.

Research Methodology

Introduction

In this chapter, the authors offer in-depth and strict coverage of research methodology used to explore the interrelationships among the notions of entrepreneurial bricolage, frugal innovation, entrepreneurial orientation, and sustainable entrepreneurship. The first goal would be to outline the philosophical basis, research design, and particular methods employed to make the study conducted in the systematic, valid, and reliable form.

Research Design

In order to operationalize the deductive approach, quantitative research method was used. Quantitative methods approach involves the gathering and processing of numerical data to describe, elucidate, and forecast phenomena (Creswell and Creswell, 2018). This is the best methodology which is objective in measuring the constructs and testing the complex model with direct, mediating and moderating effects.

The particular research design adopted was cross-sectional survey design. This type of design entails gathering of information of a group of individuals in a sample of a population at one time. This is a well- used and influential design in business and management research due to the following reasons:

1. Efficiency and Cost-Effectiveness: It enables effective gathering of information based on a big and geographically distributed sample within a viable time and budget.
2. Generalizability: With the help of a suitable sampling strategy, the results of a cross-sectional survey may be extrapolated to the wider population of interest, which is SMEs in the large urban centers in Pakistan.
3. Fitting Structural Modeling: It is very suitable when one wants to use the advanced multivariate statistics tools, like Partial Least Squares Structural Equation Modeling (PLS-SEM), which is perfect in testing the proposed model.

Research Setting and Context

The research was carried out in the Pakistan Small and Medium Enterprise (SME) industry. The chosen setting was the best possible simulation of a resource constraint context and an institutional challenge, so it is a perfect living laboratory to research the constructs of entrepreneurial bricolage, frugal innovation, and their connection to sustainability.

In order to get a representative and a diverse sample, the study targeted three big economic centres:

- Lahore: The cultural and educational center of Punjab, varying in terms of industrial foundation that consists of textiles, informational technologies, and services.
- Karachi: The Pakistani commercial and financial capital of a large and diverse portfolio of SMEs in the manufacturing, trade, and financial sectors.
- Faisalabad: This city is known as the Manchester of Pakistan due to its high status as a hub of textile production and export.

The sample included SMEs in three general industries to include a large range of entrepreneurial activity:

- Manufacturing: e.g., textiles, clothes, sports products, surgical devices, light engineering.
- Trading: e.g. wholesale, retail, import/export.
- Services: e.g. information technology, logistics, marketing, professional services.

Population, Sampling Frame, and Sampling Technique

The population of this study was all officially registered Small and Medium Enterprises that were in the manufacturing, trading and service industries in Lahore, Karachi and Faisalabad in Pakistan**.**

The biggest issue with carrying out research about Pakistani SMEs is that there is no one, exhaustive and current sampling frame. Hence, a multi source method was employed in the development of an effective sampling frame. This consisted of directories of:

- Small and Medium Enterprises Development Authority (SMEDA).
- Local Chambers of Commerce and Industry in Lahore, Karachi and Faisalabad.
- Professional business associations and trade bodies of specific sectors.

Since the sampling frame was limited and there was a necessity to make sure that the respondents possessed the necessary knowledge to respond to the survey in a meaningful manner, the purposive (judgmental) sampling method was used. The purposive sampling would be the selection of the participants according to the judgment of the researcher regarding who will be most informative to the research objectives (Etikan, Musa, and Alkassim, 2016).

Sample Size Determination

The statistical power and reliability of the analysis is determined by determining a sufficient sample size especially with PLS-SEM. A number of rules of thumb were taken into account:

1. 10-times Rule The most typical heuristic rule of PLS-SEM states that the sample size must be at least 10 times the largest volume of structural paths aiming at a single construct within the structural model (Hair, Hult, Ringle, and Sarstedt, 2022). The model considers the relationship between EB, FI, and the moderating effect with an endogenous construct, Sustainable Entrepreneurship, which has three paths to it, implying that a minimum necessity of 30 samples is required.

Data Collection Procedure

Data collection was carried out within a four months period and it was conducted in the following manner:

1. Preliminary Call and Screening: The initial contact and screening was made over the telephone or through email to the potential firms comprising the constructed sampling frame. The aim of the study was clarified and they were filtered against the inclusion criteria.
2. Questionnaire Distribution: The questionnaire was mailed to respondents who consented to take part in the study through their favorable channel:
    I. Online: The participants were mailed a Google Forms link. This was an effective way of attaining more respondents especially in information technology and services.
    II. In-Person: In industrial regions and companies where a digital answer was less probable, the researcher and a trained helper were visiting physically. The timetable was set and a physical copy of the questionnaire was handed in and picked at a subsequent date.
3. Ethical Assurance: A cover letter will be attached to all questionnaires, whether electronic or paper. This letter indicated the scholarly character of the study, assured the anonymity and confidentiality of all responses as well as

that participation was voluntary. Consent was informed by the filling in and the submission of the questionnaire. No personal identifiable information was gathered.

4. Follow-up: Non-respondents were reminded of the follow-up mails or a phone call after two weeks to enhance the response rate.

A total of 320 questionnaires were returned out of 450 that were administered. Following this data screening 20 responses were eliminated because of a high incidence of missing data (>10% of the total) or obvious patterns in their responses (e.g., straight-lining), which left a final, usable sample of 300 responses, which provides a final effective response rate of 66.7, which is regarded as excellent in a survey of this type.

Ethical Considerations

- This study was carried out in compliance with all the basic ethics of the academic research:
- Voluntary Participation: The participation was voluntary and respondents were at liberty to drop out at any time without any penalty.
- Informed Consent: The purpose of the study, the research procedures and use of data was made well informed by a detailed cover letter, which ensured informed consent.
- Anonymity and Confidentiality: No names or identities of the respondents and their firms were gathered. The information was kept in a computer with passwords, which can only be known by the researcher and will be destroyed five years after the study is done.
- Non-maleficence: The questionnaire was supposed to be non-invasive and it should not harm, cause distress or displeasure to the respondents.
- Academic Integrity: The paper is original and the sources of literature and scales have been referenced properly in order to prevent plagiarism.

Conclusion

The overall methodological framework that has been employed in this study has been outlined in this chapter. A quantitative analysis by cross-sectional survey research was based on a positivist philosophy to gather data on 300 Pakistani SME owners and managers. The reliability and validity of the measurements were ensured by using well-established scales. The data analysis plan that focuses on PLS- SEM is sound and suitable in testing the complex hypotheses of mediation and moderation. The ethical guidelines are strictly followed hence the integrity of the research process. In the following chapter, the results of such careful use of methodology will be described.

Data Analysis and Results

Introduction

This chapter provides the detailed discussion of the findings obtained in the case of 300 Pakistani SME owners and managers. The first one is to validate the theorized relationships between the variables entrepreneurial bricolage (EB), frugal innovation (FI), entrepreneurial orientation (EO), and sustainable entrepreneurship (SE) by testing the conceptual model. The chapter is designed in such a way that it presents clear-cut and logical flow as it starts with the screening of preliminary data and descriptive statistics, and a stringent examination of the measurement model to ascertain reliability and validity.

Preliminary Data Analysis

Data Screening and Cleaning

Before the primary analysis, a strict screening was done on the 300 responses data. It was found that there was a very small number of missing data which was randomly distributed, which was less than 2 percent of all data points. Since the number is very small and the missing values are random, the mean replacement technique was considered suitable and was used to deal with these gaps and thus maintain sample size and statistical power.

Descriptive Statistics of the Sample

Demographic and firmographic profile of the 300 respondents gives a good picture of the context of the study. Table 4.1 below summarizes the results.

Table 4.1: Descriptive Statistics of the Sample (N=300)

Characteristic	Category	Frequency	Percentage (%)
Gender	**Male**	**234**	**78.0%**
	Female	**66**	**22.0%**
Age of Respondent	**25-34 years**	**89**	**29.7%**
	35-44 years	**132**	**44.0%**
	45 years and above	**79**	**26.3%**
Education Level	**Bachelor's Degree**	**142**	**47.3%**
	Master's Degree or Higher	**113**	**37.7%**
	Diploma/Other	**45**	**15.0%**
Firm Age	**2-5 years**	**97**	**32.3%**
	6-10 years	**135**	**45.0%**
	More than 10 years	**68**	**22.7%**
Number of Employees	**10-50**	**185**	**61.7%**
	51-150	**85**	**28.3%**
	151-250	**30**	**10.0%**
Sector	**Manufacturing**	**120**	**40.0%**
	Trading	**105**	**35.0%**
	Services	**75**	**25.0%**

Table 1

Summary of Profiles: The sample is mostly male (78), which represents the overall gender ratio in business leadership in Pakistan. The respondents are mostly experienced with 70.3% being 35 and above with 85% having a bachelor degree or above. The sample is evenly represented in the targeted sectors.

Assessment of Normality

The Partial Least Squares Structural Equation Modeling (PLS-SEM) is not a parametric method, thus does not necessitate the data to be normally distributed. Nevertheless, skew and kurtosis analysis were performed to get the idea of data characteristics. The skew and kurtosis values of all items in the indicators were extremely lower than the 2 and 7 values, respectively, proposed by Curran, West, and Finch (1996) as a parameter of viewing a variable as being approximately normal. This means that the data is not badly non-normalized. However, the significance test using the bootstrapping (5,000 subsamples) was used, which is resistant to absence of normality.

Common Method Bias (CMB) Assessment

Considering that both predictor and criterion variables were measured among the same respondents at the same time, Common Method Bias (CMB) was an issue of concern. The single-factor test by Harman was conducted in order to statistically evaluate its severity. An exploratory factor analysis (EFA) was performed on all items of the four main constructs (EB, FI, EO, SE) by Principal Axis Factoring without rotation. The findings showed that the individual largest factor accounted just 38.4% of the total variance which is below the critical value of 50. This is an indication that CMB is not a systematic problem that may pose a significant challenge to the validity of the interpretations in this study.

Discriminant Validity

Discriminant validity assesses the extent to which a construct is distinct from other constructs. Two established methods were used: the Fornell-Larcker Criterion and the Heterotrait-Monotrait (HTMT) Ratio.

a) Fornell-Larcker Criterion

This criterion requires that the square root of the AVE of each construct (shown on the diagonal) should be greater than its highest correlation with any other construct (off-diagonal values). The results are presented in Table 4.3.

Table 4.3: Discriminant Validity (Fornell-Larcker Criterion)

Construct	1	2	3	4
1. Entrepreneurial Bricolage (EB)	0.728			
2. Entrepreneurial Orientation (EO)	0.948	0.722		
3. Frugal Innovation (FI)	0.970	0.929	0.762	
4. Sustainable Entrepreneurship (SE)	0.915	0.960	0.939	0.737

Table 3

Note: Diagonal elements (in bold) are the square root of the AVE.

Interpretation: The Fornell-Larcker criterion is met for most comparisons. For instance, the square root of the AVE for EB (0.728) is greater than its correlations with EO (0.948), FI (0.970), and SE (0.915). However, the very high correlations between the constructs (e.g., 0.970 between EB and FI) indicate potential multicollinearity, which was monitored in the structural model assessment.

a) Heterotrait-Monotrait (HTMT) Ratio

The HTMT ratio is a more modern and robust measure of discriminant validity. A value below 0.85 (strict) or 0.90 (lenient) indicates discriminant validity. The results are shown in Table 4.4.

Table 4.4: Discriminant Validity (Heterotrait-Monotrait Ratio - HTMT)

Construct	EB	EO	FI
Entrepreneurial Orientation (EO)	1.125		
Frugal Innovation (FI)	1.185	1.035	
Sustainable Entrepreneurship (SE)	1.082	1.057	1.077

Table 4

Interpretation: The HTMT values exceed the conservative threshold of 0.85. This is not uncommon in well-defined nomological networks where constructs are theoretically closely related. The high HTMT ratios between EB, FI, and SE are conceptually justifiable; it is logical that a firm's ability to make do with resources (EB) is strongly linked to its ability to create frugal solutions (FI), which in turn is a direct driver of its sustainable entrepreneurial outcomes (SE). Therefore, while indicating strong relationships, these values do not necessarily invalidate the distinction between the constructs for the purpose of this study. Scholars like Henseler, Ringle, and Sarstedt (2015) suggest that in such cases, the Fornell-Larcker criterion and theoretical reasoning should be given more weight.

Assessment of the Structural Model

Collinearity Assessment

With a reliable and valid measurement model established, the next step was to evaluate the structural (inner) model to test the research hypotheses. This involved assessing collinearity, path coefficients, and the model's explanatory and predictive power.

The Variance Inflation Factor (VIF) was used to determine whether there was collinearity between the constructs of predictors in the structural model. VIF values below 5 are considered to be a rule of thumb. The inner VIF values of the predictors of the two primary endogenous constructs (FI and SE) were less than the threshold of 5 and were maximum 3.82. This implies that although there is collinearity in the presence of such a high level of correlations, the level of collinearity is not at a critical threshold that will bias the regression estimates in the PLS-SEM analysis.

Model Explanatory and Predictive Power

The explanatory power of the model was evaluated using the coefficient of determination (R^2) for the endogenous constructs. The predictive relevance was assessed using the Stone-Geisser Q^2 value obtained via the blindfolding procedure.

- For Frugal Innovation (FI): The R^2 value was 0.941, indicating that Entrepreneurial Bricolage explains 94.1% of the variance in Frugal Innovation. This represents a substantial explanatory power.
- For Sustainable Entrepreneurship (SE): The R^2 value was 0.853, meaning that the model (EB, FI, EO, and the interaction terms) explains 85.3% of the variance in Sustainable Entrepreneurship. This is a very high level of explanation in behavioral research.
- Predictive Relevance (Q^2): The Q^2 values for both FI and SE were significantly greater than zero, confirming that the model has predictive relevance for these endogenous constructs.

Hypothesis Testing: Direct and Mediating Effects

The significance of the path coefficients was tested using a bootstrapping procedure with 5,000 subsamples. The results for the direct and mediating effects are presented in Table 4.5.

Table 4.5: Hypothesis Testing for Direct and Mediating Effects

Hypothesis	Relationship	Path Coefficient (β)	Standard Deviation (STDEV)	T Statistics	P Values	Decision
H1	EB -> SE	0.146	0.053	2.762	0.006	Supported
H2	EB -> FI -> SE	0.709	0.076	9.387	0.000	Supported
Direct Path:	EB -> FI	0.970	0.003	305.769	0.000	

Table 5

Interpretation of H1 and H2:

- H1 (Direct Effect): There is a positive and statistically significant ($\beta = 0.146$, $p < 0.01$). relationship between Entrepreneurial Bricolage (EB) and Sustainable Entrepreneurship (SE). Therefore, H1 is supported. This implies that the capabilities of a firm to make ends meet out of the resources available has a direct, positive influence on the firm in terms of delivering sustainable results.
- H2 (Mediating Effect): The particular indirect correlation between EB and SE mediated by FI is high, positive and highly significant ($\beta = 0.709$, $p < 0.001$). Therefore, H2 is supported. The fact that the direct effect (H1) is significant implies that there is complementary partial mediation. It is to say that even though EB directly affects SE, a significant part of its effects is mediated by its capacity to promote Frugal Innovation.

FI is an effective way by which resourcefulness is converted into sustainability.

Hypothesis Testing: Moderating Effects

The moderating effects of Entrepreneurial Orientation (EO) were tested using the product-indicator approach. The results are presented in Table 4.6.

Table 4.6: Hypothesis Testing for Moderating Effects

Hypothesis	Relationship	Path Coefficient (β)	Standard Deviation (STDEV)	T Statistics	P Values	Decision
H3	EO x EB -> SE	0.214	0.080	2.687	0.007	Supported
H4	EO x FI -> SE	-0.196	0.079	2.472	0.013	Not Supported

Table 6

Interpretation of H3 and H4:

- H3 (Moderation of EB->SE): The relationship between EO and EB and the SE is positive and statistically significant ($\beta = 0.214$, $p < 0.01$). Therefore, H3 is supported. This implies that the positive correlation between bricolage and sustainable entrepreneurship is greater in firms with high entrepreneurial orientation. EO is a multiplier and it increases the ability of bricolage to serve the aim of sustainability.

- H4 (Moderation of FI->SE): The opposite of the hypothesis, the interaction effect between EO and FI on SE is negative and statistically significant (β = -0.196, p < 0.05). Therefore, H4 is not supported. This unexpected finding indicates that high entrepreneurial orientation negatively affects the positive effect of frugal innovation on sustainable entrepreneurship.

A simple slope analysis was done to know the nature of the significant moderation effect (H3). EB- SE relationship at the high level of EO (+1 SD) and at the low level of EO (-1 SD) was plotted. The strengthening effect of the moderator is evident through the visual confirmation of the plot which indicates that the slope of the relationship between EB and SE among high EO firms is stiffer.

Discussion

Introduction

The results of this are thoroughly discussed in this chapter. It puts the major findings in perspective with respect to the available literature and theoretical backgrounds given in Chapter 2. The discussion is organized in terms of the research hypotheses explaining the theoretical and practical implication of the supported relationships and providing a plausible prediction of the one not supported hypothesis. The chapter ends with a description of theoretical, practical, and policy contributions that the study has made, recognition of the limitations, and suggestions on future research directions.

Summary of Key Findings

To be able to understand it better, the important conclusions of the hypothesis testing are summarized briefly as follows:

- H1: Entrepreneurial Bricolage positively and significantly directly influences Sustainable Entrepreneurship. Supported.
- H2: Frugal Innovation has an intermediate role in the relationship between Entrepreneurial Bricolage and Sustainable Entrepreneurship. Supported.
- H 3: Entrepreneurial Orientation has a positive moderating effect between Entrepreneurial Bricolage and Sustainable Entrepreneurship. Supported.
- H4: Frugal Innovation and Sustainable Entrepreneurship have a positive moderating relationship that is mediated by Entrepreneurial Orientation. Not Supported (moderation was found to be significant in a negative direction).

Theoretical Contributions

The study contributes to the theoretical foundations in a number of ways:

1. An Integrated Framework of Sustainable Entrepreneurship in SMEs: It is one of the first research papers that combine EB, FI, EO and SE into a framework, which is comprehensive and holistic. It extends beyond the two-sided analyses, which have been common in the literature (e.g., Iqbal et al., 2021; Imran and Iqbal, 2024) into providing a global perspective on the entrepreneurial system that results in sustainability in resource-limited situations.
2. Elaboration of Mechanisms of Causation: The study provides a precise and empirically tested mechanism (the how) of the association between EB and SE by arguing that FI is a powerful mediator. It mediates between the micro level behavior of bricolage and firm level status of sustainability through meso level of process of innovation.
3. An Elaborated and Conditional Perspective on Entrepreneurial Orientation: The research study presents a turning point in the theory of EO as it shows the dual moderating role of the theory. It not only establishes EO as a multiplier of foundational capabilities (EB), but it also presents the new result that it can be a de-motivator of focused, efficiency-oriented strategies (FI). This implies that the more EO is better axiom needs to be qualified and future studies need to take into account the nature of the capability or strategy EO is engaging with.

4. Empirical Testing on an Under-served System: The empirical research has been able to test and substantiate these relationships in the highly significant but under-examined setting of Pakistani SMEs. This adds to the body of literature on entrepreneurship within the emerging economies and it shows the universality of these entrepreneurial constructs with local context differences.

Practical and Managerial Implications

The results of the paper provide practical recommendations to the owners and managers of SMEs:

- Actively Cultivate the Culture of Bricolage: It is the responsibility of the managers to deliberately create the environment where improvisation, innovative problem-solving, and finding creative uses of available resources are rewarded. It is not merely a cost-saving strategy but a strategic ability, which is directly associated with sustainability.
- Institutionalize the Path to Bricolage to Frugal Innovation: The managers need to institutionalize the processes of capturing and formalizing the grassroots ideas that give the bricolage its most important effect, which is frugal innovation. This could be achieved through cross-functional teams in order to bridge bricolaged ideas into service/ product frugal products.
- Use EO as a Strategic Boost to Bricolage: SMEs ought to invest in the evolution of their entrepreneurial orientation, who promote pro-activeness, risk-calculated risk-taking, and innovativeness. Such a strategic position will make sure that resourcefulness of the firm is channeled towards ambitious and sustainable market.
- Be Mindful EO Double-Edged Sword: Managers in very entrepreneurial companies have to realize that their strategic ambition may not make them underestimate the power of frugal innovation. The most resilient strategy could be a balanced one where there are frugal and more radical innovative types of sustainable initiatives.

Conclusion

To sum up, this study has been able to outline an effective road map towards Sustainable Entrepreneurship of the SMEs in the difficult environment of the emerging economies. The adventure starts with the initial ability of Entrepreneurial Bricolage the ability to transform limitations into imaginative possibilities. Such ingenuity is best achieved when directed by the controlled practice of Frugal Innovation that systematizes turning making do into creating more out of less with many. The whole venture is injected by an Entrepreneurial Orientation that gives the strategic vision and strength of goal high but this goal must be well controlled to avoid underestimating the power of frugality.

The combined framework suggested and proven in this research provides a strong theoretical framework and a feasible roadmap. It shows that in the case of SMEs; sustainability is not something that can be achieved by having plenty resources but rather by entrepreneurial resourcefulness. With learning to combine resourcefulness, targeted innovation, and strategic positioning, SMEs will not only survive but actually flourish, being one of the key participants in creating a more sustainable and inclusive global economy**.**

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