*Journal of Infrastructure, Policy and Development*2024, 8(10), 7159.
https://doi.org/10.24294/jipd.v8i10.7159

Article

# Exploring the impact of economic, social, and technological factors on sustainable entrepreneurship in Arab countries

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**CITATION**

Mohamed F, Akram BM. (2024). Exploring the impact of economic, social, and technological factors on sustainable entrepreneurship in Arab countries. Journal of Infrastructure, Policy and Development. 8(10): 7159.
https://doi.org/10.24294/jipd.v8i10.7159

**ARTICLE INFO**

Received: 14 June2024
Accepted: 10 July2024
Available online: 20 September 2024



**Abstract:** This article examines the factors influencing sustainable entrepreneurship (SE) in Arab countries, focusing on economic, social, and technological dimensions. Using data from various sources and structural equation modeling, the study explores the relationships between these factors and SE sustainability. The findings reveal that economic factors, such as GDP per capita and foreign direct investment (FDI), positively influence SE sustainability, emphasizing the need for a conducive economic environment. Social factors, measured by Internet usage and the Human Development Index (HDI), also significantly impact SE sustainability, highlighting the importance of access to information and education. However, technological factors like patent applications and high-tech exports did not show a significant positive relationship with SE sustainability, suggesting a minimal direct impact on SE longevity in Arab countries. These insights have implications for policymakers, stressing the importance of fostering economic growth and enhancing social infrastructure to support sustainable entrepreneurial ecosystems. Despite its robust methodology, the study has limitations, such as incomplete data for certain countries, affecting the generalizability of the findings. Future research could explore additional factors influencing SE sustainability, further investigate the role of technology, and expand the geographical scope to include more Arab countries.

**Keywords:** sustainable entrepreneurship; Arab countries; economic factors; social factors; technological factors; structural equation modeling; GDP per capita; Human Development Index

## 1. Introduction

In recent years, there has been a discernible surge in scholarly inquiry pertaining to sustainable entrepreneurship (SE), as evidenced by Moya-Clemente et al. (2021), Ribes-Giner et al. (2018), and Terán-Yépez et al. (2020). Scholars have predominantly employed the triple bottom line (TBL) paradigm, which encompasses social, environmental, and economic dimensions, to scrutinize this body of literature (Cralsand Vereeck, 2005; Divito and Ingen-Housz, 2021; Gu et al., 2022; Hockerts and Wüstenhagen, 2010; Schaltegger and Wagner, 2011). According to Watson et al. (2023), the TBL framework posits that entrepreneurs possess the acumen to discern sustainable economic opportunities, particularly in instances where market inefficiencies coincide with environmental and social issues. Various attempts have been made to delineate SE (Konys and Konys, 2019; Terán-Yépez et al., 2020). Schaltegger and Wagner (2011, p. 225) define SE as “the realization of sustainable innovations aimed at the mass market and benefiting most of society”, while Shepherd and Patzelt (2011, p. 156) characterize it as being “centered on protecting the environment, life, and community support while pursuing opportunities to develop new products, processes, and services for profit", where profit encompasses gains for individuals, the economy, and society. Pinkse and Groot (2015, p. 2) elucidate SE as "the discovery, creation, and exploitation of entrepreneurial opportunities that contribute to sustainability by generating social and environmental benefits for others in society". These definitions underscore the intrinsic linkage between sustainability and the well-being of future generations. From a perspective of enduring sustainability, SE underscores the imperative for enterprises to perpetuate their impact over time, with sustainability defined as enterprises maintaining relevance and efficacy over prolonged periods (Sarango-Lalangui et al., 2018). Consequently, entrepreneurs must be cognizant of the societal and environmental implications of their enterprises, both presently and in the future, to foster sustainable development that aligns with the needs of forthcoming generations. Despite its significance, the temporal dimension of SE remains relatively underexplored (Moya-Clemente et al., 2020), emphasizing the importance of moving beyond a narrow focus on the TBL framework that may inadvertently disregard the long-term welfare of future generations.

Moreover, technical competencies significantly bolster research and development (R&D) endeavors aimed at optimizing manufacturing processes and crafting sustainable goods or services with enduring viability (Ribeiro-Navarrete et al., 2021). This enhances competitiveness, performance, and value addition, with digitalization serving as a prime example, leveraging digital technology to furnish value to businesses (Ribeiro-Navarrete et al., 2021). According to Gu et al. (2022), such advancements may yield cost savings or quality enhancements, thereby fortifying businesses' capacity for sustainable expansion (Wade, 2020). Technological prowess assumes a pivotal role in ensuring firms' sustainability at the local level. Nonetheless, a broader perspective underscores the significant impact of digitalization on individuals' interactions with the virtual realm (Wade, 2020), thereby prompting shifts in talent management practices within businesses (Ribeiro-Navarrete et al., 2021). This evolution is reshaping how businesses formulate policies and procedures conducive to the responsible utilization of data and digital technologies across social, economic, technological, and environmental domains. Consequently, the technological dimension assumes paramount importance in fostering the long-term viability of SE. Primarily, this research employs partial least squares structural equation modeling (PLS-SEM) to elucidate the economic, social, technical, and historical factors influencing SE, drawing insights from diverse databases. Subsequent sections delineate the theoretical framework and hypotheses (2), methodology (3), results (4), discussion (5), and conclusion (6).

## 2. Theoretical background and hypotheses

The foundation of this study lies in a comprehensive exploration of the literature to discern potential long-term influences on sustainable entrepreneurship (SE). Subsequently, hypotheses are formulated to be tested within a relational model.

## 2.1. Economic factor

An essential determinant in the establishment, expansion, and sustenance of enterprises resides in the economic milieu. Maniyalath and Narendran (2016) assert its intrinsic correlation with pivotal macroeconomic indicators such as inflation, GDP, and foreign direct investment (FDI). Economic growth within a region profoundly impacts the sustainability of businesses over time. This is manifested in either fostering an environment conducive to entrepreneurship (Maniyalath and Narendran, 2016) or influencing the supply-demand dynamics, potentially leading to entrepreneurial closures due to lack of profitability (Fertala, 2008).

The generation of new small firms and the sustainability of businesses exhibit a direct nexus with certain attributes like GDP per capita (Huang et al., 2023; Spencer and Gómez, 2004). A high GDP per capita creates advantageous conditions for entrepreneurs to start and grow their businesses over time. Additionally, FDI catalyzes economic growth and prolongs the longevity of sustainable enterprises through the adoption of new technologies (Leiva et al., 2014; Spencer and Gómez, 2004). Other significant economic factors include the regulatory burden, economic policies technologies (Spencer and Gómez, 2004), and the stability of the regulatory framework (Valdez and Richardson, 2013). In uncertain or unfavorable macroeconomic contexts, entrepreneurs opting for survival strategies over expansion jeopardize the viability of numerous enterprises (Maniyalath and Narendran, 2016), often resulting in the formation of transient, opportunistic ventures with scant regard for long-term viability. Hence, we posit the following hypothesis:

Hypothesis 1: Economic factors are positively correlated with the long-term sustainability of SE.

## 2.2. Social factor

The socio-economic milieu prevailing in a particular nation or region significantly influences the establishment, growth, and evolution of enterprises. For instance, elevated unemployment rates may incentivize self-employment or other forms of entrepreneurship due to a dearth of alternative employment opportunities (Spencer and Gómez, 2004)). Access to capital, whether institutional or personal, is paramount for commencing and sustaining entrepreneurial endeavors (Könnölä et al., 2017; Weerawardena and Mort, 2006).

A positive correlation between internet usage and entrepreneurship has been documented (Wennekers et al., 2005), with the internet emerging as a crucial tool for enhancing subjective well-being in everyday life and work (Nie et al., 2021), thus substantiating its significant impact on entrepreneurship (Barnett et al., 2019).

While research exploring the broader social factors associated with SE exists, studies focusing specifically on the social aspects of SE primarily concentrate on social entrepreneurship. For example, regions with low human development indices may show a general lack of interest in entrepreneurship (Maniyalath and Narendran, 2016). Thus, we posit the following hypothesis:

Hypothesis 2: Social factors are positively correlated with the long-term durability of SE.

## 2.3. Technological factor

Technology exerts a profound influence on sustainable enterprises (Gu and Wang, 2022), with innovation and research and development (R&D) initiatives being pivotal for their long-term viability (Schaltegger and Wagner, 2011). These endeavors facilitate the development of goods and services that confer cost savings and quality enhancements, crucial for sustained profitability. Entrepreneurship is positively influenced by innovation, computer accessibility, and internet usage (Wennekers et al., 2005), with recent evidence highlighting innovation's pivotal role in fostering sustainable growth and organizational capabilities (Botella-Carrubi et al., 2022).

Moreover, technology transfer plays a vital role in entrepreneurship (Lado and Vozikis, 1997), fostering economic progress through efficient absorption and diffusion of knowledge (Ferreira et al., 2020). Patents serve as indicators of an organization's innovativeness and capacity to achieve its objectives (Meyskens and Carsrud, 2013), thus impacting business startups and economic growth. Given innovation's indispensable role in company success and long-term viability, we propose the following hypothesis:

Hypothesis 3: Technological factors are positively connected with the future viability of SE.

This comprehensive review of literature highlights possible connections among economic, social, and technological factors and the sustainability of SE. The proposed model seeks to empirically examine these relationships (see **Figure 1**).

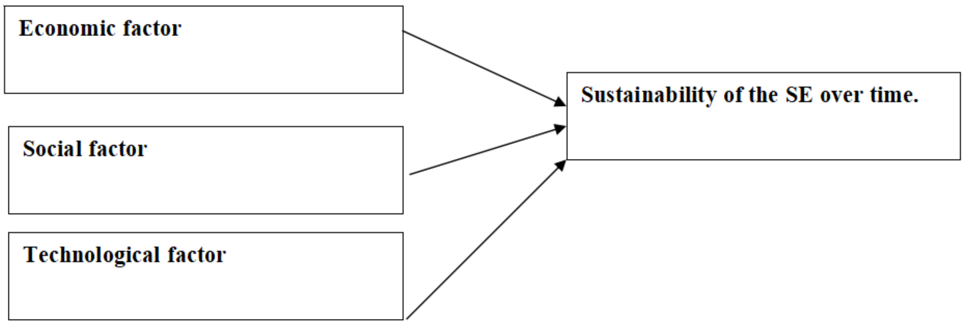


**Figure 1.** Conceptual model.

This conceptual model (**Figure 1**) represents the hypothetical relationships between social, economic and technological factors (independent variables) and the sustainability of sustainable entrepreneurship over time (dependent variable). The unidirectional arrows indicate the presumed effects of the factors on the long-term sustainability of sustainable entrepreneurship. The aim is to test these links empirically using partial least squares structural equation modeling (PLS-SEM).

# 3. Data collection and methodology

Data relevant to sustainable entrepreneurship across multiple Arab nations were gathered from various sources, including the World Bank, the Global Entrepreneurship Monitor (GEM), and the Human Development Index (HDI) (World Bank, 2017a,b,c,d,e; United Nations Development Programme, 2023). A total of 21 nations were selected, with full access to all specified databases. In instances where data were unavailable, a placeholder value of −999 was assigned to the indicator. Subsequently, using the SmartPLS software (Carrión et al., 2016; Ringle et al., 2015), missing data were managed by treating the indicator as missing and employing mean imputation, given that the rate of missing data remained below 5% (Hair et al., 2017).

The dataset encompassing all variables and nations is presented in **Table 1**, AND descriptive statistics are provided in **Table 2**.

**Table 1.** Data categorized by country.

| Country | GDP per capita growth (annual %) | Internet usage (% of population) | High-technology exports | Patent applications | Sustainability continuity index | Human Development Index (HDI) | Foreign direct investment |
|---|---|---|---|---|---|---|---|
| Algeria | 1.5 | 63.2 | 3.5 | 268 | 85.3 | 0.745 | 1.23 |
| Bahrain | 4.2 | 99.7 | 7.1 | 3 | 92.4 | 0.888 | 3.45 |
| Djibouti | 1.7 | 14.5 | 0.5 | 3 | 80.5 | 0.515 | 0.67 |
| Egypt, Arab Rep. | 4.9 | 71.9 | 2.9 | 881 | 79.8 | 0.728 | 2.89 |
| Iraq | 4.7 | 75.9 | 0.9 | 635 | 76.3 | 0.673 | 1.55 |
| Jordan | 1.2 | 66.8 | 3.4 | 25 | 89.7 | 0.736 | 0.98 |
| Kuwait | 8.4 | 98.0 | 7.2 | 1 | 93.9 | 0.847 | 5.67 |
| Lebanon | −5.8 | 84.3 | 1.3 | 110 | 70.4 | 0.723 | 0.43 |
| Libya | −2.4 | 21.1 | 0.8 | 12 | 58.7 | 0.746 | 0.78 |
| Mauritania | 3.7 | 18.1 | 1.1 | 0 | 65.8 | 0.516 | 0.34 |
| Morocco | 0.2 | 74.4 | 2.6 | 254 | 79.2 | 0.698 | 1.50 |
| Oman | 3.0 | 95.5 | 5.0 | 30 | 85.5 | 0.819 | 3.23 |
| Qatar | 3.9 | 99.0 | 6.7 | 47 | 90.2 | 0.875 | 2.65 |
| Saudi Arabia | 7.3 | 96.7 | 5.9 | 1398 | 88.4 | 0.875 | 4.78 |
| Somalia | −0.7 | 2.0 | 0.1 | 1 | 32.5 | 0.380 | 0.12 |
| Sudan | −3.5 | 30.9 | 1.2 | 153 | 61.2 | 0.516 | 0.87 |
| Syrian Arab Republic | −1.3 | 47.4 | 1.7 | 102 | 50.3 | 0.557 | 0.29 |
| Tunisia | 1.7 | 68.9 | 2.8 | 180 | 82.9 | 0.732 | 1.45 |
| United Arab Emirates | 7.0 | 99.0 | 5.5 | 69 | 95.0 | 0.937 | 5.89 |
| West Bank and Gaza | 1.4 | 74.6 | 3.2 | 0 | 78.4 | 0.716 | 1.12 |
| Yemen, Rep. | −1.7 | 27.6 | 0.4 | 20 | 45.3 | 0.424 | 0.14 |

**Table 2.** Summary of statistical descriptions.

| Construct | Indicator | Mean | Median | Min | Max | Standard deviation |
|---|---|---|---|---|---|---|
| Economic | GDP | 1.8 | 1.7 | −5.8 | 8.4 | 3.4 |
| | FDI | 72.7 | 71.9 | 2.9 | 1398 | 399.2 |
| Social | Internet use | 62.7 | 71.9 | 2.0 | 99.7 | 32.7 |
| | HDI | 76.9 | 77.5 | 45.3 | 95.0 | 14.9 |
| Technological | HTE | 3.1 | 3.2 | 0.1 | 7.2 | 2.0 |
| | Patents | 199.3 | 110 | 0 | 1398 | 435.8 |
| Sustainable entrepreneurship over time | Continuity | 2.0 | 1.5 | 0.12 | 5.89 | 1.8 |

### 3.1. Utilization of business continuity index

Due to the lack of an appropriate metric for assessing the long-term sustainability of sustainable entrepreneurship, the business continuity index proposed by Moya-Clemente et al. (2020) was utilized. This index, derived from the business discontinuity rate reported by GEM in 2022, calculates the complement of the discontinuity rate—specifically, 100 minus the discontinuity rate. The GEM discontinuity index reflects the percentage of individuals who have ceased their business activities within the past 12 months. Therefore, the continuity index represents the proportion of businesses that have maintained their viability over time (Moya-Clemente et al., 2021)

### 3.2. Inclusion of economic, social, and technological dimensions

The World Bank Data 2017 report provided metrics for economic factors, including GDP per capita and foreign direct investment. Social aspects were quantified using the HDI and the indicator for internet usage (de Siqueira et al., 2022; World Bank, 2017a,b,c,d,e). Furthermore, indicators for the technological component comprised high-tech exports and patent applications (World Bank, 2017a,b,c,d,e). **Table 3** displays these factors with their definitions, source databases, and specific indicators.

This methodological approach ensures a comprehensive analysis of sustainable entrepreneurship across diverse Arab nations, incorporating economic, social, and technological dimensions to elucidate the factors influencing long-term viability.

**Table 3.** Construct indicators description (2017 data).

| Factor | Indicator | Description | Source |
|---|---|---|---|
| Economic | GDP per capita growth (annual %) | The gross domestic product divided by the population at midyear yields the GDP per capita. It is the total gross value added by all producers who are residents of an economy, plus any product taxes and less any subsidies that aren't factored into the product value. The depletion of natural resources and the depreciation of artificial assets are not included in this statistic. | World Bank Data (World Bank, 2017b) |
| | Foreign direct investment (FDI) | Direct investment equity flows into a reporting economy are referred to as FDI. It consists of other capital, equity capital, and earnings reinvested. When a citizen of one economy exercises substantial influence or control over the operations of a business in another, this is known as direct investment. This is usually demonstrated by the ownership of at least 10% of the voting shares. | World Bank Data (World Bank, 2017a) |
| Social | Human Development Index (HDI) | A long and healthy life, access to information, and a reasonable level of living are the three fundamental characteristics of human development that the HDI measures on a composite index. For each of these three dimensions, it is computed as the geometric mean of the normalized indices. | UNDP Data (de Siqueira et al., 2022) |
| | Internet usage (% of population) | This statistic shows the proportion of people who, independent of the device or location of access, have used the Internet in the last three months. | World Bank Data (World Bank, 2017d) |

**Table 3.** (*Continued*).

| Factor | Indicator | Description | Source |
|---|---|---|---|
| **Technological** | Patent applications | This metric monitors the number of patent applications filed globally to secure exclusive rights for an innovation, either through national patent offices or the Patent Cooperation Treaty. A patent grants the patent holder temporary, typically 20 years, protection for their invention. | World Bank Data (World Bank, 2017e) |
| | High-technology exports (HTE) | Products with a high level of research and development, such as those in the aerospace, computer, pharmaceutical, scientific instrument, and electrical equipment industries, are included in the category of high-technology exports. | World Bank Data (World Bank, 2017c) |
| **Sustainable entrepreneurship over time** | Sustainability continuity index | The percentage of entrepreneurial endeavors that continue to be viable throughout time is measured by the continuity index, which gives an indicator of their long-term viability and capacity to prevent discontinuance. | GEM Data (Reynolds, 2022) |

The model validation employed the partial least squares structural equation modeling (PLS-SEM) technique, which allows for the direct measurement of latent factors using observable variables or indicators (Hair Jr et al., 2017). This approach is particularly advantageous for exploratory research efforts (Guenther et al., 2023), enabling the examination of correlations between latent variables composed of multiple items while maximizing the explained variance in one or more dependent variables (Manley et al., 2021)

PLS-SEM offers significant benefits, including its capability to estimate models effectively even with limited sample sizes and without assuming a specific data distribution (Hair et al., 2019). The analysis typically progresses through several stages as outlined by Hair et al. (2019):

1) Specification of the structural model
2) Specification of the measurement model
3) Data collection and analysis
4) Nomogram (path model) estimation
5) Evaluation of the measurement models
6) Assessment of PLS-SEM results
7) Advanced PLS-SEM analyses
8) Interpretation of findings and conclusions

The structural and measurement models are encompassed within the nomological network (Hair et al., 2019), facilitating a comprehensive understanding of the relationships among the variables under investigation. This rigorous methodological approach ensures robust validation and analysis of the model, allowing for meaningful interpretations and conclusions to be drawn.

## 4. Evaluation of the total model fit

The proposed model demonstrates a strong fit to the data, as indicated by the criteria recommended by Henseler et al. (2016). The results of the bootstrap-based fit test are detailed in **Table 4**. This non-parametric resampling technique assesses the variability of a statistic by analyzing the variability within the sample data, rather than relying on parametric assumptions to evaluate estimate precision (Streukens and Leroi-Werelds, 2016).

**Table 4.** Indices of model fit.

| Fit index | Value | Threshold range | Interpretation |
|---|---|---|---|
| (SRMR) | 0.060 | 0.050 ≤ 0.060 ≤ 0.100 | Acceptable fit |
| (d_ULS) | 0.400 | 0.300 ≤ 0.400 ≤ 0.700 | Acceptable fit |
| (d_G) | 0.220 | 0.100 < 0.220 < 0.350 | Good fit |

The outcomes of the fit test align with the benchmarks outlined by Benitez et al. (2020) for the unweighted least squares discrepancy (d_ULS: 0.300 ≤ 0.400 ≤ 0.700), geodesic discrepancy (d_G: 0.100 < 0.220 < 0.350), and the standardized root mean square residual (SRMR) (0.050 ≤ 0.060 ≤ 0.100). These findings indicate that the model effectively captures the relationships among the variables studied, affirming its validity and reliability for further analysis and interpretation.

The standardized root means square residual (SRMR), unweighted least squares discrepancy (d_ULS), and geodesic discrepancy (d_G) collectively indicate a good fit between the proposed model and the observed data. The SRMR value of 0.060 falls within the acceptable threshold range of 0.050 to 0.100, suggesting that the model is well-fitted to the data. Similarly, the d_ULS value of 0.400 and the d_G value of 0.220 are both within their respective permissible ranges of 0.300 to 0.700 and 0.100 to 0.350.

Taken together, these fit indices affirm that the suggested model is well-defined and adequately captures the structural relationships it posits, thereby confirming the validity of the model's structural framework.

## 4.1. Measurement model assessment

The measurement model for the reflective variables was assessed using multiple criteria, including individual-item reliability, tests for convergent and discriminant validity, and internal consistency (reliability) of scales (Hair et al., 2019; Manley et al., 2021). The findings are presented in **Table 5**.

**Table 5.** Constructive reflectiveness.

| Variables | External loads | CR | AVE |
|---|---|---|---|
| Sustainability continuity index | 1.000 | 1.000 | 1.000 |
| Economic | | 0.765 | 0.582 |
| GDP per capita growth | 0.918 | | |
| Foreign direct investment | 0.620 | | |
| Social | | 0.925 | 0.833 |
| Human Development Index (HDI) | 0.958 | | |
| Internet usage | 0.882 | | |
| Technological | | 0.790 | 0.650 |
| Patent applications | 0.804 | | |
| High-technology exports | 0.750 | | |

A minimum threshold of 0.707 ($\lambda \geq 0.707$) is recommended for individual-item reliability (Hair et al., 2019, p. 159). Most of the metrics in our evaluation exceed this threshold. However, the loading of $\lambda = 0.620$ obtained with the FDI indicator falls slightly below this guideline. According to some studies, loadings between 0.40 and 0.70 can be acceptable in the initial stages of scale development (Hair et al., 2019, p. 159), and the strict application of the rule of thumb ($\lambda \geq 0.707$) should be considered with flexibility. This criterion is still used to validate other requirements and is not disregarded.

Composite reliability was used to determine construct reliability (internal consistency), which denotes that the construct indicators represent the latent construct and must be greater than 0.7. Each construct's average variance extracted (AVE) value surpasses this threshold, indicating that each set of indicators accurately reflects a single construct and that each construct, on average, explains at least 50% of the variance in its indicators. In other words, the indicators effectively measure their respective constructs.

In summary, the model meets the criteria for convergent validity, individual-item reliabilities, and composite reliabilities. Discriminant validity is assessed using the Fornell and Larcker criteria as well as cross-loadings, ensuring that each construct is distinct from the others and that the study effectively evaluates multiple constructs.

#### 4.1.1. Cross-loadings

**Table 6** makes it clear that each indication has a strong correlation with the indicators of its own construct and is more closely tied to it than to the others. It is obvious that this is true even if it is not commonly utilized (Hair et al., 2019).

**Table 6.** Cross-loadings analysis for discriminant validity of sustainable entrepreneurship.

| Cross loadings | Economic | Sustainable entrepreneur ship over time | Social | Technological |
|---|---|---|---|---|
| Sustainability continuity index | 0.300 | 1.000 | 0.340 | 0.210 |
| GDP per capita growth | 0.918 | 0.310 | −0.170 | 0.430 |
| High-technology exports | 0.420 | 0.140 | 0.240 | 0.750 |
| Human Development Index | −0.030 | 0.380 | 0.958 | 0.120 |
| Foreign direct investment | 0.620 | 0.130 | 0.190 | 0.020 |
| Patent applications | 0.190 | 0.180 | −0.060 | 0.804 |
| Internet usage | −0.270 | 0.130 | 0.882 | 0.230 |

#### 4.1.2. Fornell-Larcker criterion

According to Hair Jr et al. (2017), a construct's average variance extracted (AVE) should be greater than the variance it shares with other constructs in the model. The correlations between constructs are indicated by the off-diagonal elements, while the square root of the AVE is displayed on the diagonal (refer to **Table 7**).

**Table 7.** Fornell-Larcker criterion assessment for discriminant validity of sustainable entrepreneurship over time.

| Fornell-Larcker | Economic | Sustainable entrepreneurship over time | Social | Technological |
|---|---|---|---|---|
| Economic | 0.763 | | | |
| Sustainable entrepreneurship over time | 0.320 | 1.000 | | |
| Social | −0.090 | 0.340 | 0.913 | |
| Technological | 0.380 | 0.210 | 0.100 | 0.805 |

In conclusion, as every need an indication is satisfied, the suggested A-mode measurement model is verified.

## 4.2. Structural model evaluation

The evaluation of the structural model follows the assessment of the measurement model, focusing initially on identifying any collinearity among variables, particularly emphasizing SE over time (SE_OT), which features the highest number of paths. The values obtained (VIF < 3) indicate no significant collinearity issues (see **Tables 8** and **9**), aligning with established guidelines (Hair Jr et al., 2017).

The signs and magnitudes of path coefficients ($\beta$) were scrutinized, revealing positive coefficients for all variables, thus supporting the proposed theories (see **Table 8**). Specifically, the economic component (ECO → SE_OT: $\beta$ = 0.292, $p$< 0.05) and social component (SOC → SE_OT: $\beta$ = 0.376, $p$< 0.05) exhibit significant positive relationships with SE over time. In contrast, the technological component (TEC → SE_OT: $\beta$ = 0.068, $p$> 0.05) shows no significant association with SE over time.

Further employing a bootstrapping technique with 5000 subsamples confirmed a positive correlation between the economic factor and SE over time. Conversely, the technological factor did not demonstrate a significant connection, while the social factor displayed a robust association with SE over time, as detailed in **Table 8**.

**Table 8.** The path coefficients of the structural model.

| Path | ($\beta$) | ($T$) | $p$ | 95% CI | Sig. | $f^2$ |
|---|---|---|---|---|---|---|
| Economic → sustainable entrepreneurship over time | 0.292 | 2.834 | 0.004 | [0.152–0.452] | Yes | 0.110 |
| Social → sustainable entrepreneurship over time | 0.376 | 3.025 | 0.002 | [0.198–0.488] | Yes | 0.142 |
| Technological → sustainable entrepreneurship over time | 0.068 | 0.432 | 0.332 | [−0.046–0.289] | No | 0.004 |

Note: Critical $t$-values 1.96 ($P$< 0.05).

**Table 9.** Assessment of collinearity among antecedent variables.

| VIF | Sustainable entrepreneurship over time |
|---|---|
| Economic | 1.172 |
| Social | 1.018 |
| Technological | 1.165 |

The predictive power within the sample was assessed using $R^2$ (Carrión et al., 2016), yielding a value of 0.242, indicating that collectively, economic, social, and technological factors explain 24.2% of SE performance over time. Additionally, individual variance explained by each construct—economic (11%), social (14%), and technological (2%)—is detailed in **Table 10**.

**Table 10.** Variance explained analysis.

| Variable | (*β*) | Correlations | AVE |
|---|---|---|---|
| Economic | 0.292 | 0.308 | 11% |
| Social | 0.376 | 0.354 | 14% |
| Technological | 0.068 | 0.210 | 2% |

To gauge predictive relevance ($Q^2$) and impact magnitude ($f^2$), following Hair et al.'s (2017) guidelines, the social component shows a moderate influence ($f^2$ = 0.142), the economic element demonstrates a weak effect ($f^2$ = 0.110), and the technological factor exhibits a minimal effect size ($f^2$ = 0.004). The Henseler test confirms predictive significance, with a positive statistic result. The predictive significance ($Q^2$) for the model is 0.180.

## 5. Discussion

The primary aim of this study was to investigate the persistent impacts of economic, social, and technological factors on sustainable entrepreneurship (SE) across diverse Arab nations. While SE lacks a universally agreed definition, it generally focuses on the sustainability of ventures for successors generations (Sarango-Lalangui et al., 2018), thereby framing our study's emphasis on long-term entrepreneurial viability. Notably, there is a scarcity of research exploring SE and its sustained longevity (Moya-Clemente et al., 2019), which motivated our investigation.

Our findings reveal a positive correlation between economic factors, such as GDP per capita and FDI, and sustainable entrepreneurship over time. This finding aligns with Maniyalath and Narendran's (2016) assertion that economic growth significantly impacts entrepreneurial sustainability, indicating that the economic advancements observed in the Arab countries studied create an environment conducive to sustaining entrepreneurial initiatives. However, the effect size ($f^2$ = 0.110) suggests that while economic factors exert influence, they do not singularly determine SE sustainability.

Additionally, our analysis indicates a positive correlation between social factors, such as internet usage and HDI and sustainable entrepreneurship over time. This finding aligns with Lau and Busenitz's (2001) assertion that social conditions are pivotal in the creation and growth of enterprises. The robust positive relationship ($\beta$ = 0.376, $p$< 0.05) and moderate effect size ($f^2$ = 0.142) underscore the critical importance of social infrastructure, including education and access to information, in supporting entrepreneurial ventures. This observation resonates with Huang et al.'s (2023) findings regarding the beneficial impact of social factors such as education on sustainable entrepreneurship.

In contrast to our initial hypothesis (H3), technological factors (specifically patent applications and high-tech exports) did not demonstrate a significant positive relationship with sustainable entrepreneurship over time. This contrasts with previous research highlighting the role of innovation and technological infrastructure in entrepreneurship (Wennekers et al., 2005). The lack of a significant relationship may suggest that technology serves more as an enabler of economic development

(Lado and Vozikis, 1997) rather than a direct driver of SE sustainability. The minimal effect size ($f^2$ = 0.004) further emphasizes the limited direct impact of technological factors on SE sustainability within the specific context of Arab countries studied.

### 5.1. Research limitations

A notable limitation of this research is the incomplete data for some countries, necessitating the use of imputed values and limiting the geographical scope to countries with complete datasets. Nonetheless, the included countries represent a diverse range of regions and income classifications, enhancing the study's robustness and applicability across different Arab contexts.

### 5.2. Implications and future research

These findings have significant implications for policymakers and practitioners aiming to foster sustainable entrepreneurship. Economic growth and robust social infrastructure emerge as crucial components. However, future research should explore why technological factors did not exhibit the expected influence and whether other unmeasured variables might account for this discrepancy.

## 6. Conclusion

In conclusion, future research could delve deeper into the specific mechanisms through which economic and social factors influence the sustainability of social entrepreneurship, particularly exploring the pivotal roles of education, access to finance, and institutional support. However, it's essential to acknowledge several significant limitations of this study. Firstly, the heterogeneity across the Arab world, with substantial variations between countries in terms of institutional frameworks and metrics, limits the generalizability of findings and replication potential. Similarly, diversity within Arab populations, including disparities between rural and urban areas, may affect sample representativeness and constrain the scope of conclusions for the entire region. Moreover, this quantitative research does not fully account for global economic, social, and technological trends that may impact regional sustainable entrepreneurship. Lastly, cultural aspects such as resistance to change and sustainable practices have not been explored here and warrant detailed examination to understand fully the challenges faced by social entrepreneurs in Arab countries.

To address these limitations, future studies could benefit from qualitative research approaches such as in-depth interviews and case studies, complementing quantitative analyses to uncover contextual factors and individual experiences shaping the sustainability of entrepreneurial ventures. Additionally, longitudinal studies tracking the performance of social enterprises over time could provide valuable insights into the dynamic interplay of economic, social, and technological factors influencing social entrepreneurship in Arab countries.

**Author contributions:** Conceptualization, FM; methodology, FM; software, FM; validation, FM; formal analysis, ABM; investigation, ABM; resources, FM; data

curation, FM; writing—original draft preparation, FM; writing—review and editing, FM and ABM; visualization, ABM; supervision, FM; project administration, FM; funding acquisition, ABM. All authors have read and agreed to the published version of the manuscript.

**Conflict of interest:** The authors declare no conflict of interest.

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