Journal of Management and Business Education

JMBE

www.journaljmbe.com ISSN: 2605-1044 Published by Academia Europea de Dirección y Economía de la Empresa.

Predicting the power of entrepreneurial orientation in improving the level of product innovation. Business education as a mediator

Predicción del poder de la orientación empresarial para mejorar el nivel de innovación de productos. La educación empresarial como mediadora

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Massoudi, A. (2025) Predicting the power of entrepreneurial orientation in improving the level of product innovation. Business education as a mediator. *Journal of Management and Business Education*, 8(1), 58-73.
https://doi.org/10.35564/jmbe.2025.0004
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Language: English
Received: 6 Sep 2024 / Accepted: 25 Feb 2025

Funding. The author received no financial support for the research, authorship, and/or publication of this article.

Ethical Statement. The author acknowledges the importance of ethical considerations in conducting and publishing this research. The study adhered to strict ethical guidelines to ensure the confidentiality, voluntary participation, and informed consent of all respondents. Informed Consent: Prior to data collection, all participants were provided with a detailed explanation of the study's purpose, procedures, and their rights as participants. They were informed that their participation was entirely voluntary and that they could withdraw at any stage without any consequences. Confidentiality & Anonymity: The study maintained strict confidentiality protocols. No personally identifiable information was collected or reported, ensuring that individual responses remained anonymous. The data was analyzed in aggregate form to prevent any identification of specific respondents or companies. Ethical Approval: The research protocol was reviewed and approved by ethics committee consist of 2 professors in Cihan University-Erbil, Iraq, aligning with standard ethical research practices. They checked the research design respects participants' rights, including informed consent, confidentiality, and voluntary participation. Also, evaluated whether the study poses any potential risks, Data Protection: The collected data was securely stored and only accessible to authorized researchers. It was used exclusively for academic purposes and handled in compliance with relevant data protection regulations. By adhering to these ethical principles, the study ensured the protection of participants' rights, privacy, and well-being while maintaining the integrity and reliability of the research findings.

Declaration of conflicting interests. The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

CRediT author statement. The entire paper has been written by its author.

ABSTRACT

Innovative firms may react to the swift shift in the business landscape by developing new competencies that allow them to attain an improved outcome. Earlier studies have stressed that entrepreneurial orientation is an essential component for business success. Hence, this article will determine the immediate influence of entrepreneurial orientations on product innovation in the Syrian pharmaceutical industry with a business education as a mediator. A primary quantitative research strategy backed by qualitative input was used to obtain empirical data from 264 senior executives, and innovation experts and staff representing 40 pharmaceutical companies in the Syrian pharmaceutical industry. The finding showed that the application of entrepreneurial orientation dimensions has a significant and positive influence on product innovation in the Syrian pharmaceutical companies. Also, business education mediates the relation between entrepreneurial orientation and product innovation. The article likely explores how entrepreneurial orientation influences product innovation, with business education acting as a mediator. This study is novel in examining how education strengthens the link between an entrepreneurial mindset and innovation outcomes. This highlights the potential of business education to enhance innovation-driven entrepreneurship.

Keywords. Entrepreneurial orientation, product innovation; business education, innovativeness, risk taking, proactively, Syrian Pharmaceutical Industry.

RESUMEN

Las empresas innovadoras pueden reaccionar a los rápidos cambios en el entorno empresarial desarrollando nuevas competencias que les permitan lograr mejores resultados. Estudios anteriores han destacado que la orientación empresarial es un componente esencial para el éxito empresarial. Por lo tanto, este artículo determinará la influencia inmediata de las orientaciones empresariales en la innovación de productos en la industria farmacéutica siria con una educación empresarial como mediadora. Se utilizó una estrategia de investigación cuantitativa primaria respaldada por aportes cualitativos para obtener datos empíricos de 264 altos ejecutivos y expertos en innovación que representan a 40 compañías farmacéuticas de la industria farmacéutica siria. El hallazgo mostró que la aplicación de las dimensiones de orientación empresarial tiene una influencia significativa y positiva en la innovación de producto de las empresas farmacéuticas. Además, la educación empresarial media la relación entre la orientación empresarial y la innovación de productos. El artículo probablemente explora cómo la orientación empresarial influye en la innovación de productos, con la educación empresarial actuando como mediadora. La novedad radica en examinar el papel del aspecto educativo en el fortalecimiento del vínculo entre la mentalidad empresarial y los resultados de la innovación. Esto pone de relieve el potencial de la educación empresarial para mejorar el emprendimiento impulsado por la innovación.

Palabras clave. *Orientación empresarial; innovación de productos; educación empresarial, capacidad de innovación; toma de riesgos; proactividad; industria farmacéutica siria.*

INTRODUCTION

In today's highly competitive and dynamic global market, product innovation (PI) has become a critical factor for sustaining business growth and maintaining a competitive edge. As companies strive to create unique products that meet evolving consumer demands, entrepreneurial orientation (EO) has appeared as a key driver of innovation. Entrepreneurial orientation is an essential concept for executives to develop strategies aimed at innovation and seizing opportunities that other

organizations may not be able to pursue. EO encompasses the processes, practices, and decision-making styles of organizations that operate in an entrepreneurial manner. EO is grouped within the distinctions of proactiveness, innovativeness and a propensity for risk-taking, EO allows firms to continuously realign themselves with emerging business environment changes and seizes new opportunities as necessary and scale up along with innovation (Chowdhury & Audretsch, 2021). Yet the magnitude of EO impact on PI tributary might be contingent with factors such as business education.

The cultivation of required product innovation capabilities to promote product innovation through BE is a necessary mediating factor (Dana et al., 2021). By means of well-ordered learning, entry to systems, and introduction to enterprising practices, business instruction gives an individual with the fundamentals needed to explore complex commercial venture conditions make educated choices and apply creative arrangements (Singha & Singha, 2024). It is a necessary bridge to strengthen the ability of EO to initiate PI, by offering entrepreneurs a solid grounding in strategic reasoning, market assessment, and innovation and design management capabilities.

The creation of unique new products is an enormous task that faces businesses in today's dynamic environment. Companies with a new product innovation will yield a higher rate of return than businesses with less development abilities. According to Villani et al. (2021) firms with product innovation has an 86% success rate compared to non-innovative firms. Innovative firms take desperate and costly measures to increase the research and development, or substantial changes in the organization's hierarchy to expand business development competences and thereby create unique product in their line of business (Massoudi et al., 2019).

When firms focus on industrial innovation, they are considered socially responsible and care about the welfare of society and probably gain competitive advantage globally and at their home countries (Padilla-Lozano & Collazzo, 2022). According to Jia et al. (2022) innovation is linked to community benefits and corporate social responsibility. Also, innovation produces benefits that enhanced products and generate higher returns to the organization. Innovation has various levels including radical innovation which is considered the utmost technically sporadic and highly significant for competitive edge. Successful launch of a radical innovative product can provide a leverage to the firm by reaping from the increase in market demand (Radicic & Petković, 2023). Abbas et al. (2024) noted that positive outcome will be generated whether a business introduces a new innovative product or improve standing one when compared with the competition. Competing businesses in pharmaceutical and technological sectors experience constant weight to advance their products with technology-cantered innovation (Roh et al., 2022).

This study aims to explore the predictive power of EO in improving PI, with business education as a mediating factor in the Syrian pharmaceutical industry. By examining the interplay between EO and business education, this research seeks to uncover how the knowledge and skills acquired through formal education amplify the innovative potential of entrepreneurship at the Syrian companies. Understanding this relationship is crucial for the pharmaceutical industry by looking to harness their entrepreneurial capacity to achieve sustainable innovation outcomes

The motivation of the study is designed for practitioners and scholars. For practitioners, the challenges of innovation introduced by this study is appropriate for the pharmaceutical sector due to the continuing demands and market vitality. The current dynamism in the Syrian market forces businesses to create new and novel products. Firms in dynamic industries such as the pharmaceutical industry that do not adopt innovation capabilities in their sector are exposed to risk from their competitors. For Scholars, the chance to examine the product innovation concept in a new industry will be of help to scholars and researchers. Also, this study would aid in predicting the effect of EO competency and business education on improving the level of product innovation.

LITERATURE REVIEW

Entrepreneurial orientation

Several scholars had contended that entrepreneurship is a fundamental process that leads to the growth and prosperity of the firm by generating jobs, creating innovative products, and improve the standard of living (Amini Sedeh et al.,2022; Massoudi & Fatah, 2021; Mitra, 2019). However, the constant changes in the business environment can be an enormous challenge to entrepreneurship (Ricciardi et al., 2021). Within entrepreneurship literature, a new concept has emerged and called corporate entrepreneurship. A study by Kim & Park (2021) acknowledged that corporate entrepreneurship is exploring and influencing the business environment to increase the innovative process in the corporation. A notable assistant of corporate entrepreneurship is detected in the EO processes which support workers' capability to examine markets and create novel products (Hughes & Morgan 2021).

EO is defined as an essential concept for executives developing strategies aimed at innovation and seizing opportunities that other organizations may not be able to pursue. EO encompasses the processes, practices, and decision-making styles of organizations that operate in an entrepreneurial manner (Huang et al., 2023). According to Sawaean & Ali (2020) EO is the procedure, performance, and the activities that generate new access to an invention. An organization that participates in EO participates in innovative products, risk-taking and proactive inventions of new products (Lumpkin & Pidduck, 2021).

Prior study by Alshibani et al. (2023) identified three dimensions related to EO: innovativeness, proactivity, and risk-taking. Innovativeness reflects organizational ability to involve in novel ideas, originality, research, and inventive processes that generate ideal products and services. Risk-taking is the ability of executives to commit to risky and costly resources. Finally, proactiveness is searching for original prospects not related to the standard operations, such as introducing a new brand ahead of the competition.

Business education

Business education is the formal training and knowledge development that provides essential skills, strategies and insights for sound business practice (Fang & Chiu, 2024). Business education is an origin in which entrepreneurs gain the potential to be endowed with tools and frameworks that allow them to make well-informed decisions, efficiently managing resources whilst establishing innovative strategies from their key ideologies (Jardim, 2021). It enables entrepreneurs to read market demands, manage uncertainties and improve innovation capabilities through which EO leads to successful PI.

Recent research identified that its well-recognized role of business education can facilitate EO and PI in the pharmaceutical sector (Abdelwahed et al., 2024; Yaseen et al., 2023). Business education aids in instilling entrepreneurship learning that enhances the decision-making potential of managers for identifying transformative market opportunities while effectively managing risks, particularly salient in an innovation-driven and highly competitive sector such as pharmaceuticals (He et al., 2024).

The pharmaceutical industry has seen a high demand for innovative drugs to treat different diseases. BE emphasizes strategic thinking, creativity, and knowledge integration, which are pivotal in driving product innovation (Ghafar, 2020). The influence of business education on PI is based on the level or type of education an employee has. Employees with higher levels of BE, such as an MBA or a master's in innovation management, tend to have more comprehensive skills in strategic thinking, market analysis, and cross-functional collaboration. This enables them to contribute more effectively to PI by aligning new product development with market needs and business goals (Na, 2021).

Product innovation

Innovation is the formation of a novel product or the modifications of existing one (Kochetkov, 2023). Innovation has the ability to raise quality, features, adeptness of a firm's product or service (Massoudi & Fatah, 2021). On the other hand, PI is defined as a product that creates distinction and a competitive edge that leads to higher organizational performance (Guthrie, 2024). PI is the announcement of novel products that are characterized by distinguished specifications, mechanisms, and resources. A study by Tewari et al. (2022) clarified it as a modification or advancement of a product or service. PI also follows the modification of the complete product or make minor changes to generate exceptional products. Successful PI delivers numerous benefits to organizations, including consumer attractiveness and devotion, brand equity, and market share Also, PI is an essential step in which firms modify and launch new competencies that are crucial for facing competition in today's business environment (Rajapathirana & Hue, 2018). Firms' capability to launch new products is characterized as a dynamic capability, because it aids firms to amend their resource measures as a response to the changing environment (Bag et al., 2022).

Additional factor improves PI is process innovation. According to Nwankpa et al. (2022) process innovation enhances efficiency, reduces production costs, and accelerates the time-to-market for new drugs. By optimizing manufacturing methods and streamlining operations, these innovations improve product quality and regulatory compliance, ultimately boosting competitiveness and profitability (Massoudi & Fatah, 2024).

According to Suwignjo et al. (2022) Innovation is distinguished by four kinds, namely: marketing innovation, product innovation, organizational innovation, and process innovation. In this article, the author chose only PI from the four mentioned kinds. The development of PI is likely to accelerate the organizational capacity in creating an exceptional product. High quality products improve the firm's ability to achieve a desirable outcome. In addition, PI creates a better value for consumers and better production process in comparison with competitors (Distanont, 2020).

Business Education as a Mediator

Hypothesis development

Entrepreneurial orientation and product innovation

The literature of entrepreneurship has revealed that innovation-oriented businesses are distinguished by the ability to announce novel products, very active in the market, also, a risk-taker in exploring innovative chance (Ayinla, 2020). Those three components work together to create a unidimensional structure. An article by Asemokha et al. (2019) claimed that EO is an institutional culture that motivations firms to launch new products. These components act more innovatively, closely, and courageously when firms apply EO in their tasks. These Components were examined by enormous studies that confirmed the EO concept (Kristinae et al., 2019; Fredyna et al., 2019).

Studies consistently indicate that companies with a strong EO are more inclined to pursue innovative initiatives, especially in the area of PI. A study by Liao & Zhao (2020) concluded that EO has a significant effect on PI. Conversely, Thoumrungroje & Racela, 2013) showed that an EO by itself is insufficient to influence PI. Therefore, the author revisited this concept and proposed the following hypothesis:

H1: There is a significant positive relationship between EO and the level of PI in the Syrian pharmaceutical industry.

Entrepreneurial orientation and business education

Many studies have shown a significant relationship between EO and the effectiveness of employee BE in the pharmaceutical industry. Studies by Nallaluthan et al. (2022) and Iyiola et al. (2023) have found that employees with higher levels of education are more engaged, motivated and adaptable in their learning experiences. This way of thinking motivates them to act, find new

information, and use their knowledge to solve real challenges. In addition, employee attitude with entrepreneurship orientation will be more willing to take the risk of innovation that can lead to success in the development of pharmaceuticals which is rapidly changing (Al-Momani et al., 2023). Organizations that encourage a culture of entrepreneurial thinking can create a more dynamic and effective learning environment that empowers employees to participate in the development of new products, strategies and business models. Study by Anfi et al. (2023) found that there is a direct influence of entrepreneurship education and EO. Also, Al-Awlaqi et al. (2021) identified positive and significant link between entrepreneurship training and all three dimensions of EO. From the above discussion, the author proposed the following hypothesis:
H2: There is a significant positive relationship between EO and BE in the Syrian pharmaceutical industry

Business education and product innovation

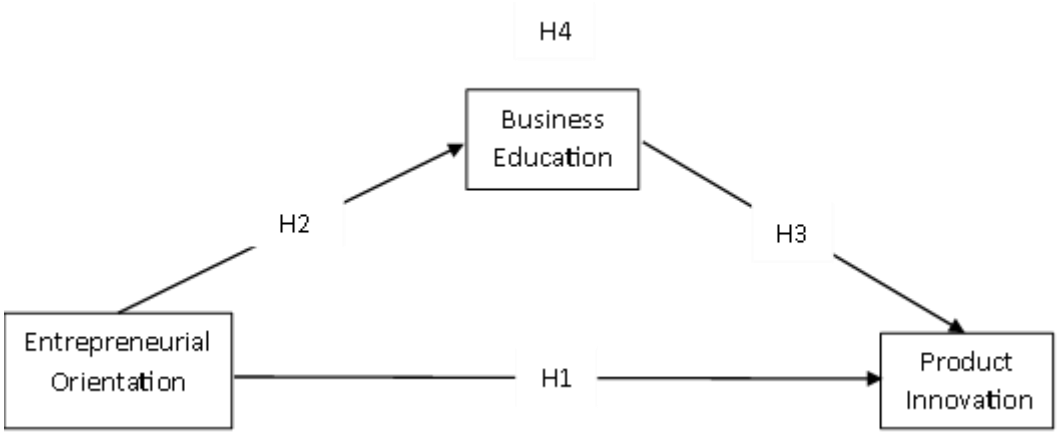
BE plays a pivotal role in PI within the pharmaceutical industry. Studies like (Damle & Krishnamoorthy, 2022; Demirkan et al., 2022) have shown that trained employees can lead their companies to a better future by identifying unmet needs of the patient population and developing innovative product concepts while navigating the complex regulatory landscape. Continuous education and training would create an innovative climate of the employees in pharmaceutical companies (Ryu et al., 2021). It allows employees to understand the latest trends, learn new skills and work across different functional domains. In the end, a workforce with relevance to drug discovery and development is essential for creating game-changing new drugs, therapies that enhance patient outcomes and provide a stimulus to business growth. A study by Suparno et al. (2024) Found entrepreneurship education to have a positive and significant effect on Pi and creativity. Based on the above, we hypothesize that:
H3: There is a significant positive relationship between BE and PI in the Syrian pharmaceutical industry.

Business education as a mediator

BE may play a pivotal role as a mediator between EO and PI by equipping people with the skills, knowledge, and tools necessary to transform innovative ideas into tangible products (Makhloufi et al., 2021). The mediating role of BE on the EO-PI relationship is further supported by studies that emphasize the role of knowledge and learning in innovation processes (Massoudi & Birdawod, 2023). BE equips entrepreneurs with technical and managerial skills that enable them to better harness the potential of EO. These skills help in market analysis, technology development, and innovation management, creating a conducive environment for product innovation (Asghar et al., 2023). Additionally, BE enhances decision-making, enabling entrepreneurs to balance risk-taking with market insights, ultimately improving the likelihood of successful product innovations (Garrido-Moreno et al., 2024).

While previous studies have recognized the direct impact of EO on innovation, the role of BE as a mediator remains underexplored. The study objectives to fill this gap by investigating how BE mediates the EO and PI n relationship. Specifically, it explores whether formal BE enhances the positive effects of EO on PI, offering a pathway for better understanding the mechanisms through which EO drives innovation.
H4: The relationship between EO and PI is mediated by BE in the Syrian pharmaceutical industry.

Figure 1. Research model



METHODOLOGY

Data collection

The objective of this study is to address the interactions between EO and PI in the Syrian pharmaceutical industry with emphasis on BE as a mediator. Figure.1 above explains the interrelationships between the study variables, considering the suggested propositions above. Therefore, selecting the suitable respondents is a vital step in retrieving precise information to examine the connections between the corresponding variables.

The rationale for selecting the pharmaceutical industry in Syria as the focal point of our study. This choice was driven by several key factors: The pharmaceutical industry is one of the most vital sectors in Syria, playing a crucial role in both economic resilience and public health, particularly during periods of conflict and crisis. Also, the pharmaceutical sector provides an exceptional context to inspect the influence of EO on PI. In addition, Syrian companies, especially in the pharmaceutical sector, do not operate under normal conditions due to factors such as economic sanctions, supply chain disruptions, and infrastructure challenges. These constraints force companies to adopt adaptive strategies that influence both their day-to-day operations and their capacity for innovation. We have included examples of how companies have adapted to these adverse conditions. For instance, many firms have shifted from relying on imported raw materials to sourcing locally or using alternative production methods. This has influenced both product and process innovation, with firms developing cost-effective manufacturing processes and locally-tailored pharmaceutical solutions to sustain operations.

This study targets pharmaceutical companies' executives and managers to conduct the empirical study. According to report by Syrian Arab News Agency (2021) The number of pharmaceutical factories in Syria has reached 70. In this study, the population was composed of 40 Syrian pharmaceutical companies' executives, managers, R&D specialist, innovation managers, marketing specialists and other managers. For practicality and feasibility, the author applied simple random distribution of the questionnaire due to its straightforward implementation, especially when other sampling methods may require more detailed population data or more complex logistics. More sophisticated sampling techniques, such as stratified sampling or systematic sampling, often require additional time, financial resources, or prior knowledge about the population structure, which might not always be feasible.

The author granted permission to conduct the study from the 40 firms' executives. A self-managed questionnaire was distributed to 290 specialists, only 264 were deemed usable, indicating a reply rate of 91 percent. For each of the 40 companies we interviewed, multiple employees were

surveyed also to capture a comprehensive view of company operations, strategies, and innovation practices. Specifically, we targeted managers and senior staff members who could provide valuable insights into the company's entrepreneurial orientation and innovation processes.

Measurement instrument

The questionnaire had three sections. The first section has five screening questions to ensure the right profile by respondents adapted from Stowell (2019). The questions included tenure at the company (no less than three years are qualified), Job title (only high ranked manager are included), company size, R & D spending (more than 2% of yearly revenues), and finally, specialization. The second section represents entrepreneurial orientation with 9 items linked to EO dimensions (Innovativeness, Proactivity, and Risk-Taking). These items were adapted from (Stowell, 2019). The third section represenst PI with 5 items adapted from (Tresna & Raharja, 2019). The fifth section represents BE with 8 items adapted from Anfi et al. (2023). The constructs were measured using a five-point Likert scale, ranging from 1 in lieu of strongly disagree to 5 in lieu of strongly agree.

Although these scales have been validated in international settings, adaptation for a specific context like Syria was essential due to potential differences in cultural, economic, and industrial environments. The original survey items were translated into Arabic, the primary language in Syria, to ensure comprehension. To maintain semantic equivalence, a back-translation was conducted by independent bilingual experts who translated the items back to the original language and resolved discrepancies.

Also, certain terms or concepts used in global surveys might not have direct equivalents or could be interpreted differently. The author adopted a culturally relevant language to ensure that respondents understand and interpret the items as intended.

In this study, the author utilized structural equation modeling to examine the relationships between the constructs. The author began by conducting a reliability test using Cronbach's Alpha, followed by an evaluation of measurement validity through convergent and discriminant validity analysis. For the model-fit assessment, path analysis was performed to evaluate the proposed hypotheses and the path coefficients between the constructs.

Demographics

The respondents' demographic in table 1 indicates that (69%) of respondents had work experience with more than 4 years. Regarding job responsibilities of employees, it was spread between (23%) work in product development, (18%) work in sales, (15%) in research development and (15%) in marketing. The majority of the respondents were managers in their firms (32%), (27%) were coordinators, (15%) were directors, (13%) were vice presidents, and (13%) were presidents or CEOs of their companies. In regards to the firm's size (71%) of these respondents works in a middle-size firms (30-100 employees) and the rest were between very small companies (10%) and more than 300 employees also (10%). Finally, the annual revenue spent on R&D (40%) spent between (3 to 4%), 24% spent between (4 to 8%) of their revenues, and 20% between (1 to 3 %) of total revenue and 16% devote (9%) of their revenues on R&D.

Table 1. Respondents demographic profiles (%)

		Frequency	Percent
Tenure Duration	Less than 4 years	83	31.4
	4 years or longer	181	68.6
	Total	264	100.0
Responsibility	Sales	46	17.5
	Product Development	60	22.7
	Marketing	40	15.1
	Research and Development	40	15.1
	Innovation	50	18.9
	Project Management	28	10.7
	Total	264	100.0
Job Title	Coordinator	72	27.3
	Manager	85	32.2
	Director	39	14.8
	Vice President	35	13.2
	President/CEO	33	12.5
	Total	264	100.0
Size of the firm	Fewer than 30 Employees	27	10.2
	30-100 Employees	186	70.1
	100-300 Employees	24	9.1
	Greater than 300 Employees	27	10.2
	Total	264	100.0
Annual Revenue Spent on R&D	1.1% to 3.0%	54	20.4
	3.1% to 4.0%	106	40.2
	4.1% to 8.0%	62	23.5
	More than 9.0%	42	15.9
	Total	264	100.0

RESULTS AND DISCUSSION

Outer loading

According to Legate et al. (2023), outer loadings should ideally be above 0.7 to indicate reliability of individual items. However, loadings between 0.4 and 0.7 may be acceptable if the composite reliability and AVE meet the required thresholds. For construct reliability and validity, Cronbach's Alpha values above 0.7 are acceptable, and AVE should be at least 0.5 (Legate et al., 2023). These measures help researchers assess the quality of their measurement instruments and the validity of their constructs. By examining these values, researchers can determine whether their scales are reliable and accurately measure the intended concepts.

As illustrated in table 2 a low loading on items such as BE6, BE7, and EO1-EO4 indicates that these items do not strongly correlate with their respective latent constructs. This weak correlation suggests that these items may not effectively represent the underlying construct, which can compromise the convergent validity of the model. When items within a construct have low loadings, it affects the internal consistency of the construct, potentially reducing the overall reliability. This inconsistency may indicate that certain items do not adequately capture the concept being measured, which can create misleading interpretations of relationships within the model.

Table 2. Convergent outcomes

Construct	Item	Outer Loading	CA	rho_A	CR	AVE
Business Education	BE1	0.830	0.814	0.851	0.862	0.461
	BE2	0.816				
	BE3	0.829				
	BE4	0.776				
	BE5	0.731				
	BE6	0.418				
	BE7	0.493				
	BE8	0.297				
Entrep. Orientation	EO1	0.378	0.846	0.907	0.861	0.445
	EO2	0.303				
	EO3	0.284				
	EO4	0.371				
	EO5	0.833				
	EO6	0.876				
	EO7	0.831				
	EO8	0.833				
	EO9	0.842				
Product Innovation	PI1	0.790	0.902	0.906	0.928	0.720
	PI2	0.883				
	PI3	0.884				
	PI4	0.874				
	PI5	0.806				

Note: n = 264. BE (Business Education); EO (Entrepreneurial Orientation); PI (Product Innovation).

According to Legate et al. (2023), the Heterotrait-Monotrait Ratio (HTMT) is a key criterion for assessing discriminant validity in SEM, with values below 0.90 (or 0.85 for stricter interpretations) indicating acceptable discriminant validity between constructs. In Table 3, the HTMT values between BE and EO (0.559) and BE and PI (0.635) are below the threshold of 0.85. Likewise, the HTMT value between EO and PI (0.498) confirms discriminant validity. These values suggest that the constructs are sufficiently distinct from one another, thereby meeting the criteria for discriminant validity as per the guidelines in Legate et al. (2023), which ensures the robustness and distinctiveness of the measurement model. HTMt is illustrated in table 3 below.

Table 3. Heterotrait-Monotrait ratio

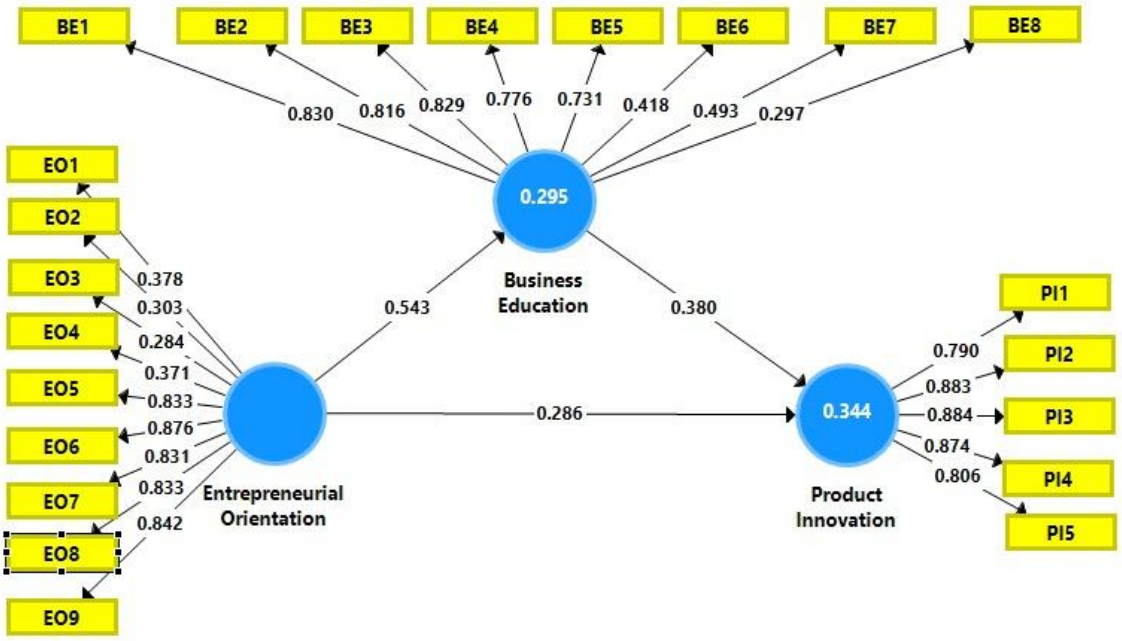
	BE	**EO**	**PI**
Business Education	—		
Entrepreneurial Orientation	0.559	—	
Product Innovation	0.635	0.498	—

Structural model analysis

According to Sarstedt et al. (2021), bootstrapping procedure is utilized to examine the significance of several PLS-SEM outcomes including path coefficients and R^2 values. The coefficient of determination (R^2) was examined. R^2 measures the variance of endogenous variables explained by exogenous variables. Chin (1998) indicated that R^2 values below 0.19 should be rejected, values ranging from 0.19 to 0.33 are deemed weak, those from 0.33 to 0.67 are considered moderate, and those exceeding 0.67 are categorized as high. As indicated in Figure 2, the R^2 values for EI is 0.295 and 0.344 for PI, respectively. The analysis showed a low R^2 value of

0.295. This value indicates that only 29.5% of the variance in entrepreneurial innovation can be explained by the model's predictors. This is indeed a limitation that weakens the model's predictive power and generalizability. The low R^2 value was due to the inclusion of irrelevant variables. Consequently, the R^2 is considered moderate for this model. Figure 2 shows the measurement model.

Figure 2. Measurement model

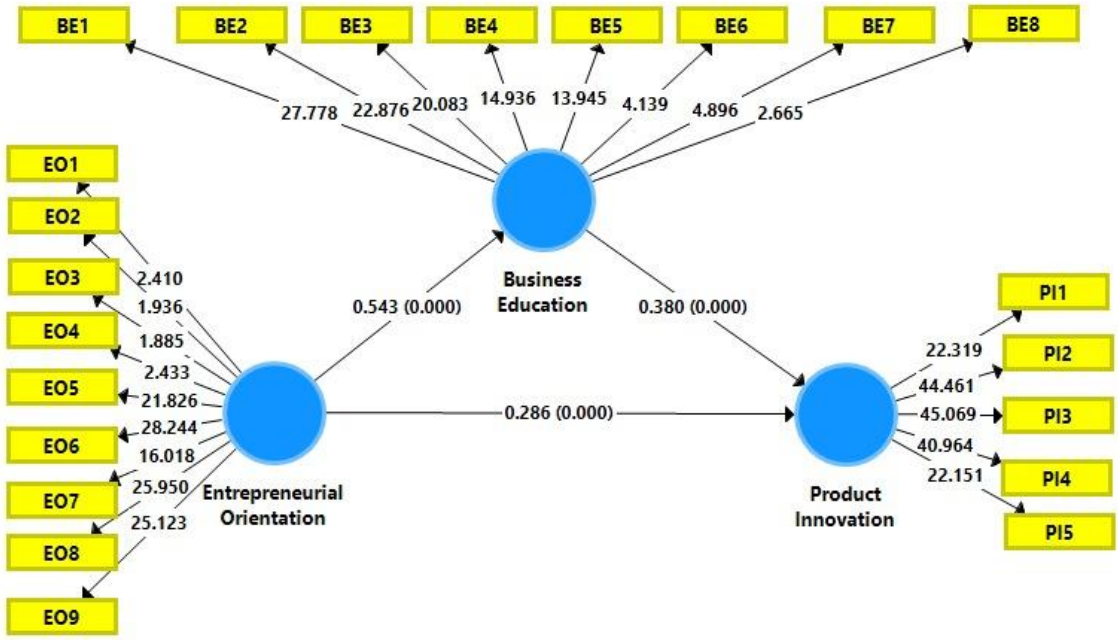


In Table 4, the author examined the proposed model direct and indirect effects to test the hypotheses of this study. The findings in Table 4 reveal that entrepreneurial orientation significantly affects product innovation, where β = 0.286, the p-value of 0.00 < 0.05 besides t-values of 3.594 > 1.96. Hence H1 is confirmed. Likewise, entrepreneurial orientation exerts a significantly positive influence on business education, as evidenced by the β = 0.543, p-value of 0.00 < 0.05 with a t-values of 10.098 > 1.96. Consequently, H2 is confirmed. Similarly, these outcomes are displayed in Table 4 showing that business education has a significant impact on product innovation among firms in the Syrian pharmaceutical industry. This conclusion is drawn from the β = 0.380, p-value < 0.05 and the t-value of 4.819 > 1.96. Accordingly, H3 is validated. Ultimately, the analysis revealed a significant indirect effect path where EO significantly influences the PI via the mediation function of BE, where the β = 0.206, p-value of 0.00 < 0.05 and a t-value of 4.112 > 1.96. Therefore, H4 is confirmed. Figure 3 illustrates the structural model output.

Table 4. Path coefficient and hypothesis results

Relationship	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics	P Values	Support (Yes/No)
EO -> PI	0.286	0.283	0.080	3.594	0.000	Yes
BE -> EO	0.543	0.552	0.054	10.098	0.000	Yes
BE -> PI	0.380	0.382	0.079	4.819	0.000	Yes
Specific Indirect effect						
EO -> BE -> PI	0.206	0.206	0.050	4.112	0.000	Yes

Figure3. Structural model output



DISCUSSION

The objective of this study was to inspect the influence of EO competency on improving the level of PI within the context of Syrian pharmaceutical industry. This industry is considered one of the most innovative industries in Syria. The result that emerged from the study showed that the components of EO (Innovativeness, Proactivity, and Risk-Taking) have positive relationship with PI. Therefore, the first hypothesis was confirmed. The outcome of this study is consistent with preceding EO literature including (Liao & Zhao, 2020, Kristinae et al., 2019) which concluded a positive relationship between EO and PI.

In addition, the second hypothesis also was confirmed where EO has a significant impact on BE. The result also consistent with (Djayadiningrat et al., 2017; Cho & Lee, 2018) where EO has a substantial role in BE in the firms studied. This study advocates that firms who depend on technology must concentrate on developing sources of knowledge and offer an intensive technical and training courses to simplify innovation actions and invest in EO intellectual skills. This article clarifies the essential necessity to improve other entrepreneurial areas including information, interpersonal skills, learning orientation, and adopting entrepreneurial characteristics for better outcomes.

Hypothesis 3 suggests that BE has a direct and positive influence on PI within the Syrian pharmaceutical industry. BE equips individuals with critical skills in management, strategy, marketing, and entrepreneurship, which can enhance innovative capabilities. In the pharmaceutical industry, where competition and R&D are key, individuals with a BE may better identify market needs, optimize resource allocation, and implement strategies for new product development. If validated, this relationship would imply that fostering business education could lead to increased innovation, competitiveness, and growth within Syria's pharmaceutical sector. This finding is in line with Suparno et al. (2024). And He et al. (2023).

In hypothesis 4, the author proposes that EO influences PI in the Syrian pharmaceutical industry, but this effect is mediated by BE. Entrepreneurial orientation, which includes risk-taking, proactiveness, and innovation, drives firms toward new opportunities and innovation. However, BE may enhance the impact of EO by providing the necessary managerial, strategic, and market-oriented knowledge to turn entrepreneurial intentions into successful PI. In this sense, BE serves as a mediator, facilitating the translation of entrepreneurial behaviour PI outcomes within the industry. This study corresponds with Makhloufi et al. (2021). This suggests that the more a firm is entrepreneurially oriented, the more learning and knowledge creation processes are involved in the interaction relationship which lead to innovative product.

The study confirms its hypotheses, but the author encounters unexpected results that showed lower-than-expected factor loadings (e.g., BE6, BE7, EO1-EO4). The author attributed this outcome to cultural and contextual influences. For example, some items might not resonate as strongly due to specific local business practices and conditions unique to the Syrian pharmaceutical industry. In addition to construct misalignment where items may not perfectly align with the theoretical construct in this context, indicating a need for further refinement or adaptation. Finally, respondents may have interpreted certain questions differently, affecting the response consistency and resulting in lower loadings. These low-loading items might affect the internal consistency and construct validity. Nevertheless, the retention of these items was justified by theoretical importance despite their lower loadings.

The study suggests that future studies could refine or replace these items, possibly by conducting qualitative interviews to understand respondents' perceptions and improve item alignment. Also, comparisons with studies in less innovative sectors to enhance the generalizability of the findings. A comparison with studies conducted in less innovative sectors would be beneficial. This would help illustrate how the relationships among entrepreneurial orientation, product innovation, and business education may differ based on sector-specific innovation levels. Similarly, a broader contextual analysis discusses how the pharmaceutical sector, known for its innovation-driven environment, might produce different results compared to less innovative sectors such as traditional manufacturing or agriculture.

Syrian pharmaceutical executives must promote the organizational culture of allowing risk-taking, out-of-the-box thinking and going with proactive approach. This could be done through focused internal campaigns, leadership training and embedding entrepreneurial ethos in the company mission. In addition, partner with business schools or align with educational institutions to create a tailored training module that addresses entrepreneurial competencies specific to the pharma industry. Such as workshops on innovation management, strategic thinking in the pharmaceutical context and leadership development. Lastly, in Syria, executives need to conduct workshops within their own facilities with the guidance of previous entrepreneurs and pharmaceutical innovators. This method strengthens work-integrated learning and allows employees to immediately implement terms used in entrepreneurship at their workplace.

This study would add to the theoretical framework of EO by exploring its impact within the unique context of the Syrian pharmaceutical industry. The findings could validate the applicability of EO dimensions such as innovativeness, proactiveness, and risk-taking in industries facing economic and political challenges, contributing to a broader understanding of EO in diverse contexts. In addition, the inclusion of business education as a mediating variable between EO and product innovation introduces a new dimension to innovation theory. This implies that the effectiveness of EO in promoting innovation can be amplified or enabled through the development of relevant skills and knowledge. Finally, the study contributes to human capital theory by highlighting how targeted education and skill development serve as critical enablers of strategic orientations like EO, thereby fostering innovative outcomes. It underscores the need for an adaptive learning environment in enhancing innovation capabilities.

CONCLUSION

The study tested the influence of entrepreneurial orientation in improving the level of product innovation: Business Education as a Mediator. Business education amplifies the effect of entrepreneurial orientation by providing essential skills and knowledge, enabling better strategic decision-making and resource management. the research concludes that EO, when combined with robust business education, can drive significant improvements in product innovation, even in a challenging environment. This synergy offers a pathway for pharmaceutical companies in Syria and potentially in other similar settings to overcome obstacles and achieve sustainable growth through innovation.

Limitations

The study consists of a few limitations; a small sample size was applied for each pharmaceutical company due to time constrain, a larger sample size would be more appropriate to generate better result. This article utilized an observational method that attempts to appreciate and reform the variances between two or more variables. As a result, it is recommended to apply a panel study to cover the progress of innovation through a detailed period of time.

From a business perspective, the study concentrated merely on the pharmaceutical industry, excluding other industries with less technological input such as agriculture was justified given the objectives of the study. Yet, excluding less innovative businesses in this study can decrease the accuracy of judgement with other studies that is related to entrepreneurship and innovation. Moreover, lower-than-expected factor loadings can be an implication for future research, suggesting that future studies could refine or replace these items, possibly by conducting qualitative interviews to understand respondents' perceptions and improve item alignment.

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