

## The Role of Technological Innovation on the Effect of International Strategic Alliances on Corporate Competitiveness in Jordanian International Business Administration: Moderating and Mediating Analysis

Bashar Younis Alkhalwaldeh<sup>1</sup>, Hamzeh Alhawamdeh<sup>2</sup>, Kadri S. Al-Shukri<sup>3</sup>, Maria Yousef<sup>4</sup>, Abdallah Yousef Ata Shehadeh<sup>5</sup>, Ala M. Abu-Samaha<sup>6</sup>, Ahmad A.M. Alwreikat<sup>7</sup>

### Abstract

*Within the context of Jordanian international business management, the current study explores the subtle relationships between global strategic alliances (ISA), corporate competitiveness (CC), and technological innovation (TI). Partial Least Squares Structural Equation Modeling (PLS-SEM) is used to assess the interaction between these variables as well as the mediation and moderation effects. Utilizing a sample size of 350 individuals who occupy professional, management, and decision-making roles in Jordanian businesses engaged in international commerce, the research article shows notable and significant positive associations. The results of the path analysis show a strong relationship between global strategic alliances (ISA) and both corporate competitiveness (CC) and technological innovation (TI). This shows that ISA is essential in fostering innovation inside organizations and developing competitive strategies. Additionally, this study looks at the connection between corporate competitiveness (CC) and technical innovation (TI), finding a very strong one. This emphasizes how important technological advancement is in enhancing a company's ability to compete. The model's mediating and moderating effects are the focus of the study's most important findings. The results provide solid support for the mediating role, indicating that the correlations between ISA, TI, and CC are interrelated and have an impact on one another. Furthermore, the findings of this study demonstrate a noteworthy moderation effect, suggesting the existence of external factors that exert an influence on the associations between these variables. This research provides valuable perspectives on the intricacies of global strategic partnerships, technical advancements, and corporate competitiveness within the realm of international business administration in Jordan. Through the elucidation of the complex interconnections and fundamental mechanisms, this research endeavour enhances our understanding of the influence of these factors on the competitive strategies and innovation endeavours of organisations.*

---

<sup>1</sup> Assistant Professor, Department of Administrative Sciences, Business Faculty, Jerash University, PO. Box 26150, basharyounes@yahoo.com, <https://orcid.org/0000-0002-4921-5702>

<sup>2</sup> Associate Professor, Department of Administrative Sciences, Faculty of Business, Jerash University, PO. Box 26150, hamzeh.alhawamdeh@jpu.edu.jo, <https://orcid.org/0000-0002-6515-9333>

<sup>3</sup> Department of Management Information Systems, Ajloun National Private University, Ajloun, Jordan, qadri.shukri@anu.edu.jo

<sup>4</sup> Instructor of computer science, Scientific basic science Dept., Middle East university (MEU), Myousef@meu.edu.jo

<sup>5</sup> Department of Accounting, Al al-Bayt University, Mafraq 25113, Jordan, abdallahghandi99@gmail.com

<sup>6</sup> Assistant Professor in Computer Science, Software Engineering Dept., Faculty of IT, University of Petra, 961343 Amman 11196 Jordan, ala.abusamaha@uop.edu.jo

<sup>7</sup> Department of Administrative Sciences, Faculty of Business, Jerash University, PO. Box 26150, ahmadwreikat@gmail.com

**Keywords:** *Corporate Competitiveness, International Strategic Alliances, Technological Innovation, PLS-SEM.*

## **Introduction**

In the contemporary global business landscape, organisations are actively exploring novel strategies to enhance their market position and achieve sustainable growth. International strategic alliances play a crucial role in achieving this objective. According to Shahzad et al. (2021), The establishment of cross-border activities by corporations has demonstrated the indispensability of these relationships as strategic assets for attaining a competitive advantage and fostering expansion in the international market. International strategic alliances are founded on the premise that cooperation has the potential to generate synergistic outcomes. Alliances provide as a novel approach for corporations to leverage their collective capabilities within a global landscape where the intricacies of international marketplaces are intricately interconnected (Spieth, et al., 2021). By sharing their different skills, resources, and networks, companies can handle problems and take advantage of chances better than if they did things on their own. These kinds of partnerships help companies to build on each other's strengths, which leads to more efficiency and better results. (Neumann, et al., 2019) says that when companies work together, they can match their goals strategically and use their resources to help each other. One of the most important things about international strategic alliances is that they can give people new ways to get into markets. Getting into international markets can be hard and full of unknowns. Strategic alliances connect companies to areas that would be hard for them to get into on their own. By working with local partners who have indigenous market knowledge, distribution channels and established networks, companies can more easily navigate cultural nuances and regulatory frameworks. This not only accelerates market entry, but also increases the likelihood of success. In this context, these alliances serve as incubators for innovation (Gilmore, 2020). When companies from different backgrounds come together, they bring different perspectives and new approaches. The cross-fertilization of ideas leads to the emergence of innovative solutions that might not have been conceivable in isolation. Through knowledge sharing, technology transfer and joint research and development efforts, strategic alliances facilitate the development of new products, services and operating methods. Innovation is therefore a natural byproduct of collaboration and strengthens the competitive arsenal of partner companies (Donner, & de Vries, 2021). However, the context in which these partnerships develop is in constant flux, with the unrelenting advancement of technology serving as its primary shaper. The disruptive power of technology is altering the very foundations of how businesses function. It has shifted focus away from tried-and-true methods and opened the door to novel approaches that can boost businesses' competitiveness. Technological advancements, such as digitization, data analytics, artificial intelligence, and blockchain, are allowing businesses to reimagine their operations, items, and interactions with customers (Borowski, 2021). The impact of this technological revolution on the corporate world goes far beyond the goods and services that individual companies provide. The way businesses operate is changing drastically as a result of new methods of communication, production, distribution, and consumption. Technology is being used by businesses to enhance the customer experience, save costs, and increase the quality of data from which decisions may be made. In addition, technology has broadened the possibilities for innovation, opening up new ways to stand out from the crowd and disrupt established industries (Casciani, et al., 2022). In essence, rapid technology advancements have altered the norms of global trade. They have provided businesses with the means to enhance their operations, generate revenue, and achieve a worldwide competitive edge. Technology serves as a catalyst for international strategic partnerships, taking collaboration to new heights (He et al., 2020). It not only

multiplies the positive effects of combining forces and exchanging knowledge, but it also paves the way for the creation of novel approaches that benefit both organisations. Academic study and professional practise in Jordanian international business studies place a premium on elucidating the complex relationship between international strategic alliances, technical innovation, and corporate competitiveness (Jum'a, et al., 2022). To broaden their customer base and revenue streams, many businesses are actively pursuing international expansion. Joint ventures, partnerships, and other forms of international strategic alliances have become crucial tools for dealing with the difficulties of international marketplaces (Oyedele, & Firat, 2020). The ability to incorporate novel technology into the partnerships is crucial to the success of such coalitions. Companies can improve their operations, distinguish their products and services, and acquire a competitive edge thanks to technological innovation (Ranta, et al., 2021; Alhawamdeh et al., 2023). The importance of international strategic alliances in boosting company competitiveness is highlighted in Jordan's specific context due to the country's strategic location, burgeoning markets, and expanding corporate ecosystem. These partnerships can provide doors to new markets, supply chains, and sources of expertise for Jordanian businesses as they want to take advantage of globalisation. In addition, the increasing pace of technological advancement in various sectors offers companies the opportunity to leverage innovation as a means to strengthen their competitiveness and effectively penetrate global markets. Therefore, this study examined the moderating and mediating analysis role of technological innovation in the relationship between international strategic alliances and corporate competitiveness in Jordanian International Business Administration

## Literature Review

### Corporate Competitiveness

In the dynamic and interconnected global business world, corporate competitiveness is a cornerstone of an organization's sustainable success and growth. In essence, a company's competitiveness encompasses its ability to strategically position itself within its industry, adapt to changing market dynamics, and continually outperform its competitors. This complex interplay of factors determines not only a company's ability to succeed in its current environment, but also its ability to seize opportunities as they arise and to meet future challenges (Sukumar, et al., 2020). Delivering value to customers is only one aspect of what makes a business competitive; others include careful management of resources, careful optimisation of operations, and constant innovation. Beyond only product quality and cost, a holistic strategy is essential for success in today's business climate. Instead, a multifaceted approach that includes everything from company values and strategy to customer service and technical advancements is required. The dynamic nature of the modern market necessitates more than just a commitment to excellence (Myung et al., 2019). The ability to adapt to shifting market conditions, shifting consumer tastes, and new technologies is a hallmark of a successful business. The ability to change with the times positions a company for long-term success in an ever-changing market (Hutabarat et al., 2021). Competitiveness, though, isn't something that can be worked on in isolation. It's inextricably linked to the company's place in the industry at large. To be competitively successful, a business must be able to compete with other firms in its field, recognise shifting market dynamics, and adjust its plans accordingly. Collaboration and partnerships, such as international strategic alliances, often play a critical role in improving competitiveness by providing access to complementary resources, new markets and shared knowledge. In the quest for competitiveness, innovation is a driving force (Evplova, 2019). Companies that consistently innovate are better able to differentiate their offerings, respond to changing consumer needs, and set new industry standards. Technological advances are catalysts for innovation, enabling companies to increase operational efficiency, develop new products and services, and even create

entirely new business models, (Alkhawaldeh, and Mahmood, 2021). Moreover, corporate competitiveness goes beyond financial metrics to include sustainable practices and societal impact. Companies that incorporate ethical considerations, environmental stewardship and social responsibility into their operations tend to build more resilient and enduring brands. Such holistic competitiveness not only attracts stakeholders who prioritize sustainability, but also contributes to long-term success by mitigating risk and enhancing reputation, Fraihat et al., (2023).

#### International Strategic Alliances

In the complex world of international business, companies are increasingly turning to strategic alliances to meet the challenges of globalization, drive growth and enhance their competitive advantage. Companies from various countries join forces in international strategic alliances to pool their resources and use each other's capabilities. Companies that want to expand their reach, increase efficiency, and cut costs should form strategic partnerships with similar businesses (Robson, et al., 2019). One reason for the rise of worldwide strategic alliances is the realisation that no single business can handle every potential opportunity or threat in the global market alone. Companies can gain access to more resources, technologies, and market intelligence by forming strategic alliances with like-minded businesses. Together, they are able to accomplish goals that would be prohibitively difficult or time-consuming to accomplish individually. International strategic alliances are distinguished by their capacity to generate synergies (Sadegh, et al., 2020). When two or more companies work together to achieve a common goal, this is called synergy since the combined efforts outweigh those of either company working alone. Cost reduction, risk sharing, and the creation of novel goods and services are all outcomes of this synergy. Alliances like these are also beneficial since they encourage knowledge sharing and the development of new viewpoints among members. International strategic partnerships are attractive because they provide access to new markets. Local expertise and relationships are becoming increasingly valuable to organisations when they expand into new markets (Bamel, et al., 2021). When entering a new market, it might be difficult to understand the local customs, laws, and distribution systems without a local partner. This expedites market access and lessens the dangers of expanding into uncharted territory. Global strategic alliances frequently produce novel outcomes. When businesses work together, they share their unique perspectives, methods, and experiences, creating an atmosphere where innovative solutions can flourish. Breakthrough discoveries that propel both parties forward can result from collaborative R&D (Cacciolatti, et al., 2020; Alkhawaldeh, et al., 2020). When people from different countries share their knowledge and skills, it paves the way for innovative goods and services that may satisfy a wide spectrum of consumers. However, there are difficulties associated with worldwide strategic partnerships. Significant challenges might arise from having to deal with cultural differences, aligning competing interests, and maintaining good communication, (Alkhawaldeh et al., 2022). As businesses expand internationally, obstacles to effective communication arise when workers in different time zones and/or speak different languages must work together. Therefore, effective alliance management calls for an approach that strikes a balance between cultural awareness, open dialogue, and shared goals.

#### Technological Innovation

Technological innovation has evolved as a transformative force in the dynamic international business scene, transforming industries, reframing strategies, and revolutionising business practises. It's the engine that propels ground-breaking innovations that break down barriers and create new opportunities for expansion, competitive advantage, and consumer involvement (Sun et al., 2021). Companies can adapt, grow, and take the lead in today's interconnected world thanks to technological innovation, which is more than just a tool. Technological innovation can be defined as the

use of new ideas, methods, or technologies to generate benefits, address problems, and gain a market advantage. It is the culmination of original thought and sound reasoning, resulting in ground-breaking innovations in products, services, and business models (Zhao et al., 2021). Businesses on different continents are now able to work together and innovate in ways that were previously impossible because to technology advancements. The concept of innovation has expanded beyond the walls of academic institutions and into the fabric of everyday life. Technology-forward businesses are capitalising on the opportunities it presents to reduce waste, boost productivity, and better allocate resources (Cheng, Yet al., 2021). Automation, data analytics, artificial intelligence (AI), and cloud computing are just a few examples of technical breakthroughs that have revolutionised the sector by decreasing costs, increasing accuracy, and speeding up decision-making. Furthermore, technology advancement helps to set businesses apart. Companies in today's oversaturated global market need to find ways to differentiate themselves in order to attract and retain customers. The ability to innovate allows businesses to provide clients with individualised solutions to their problems (Chen, & Lee, 2020). In addition to bolstering a company's competitive position in the market, this sort of distinction helps to increase client loyalty. In the framework of global trade, technology links hitherto inaccessible cultures, markets, and parties. Because of the ease with which the internet makes crossing international boundaries possible, businesses no longer have to limit themselves to local markets. Expanding into new markets and establishing connections with clients on a global scale has become impossible without the use of e-commerce sites, social media, and digital marketing methods (Zayani, 2021). However, developing a mindset open to change and growth is just as important as using the most cutting-edge technology available. Since the rate of technological change is increasing, businesses should promote an atmosphere that welcomes innovation, risk-taking, and adaptability. An innovative attitude welcomes ambiguity and welcomes change as a chance to advance, (Alkhaldeh et al., 2023).

## Hypotheses Development

Literature on this issue demonstrates a dynamic interplay between international strategic alliances and corporate rivalry, which has far-reaching consequences for the worldwide success of corporations. As a means of increasing competitiveness, international strategic alliances, which are defined by cooperative collaborations between businesses from different countries, have grown in prominence (Ho, et al., 2019). Partnerships like these help businesses better harness their strengths, share information, and access new markets so that they can take on global concerns. Both Ferreira and Franco (2020) and Emami and colleagues (2022) demonstrate that worldwide strategic alliances can boost a company's competitiveness by fostering synergies that boost creativity, productivity, and reach. Companies can benefit from collaborations by sharing resources and knowledge to create new products and services (Goyal et al., 2020) that set them apart from the competition. By forming strategic partnerships, businesses can obtain access to local knowledge and distribution channels, reducing the risk associated with expanding into new areas. Cultural differences, selecting the right partners, and ensuring effective coordination are only few of the difficulties highlighted in the literature as obstacles to successfully managing international partnerships. Because of these obstacles, anticipated competitive benefits may not materialise as planned. Furthermore, external factors such as industry dynamics, the regulatory environment, and global economic conditions may impact the efficacy of coalitions in enhancing competitiveness (Chen, et al., 2022). In terms of corporate competitiveness, research highlights its multi-faceted nature, encompassing not only financial metrics, but also adaptability, innovation, and sustainability. Companies that actively participate in international strategic alliances tend to exhibit higher levels of competitiveness due to their ability to tap external resources and leverage complementary capabilities. The proposed intermediary role of technological innovation introduces an

additional layer to this relationship (Shuwaikh, & Dubocage, 2022). Technological innovation is recognized as a driver of competitiveness, enabling firms to differentiate themselves, optimize their operations, and seize new opportunities. Integrating technological innovation in the context of international strategic alliances could enhance the positive impact on firms' competitiveness by fostering collaborative innovation and providing partners with a competitive advantage through advanced technologies (Liu, 2020). In the context of Jordan's international business studies, there are few studies that specifically address the interplay between international strategic alliances and firm competitiveness. Given Jordan's unique market dynamics, characterized by its strategic location and growing corporate ecosystem, exploring this relationship in the Jordanian context is particularly important. By addressing the moderating role of technological innovation, we aim to contribute to how these factors intersect, influence, and shape the competitiveness of firms operating in Jordan's particular corporate landscape. To address this research gap, and building on an extensive literature review, the following hypothesis is proposed:

H1: There is positive and significant effect of international strategic alliances on corporate competitiveness

The interaction between international strategic alliances, technological innovation, and corporate competitiveness is a critical factor in the modern global business landscape (Dinesh, & Sushil, 2019). The profound impact of international strategic alliances on technological innovation and firm competitiveness has attracted considerable interest from researchers and practitioners alike. International strategic alliances, characterized by collaborative partnerships between companies from different countries, have proven to be catalysts for technological innovation (He, et al., 2020). These alliances facilitate the exchange of knowledge, resources and expertise across borders, leading to cross-fertilization of ideas and practices (Cohen, 2019). Collaboration boosts innovation because partner organisations have access to fresh ideas, cutting-edge tools, and robust R&D departments (Usman & Hammar, 2022). Alliances allow organisations to explore new technologies and develop unique solutions more efficiently than they could on their own. Companies with greater innovative potential are better able to adapt to shifting market conditions and strengthen their position in the marketplace. Concurrently, international strategic alliances have a significant effect on the competitiveness of corporations (Qiu, et al., 2020). These partnerships increase operational efficiency, cost savings, and market access by pooling the resources of multiple partners. By working together, businesses may offset their flaws and build upon their strengths to get an edge in the market. Alliances allow organisations to better navigate the complexities of global markets, increase their market share, and ensure their long-term success. Alliances also encourage the exchange of information and ideas, which can boost both flexibility and productivity (Jiang, & McCabe, 2021). Alliances increase competitiveness through technological innovation. Partner companies produce unique solutions that aid in differentiation and operational efficiency through collaborative research, technology transfer, and knowledge sharing. By integrating leading-edge technologies and novel approaches, these companies improve their products, services and processes and position themselves as industry leaders (Martínez-et al., 2023). Consequently, the innovation capability fostered in alliances directly contributes to the competitiveness of the participating companies, enabling them to seize market opportunities and embark on sustainable growth paths. In summary, the link between international strategic alliances, technological innovation and corporate competitiveness is a multi-layered dynamic that shapes the modern business landscape. These components synergistically reinforce each other, with international strategic alliances serving as catalysts for technological innovation and corporate competitiveness. Technological innovation, in turn, amplifies the positive impact of alliances on competitiveness by promoting novel solutions and operational efficiency. In examining these relationships in the context of Jordanian

international business studies, we address the unique implications of this interplay for firms' competitive strategies in the particular Jordanian market.

H2: There is positive and significant effect of international strategic alliances on technological innovation

H3: There is positive and significant effect of technological innovation on corporate competitiveness

Technological innovation, in its role as a facilitator, introduces a dynamic dimension to the interplay between international strategic alliances and corporate competitiveness. When firms engage in cross-border partnerships, technological innovation acts as a central factor shaping and amplifying the impact of these alliances on competitive positioning. Moderation in this context refers to the extent to which technological innovation influences the strength or direction of the relationship between international strategic alliances and firm competitiveness. Technological innovation isn't merely an outcome or byproduct, but takes a proactive role in shaping the impact of alliances on competitiveness. Technological innovation, when effectively integrated into international strategic alliances, can enhance the benefits of such partnerships (He, et al., 2020). Companies can foster innovation by collaborating on projects that take advantage of cutting-edge technologies, pooled R&D resources, and new ways of thinking. As a result, new and improved products, services, and methods of doing business develop, which boosts competitiveness (Linde et al., 2021). Several aspects, such as the nature of the sector, the breadth of the collaboration, and the competencies of the partners, influence how much of a dampening effect technical innovation has (Jiao et al., 2019). The moderating effect of innovation may be seen more strongly in industries marked by fast technical advancements. Businesses in these industries can leverage technology advancement to set themselves apart from the pack and acquire an upper hand in the marketplace (Lyu et al., 2020). In addition, technical innovation's moderating power is affected by the geographical range of international strategic alliances. New technologies can help improve communication and coordination among international partners despite differences in culture, regulation, and the marketplace (Gretsch, et al., 2019). Alliance operations can be made more efficient through the use of modern communication technologies, data analytics, and digital platforms, which in turn streamlines procedures and increases competitiveness. It's worth noting, too, that technical progress can only act as a moderator for so long until it creates its own set of problems (Cappiello, 2020). Factors including intellectual property sharing, data security, and alignment of technology plans must be carefully considered when integrating innovation into alliances (He, et al., 2020). In addition, the innovation landscape is characterized by rapid obsolescence, which requires constant adaptation to remain competitive. In summary, technological innovation, when used as a facilitator, transforms the relationship between international strategic alliances and corporate competitiveness into a dynamic synergy (Aloisi, & De Stefano, 2020). It enables alliances to transcend conventional boundaries and promote innovation-driven competitiveness. In exploring the moderating effect of technological innovation in the context of international corporate governance in Jordan, we uncover how this synergy plays out in the unique Jordanian corporate landscape and contributes to the evolution of corporate strategies and competitive positioning.

H4: Technological innovation mediate the effect of international strategic alliances on corporate competitiveness

H5: Technological innovation moderate the effect of international strategic alliances on corporate competitiveness

Based on the above evidences the model of the study is depicted diagrammatically in Fig. 1.

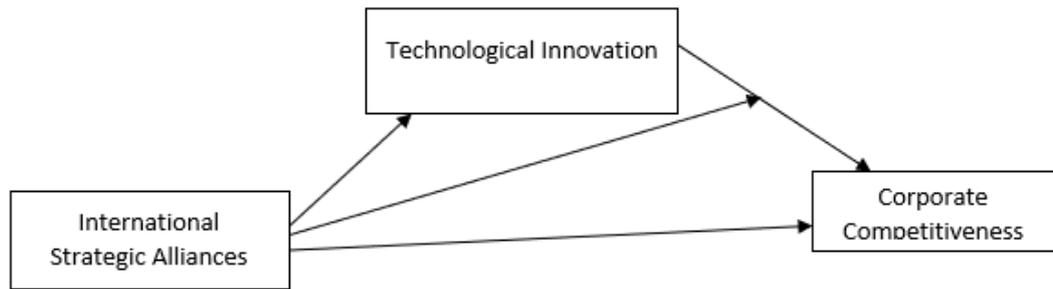


Fig 1 Model

## Research Methodology

This study employs a quantitative research approach to examine the role of technological innovation in the relationship between international strategic alliances and corporate competitiveness in the context of Jordanian International Business Administration. The target population for this study consists of professionals, managers, and decision-makers within Jordanian companies engaged in international business activities. Specifically, individuals responsible for forming or managing international strategic alliances and those involved in technological innovation initiatives are the focus. A purposive sampling technique employed to ensure that the selected respondents have relevant experience and expertise in the domains of international business, strategic alliances, and technological innovation. This approach ensures that the sampled population aligns with the research objectives and can provide meaningful insights. The sample size for PLS-SEM studies can be relatively smaller compared to other statistical methods, especially when using a purposive sampling approach. A guideline often followed is to have a minimum of ten times the largest number of structural paths directed at a latent construct. Considering the complexity of the study, a sample size of approximately 350 participants is considered sufficient to achieve reliable results. Data collected using a structured questionnaire adapted and modified from existing scales. The items for Corporate Competitiveness, International Strategic Alliances, and Technological Innovation are drawn from Andrushchenko et al. (2020), Robson et al. (2019), and Sun et al. (2021), respectively. The questionnaire was pre-tested for clarity and reliability. Items were rated on a ten-point Likert scale. The analysis will involve two stages: measurement model assessment and structural model assessment. The PLS-SEM technique was employed to assess the hypothesized relationships and the moderating and mediating effect of technological innovation. Ethical guidelines were followed throughout the research process, ensuring participant confidentiality, voluntary participation, and informed consent. Proper citation and permission protocols will be adhered to for the use of adapted scales.

## Result and Discussion

### Measurement Model

This section is primarily concerned with the statistical analysis of the reliability, validity, and potential biases inherent in the study model. The latent variables derived from the observable variables were tested for reliability using two key coefficients: Composite Reliability (CR) and Cronbach's Alpha (CA). High reliability was found, characterised by values of 0.7 or higher. The results in Table 1 show robust reliability, with both CA and CR values above 0.7, consistent with the research findings of Hair and Alamer (2022). To assess convergent validity, which measures the precision and soundness of the constructs, factor loadings were examined. Factor loadings of 0.50 or greater were considered indicative of adequate convergent validity. The results presented in the table show that all

factor loadings were above the threshold of 0.5, indicating strong convergent validity, which is consistent with the observations of Kono and Sato (2023), who claimed that significant convergent validity exists when factor loadings exceed 0.5. Table 1 also shows the values of the average variance extracted (AVE) associated with each construct. According to Legate et al. (2023), AVE values greater than 0.5 are sufficient evidence of convergent validity. It is noteworthy that all constructs in this study AVE had values greater than 0.5, further supporting their robust convergent validity.

Table 1 Measurements Model

Variables	Factor Loading	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)
<b>Corporate Competitiveness</b>		<b>0.907</b>	<b>0.908</b>	<b>0.925</b>	<b>0.606</b>
CC1	0.728				
CC2	0.772				
CC3	0.761				
CC4	0.801				
CC5	0.812				
CC6	0.857				
CC7	0.745				
CC8	0.745				
<b>International Strategic Alliances</b>		<b>0.887</b>	<b>0.887</b>	<b>0.923</b>	<b>0.751</b>
ISA1	0.766				
ISA2	0.888				
ISA3	0.907				
ISA4	0.898				
<b>Technological Innovation</b>		<b>0.866</b>	<b>0.868</b>	<b>0.918</b>	<b>0.788</b>
TI1	0.879				
TI2	0.89				
TI3	0.894				
TI x ISA	1				

Table 2 shows the heterotrait-monotrait correlation ratio (HTMT) used to assess discriminant validity. HTMT values of less than 1 indicate discriminant validity between constructs. For example, the value of 0.816 between CC and ISA indicates good discriminant validity between corporate competitiveness and international strategic alliances.

Table 2 Heterotrait-Monotrait Discriminant Validity

Variables	CC	ISA	TI	TI x ISA
CC				
ISA	0.816			
TI	0.826	0.767		
TI x ISA	0.131	0.251	0.283	-

Table 3 shows the square root of the AVE values for each construct and the correlations between constructs. The diagonal values are the square roots of AVE and represent the

common variance between a construct and itself. The values outside the diagonals are the correlations between the constructs. For discriminant validity, the square root of AVE for each construct should be higher than its correlation with other constructs. Here, the diagonal values are greater than the off-diagonal values, indicating discriminant validity.

Table 3 The Fornell and Lacker Discriminant Validity

Variables	CC	ISA	TI
CC	<b>0.778</b>		
ISA	0.624	<b>0.866</b>	
TI	0.632	0.675	<b>0.888</b>

VIF assesses the multicollinearity that occurs when predictor variables in a regression model are highly correlated. VIF values in Table 4 of more than 5 or 10 may indicate multicollinearity. In this case, the VIF values are all less than 2, indicating that multicollinearity is not a problem.

Table 4 VIF Results

	CC	ISA	TI	TI x ISA
CC				
ISA	1.85		1.000	
TI	1.874			
TI x ISA	1.081			

In this Table 5 and Figure 2, the results of the path analysis are presented, giving the estimated beta values, standard deviations (STDEV), corresponding t-statistics, p-values, and decisions made based on these statistics. Path analysis is used to examine the relationships between the latent variables: technological innovation (TI), International Strategic Alliances (ISA), and corporate competitiveness (CC). The path from International Strategic Alliances (ISA) to business competitiveness (CC) shows a significant positive relationship. The estimated beta value is 0.619, which means that every one unit increase in ISAs results in a 0.619 unit increase in CC. The t-statistic of 14.105 is remarkably high, and the associated p-value of 0.000 indicates strong statistical significance. Therefore, it may be concluded that ISA has a beneficial influence on CC. Furthermore, there is a robust positive correlation between ISA and TI. According to the projected beta value, there is a 0.675-fold rise in TI for every 1-fold increase in ISA. Extreme statistical significance is indicated by the t-statistic of 18.965 and the p-value of 0.000. Therefore, it may be concluded that ISA has a beneficial effect on TI. Finally, there is a strong positive correlation between technical innovation (TI) and company competitiveness (CC). A one-unit increase in TI is expected to result in a 0.343% rise in CC, as indicated by the projected beta value of 0.343. Strong statistical significance is indicated by the t-statistic of 7.264 and the p-value of 0.000. This lends credence to the idea that TI promotes cooperative learning.

Table 5 Path Analysis Result

	Beta Value	STDEV	T-statistics	P-values	Decision
ISA -> CC	0.619	0.044	14.105	0.000	Supported
ISA -> TI	0.675	0.036	18.965	0.000	Supported
TI -> CC	0.343	0.047	7.264	0.000	Supported
TI x ISA -> CC	0.098	0.034	2.903	0.004	Supported

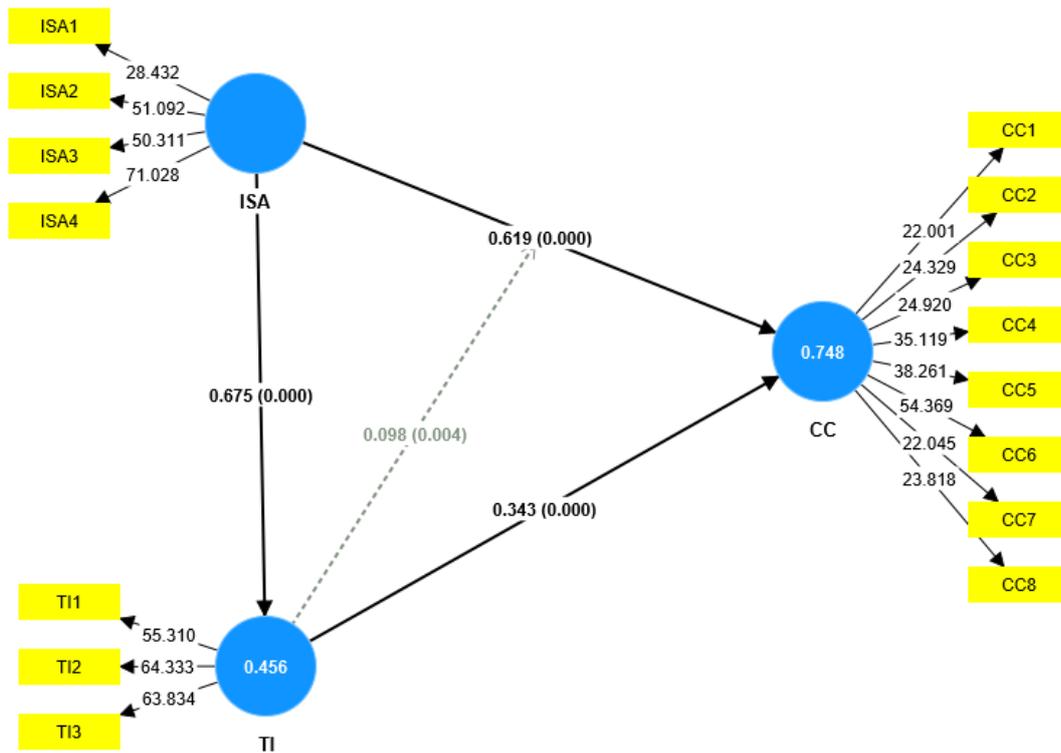


Fig 2 Graphical Result

The estimated beta value, standard deviation (STDEV), associated t-statistic, p-value, and choice made based on these data are all shown in Table 6, along with other key indicators that shed light on the mediation effect. International strategic alliances (ISA), technical innovation (TI), and corporate competitiveness (CC) are studied, and their relationships are analysed, along with the mediation effect. The indirect influence of International Strategic Alliances (ISA) on Corporate Competitiveness (CC) via Mediator Technological Innovation (TI) is investigated in this research. Using TI as a mediator, we estimate a beta of 0.232 for the path "ISA -> TI -> CC," which indicates the size and direction of the indirect effect of ISA on CC. According to Preacher and Hayes's (2004, 2008) suggestions, the mediation hypothesis "ISA -> TI -> CC" holds true. Strong support for the suggested mediation effect is provided by the statistically significant t-statistic and the extremely low p-value (0.000). Table 6 shows that there was indeed a significant mediation effect in the research. Technological innovation (TI) specifically mediates the connection between ISA and a company's competitiveness (CC). This suggests that technical progress helps to account for the beneficial effect of ISA on CC. Understanding how these concepts interact and contribute to the firm's competitive advantage can be mediated by the path "ISA -> TI -> CC."

Table 6 Mediation Effect Results

	Beta Value	STDEV	T-statistics	P-values	Decision
ISA -> TI -> CC	0.232	0.035	6.624	0.000	Supported

The estimated beta value, standard deviation (STDEV), associated t-statistic, p-value, and decision based on these statistics can all be found in Table 7 along with other key information from the analysis of the moderating impact. Focusing on the dynamic between technological innovation and international strategic alliances (TI x ISA) and corporate competitiveness (CC), the analysis probes the moderating influence within the framework of the study. Firm competitiveness (CC) is studied to determine the impact of the interplay between technical innovation (TI) and international strategic alliances (ISA). Moderation through the path "TI x ISA -> CC" is predicted to have a beta value of 0.098.

This number describes how much of a constraint the interaction term TI x ISA has on CC and in what direction. The moderating hypothesis "TI x ISA - > CC" is supported by the moderate t-statistic and significant p-value (0.004). Consequently, there is a strong moderating influence on corporate competitiveness (CC) caused by the relationship between technical innovation (TI) and international strategic alliances (ISA). Table 7's findings provide further evidence of the existence of a noteworthy moderating impact within the scope of the investigation. The connection between CC and the other constructs is affected by the interplay between TI and ISA. This shows that the synergistic impacts of technological advancement and worldwide strategic alliances on a company's ability to compete vary according to the degree to which these two factors interact with one another.

Table 7 Moderating Effect Results

	Beta Value	STDEV	T-statistics	P-values	Decision
TI x ISA -> CC	0.098	0.034	2.903	0.004	Supported

## Discussion

The purpose of this research is to provide light on the intricate interplay between ISAs, TI, and CC within the context of Jordan's international business education. The research examines the distinctive dynamics of these constructs in the Jordanian business environment using Partial Least Squares Structural Equation Modelling (PLS-SEM), and provides insights that are both contextually relevant and theoretically meaningful. The study's path analysis uncovers a network of interconnections that provide light on the underpinnings of competitiveness in Jordanian businesses. ISA has been shown to have a significantly positive correlation with CC. This result has brought attention to the significance of international strategic alliances in raising Jordan's corporate competitiveness. Cross-border alliances are evidently a crucial determinant in enhancing a company's competitive position within Jordan's dynamic commercial landscape through the amalgamation of resources, knowledge, and talents. The relationship between ISA and TI is likewise highly informative, demonstrating a robust positive link. This study illustrates the potential impact of international strategic alliances for Jordanian enterprises, specifically in terms of facilitating the adoption of advanced technologies. The establishment of collaborative efforts across national borders seems to have a notable impact on the cultivation of an inventive culture, thereby contributing to the progress of a country's technical position. The observed relationship between TI and CC demonstrates a positive correlation, underscoring its importance within the context of the study. This finding emphasises the importance of technical innovation in determining corporate competitiveness, and it does so in the context of Jordan's international business studies. Businesses that are open to new forms of technology have a better chance of succeeding in the competitive Jordanian market. The discovery of a substantial mediation effect considerably expands the significance of these results. In particular, the "ISA - > TI - > CC " pathway reveals the role of technological innovation as a mediator in the relationship between international strategic alliances and corporate competitiveness. This sheds light on the mechanism through which the impact of ISA is channeled to CC and highlights the mediating role of technological innovation in the Jordanian context. Moreover, the research findings reveal the presence of a significant moderating effect, with the interaction between technological innovation and international strategic alliances emerging as a significant factor. This highlights the dynamic nature of these relationships within the Jordanian landscape. The study's focus on international business studies in Jordan underscores the importance of considering the complex interplay between these constructs against the backdrop of the country's unique business environment. The contextual relevance and practical applicability of these findings are enhanced by the

background of Jordanian international business studies. Experts, managers, and decision-makers in Jordanian businesses with worldwide economic activity can benefit greatly from this study's findings. The study's conclusions could be applied in a variety of contexts, from the formation and management of international strategic alliances to the promotion of technical innovation. In essence, the study's findings suggest that international business management in Jordan depends on a complex web of interrelationships combining foreign strategic alliances, technological innovation, and corporate competition. The results shed light on the complex interplay between these concepts and provide useful lessons that can be implemented in a variety of contexts. This research presents a chance for better commercial and policy decisions, as well as strategic planning and development in Jordan, thanks to the country's specific circumstances.

## Conclusion

This study has undertaken an extensive investigation into the interplay between ISA, TI and CC in the specific context of management in Jordanian international companies. The findings have unveiled an intricate network of interdependencies among these three variables. This research uses the robust methodology of Partial Least Squares Structural Equation Modelling (PLS-SEM) to investigate these topics thoroughly. The findings have significant consequences for both the theoretical body of knowledge and the practical context of the dynamic business landscape in Jordan. Starting with a path analysis, the study sheds light on the fundamental connections that form the basis of the transition from ISA to CC. The findings reveal a distinct positive relationship that affirms the influential role of international strategic alliances in promoting business competitiveness in the Jordanian context. Collaborative partnerships that bridge international boundaries prove critical in leveraging shared resources and knowledge and strengthen a firm's competitive position in the complicated dynamics of the Jordanian business environment. Equally compelling is the revelation about ISA's journey to TI, which illuminates a robust positive relationship. In this context, international strategic alliances serve as catalysts for technological innovation in Jordanian companies. Bridging geographical distances, these partnerships serve as conduits for innovative ideas and practices, fostering a culture of progress that drives the country's technological landscape. The importance of technological advancement becomes even more apparent when considering the link between TI and CC. The study highlights a substantial positive relationship that underscores the transformative power of technological innovation in shaping business competitiveness in Jordan. The findings underscore the importance for companies to embrace technological change not only to remain relevant, but also to succeed in the rapidly evolving Jordanian market. In addition, the research uncovers two key effects. First, the confirmation of a significant mediation effect deepens our understanding of the interrelationships at play. In particular, the mediation path "ISA - > TI - > CC" illustrates the mediating role of technological innovation in linking international strategic alliances and firm competitiveness. This mediation path not only illustrates the linkage between the constructs, but also highlights the role of innovation as a channel for competitive success. Moreover, the observed moderating effect enriches our understanding by highlighting the interaction between technological innovation and international strategic alliances. The study's focus on Jordanian international business management underscores the nuanced nature of these relationships and highlights that the combined effects of TI and ISA vary based on their levels of interaction. This nuanced insight paves the way for tailored strategies based on the unique Jordanian business environment. In conclusion, this study has uncovered a symphony of relationships within Jordanian international business management where ISA, TI, and CC are interwoven to shape competitiveness. Using the methodological strength of PLS-SEM, the study has shined a spotlight on these constructs and provided insights that transcend theoretical domains and are applicable in the complex structure of the Jordanian business landscape in the real world. For

professionals, managers, and decision makers who need to navigate the complexities of international business operations, the findings of this study become a beacon to guide strategic decisions and promote the growth and success of Jordanian businesses. The unique contextual lens of this study sharpens our understanding of how these constructs interact within the specific domain of Jordanian international business management, ultimately contributing to the improvement of business practices and academic discourse alike.

### **Implication of the Study**

The findings of this study are of great managerial and practical importance to professionals, managers and decision makers working in the field of international business management in Jordan. The findings obtained from the relationships between international strategic alliances (ISA), technological innovation (TI), and corporate competitiveness (CC) provide actionable guidance for improving business strategies, promoting innovation, and gaining a competitive advantage in the unique Jordanian context. The observed significant positive relationship between ISA and CC underscores the strategic importance of building and maintaining international strategic alliances in Jordanian companies. Decision makers should recognize that these alliances can serve as effective tools to enhance business competitiveness. By forming cross-border partnerships, companies can leverage shared resources, knowledge, and capabilities to improve their market position and maintain their competitive advantage. The substantial positive relationship between ISAs and TI underscores the central role of international strategic alliances in promoting technological innovation. Practitioners should view alliances not only as channels for market access, but also as avenues for cross-fertilization of innovative ideas and processes. By entering into collaborations, organizations can foster a culture of innovation that drives the technological landscape and aligns with Jordan's aspirations for technological advancement. The identified pathway from TI to CC underscores the transformative role of technological innovation in shaping business competitiveness. Companies that prioritize technological advances are better positioned to gain a competitive advantage in Jordan's rapidly evolving business environment. Managers and decision makers should consider investing in research and development, technological infrastructure, and innovative practices to strengthen their competitiveness and master the intricacies of the Jordanian market. Confirming mediation and facilitation effects offers nuanced strategies for maximizing the impact of ISA and TI at CC. For professionals involved in forming or managing alliances, understanding the role of technological innovation as a mediator between ISA and CC offers insights into the mechanism by which alliances indirectly influence competitiveness. In addition, understanding the moderating effect of the interaction between TI and ISA can help guide decisions about the extent to which collaborations should be used to enhance competitiveness. Given the unique dynamics of Jordanian international business management, decision makers should consider their strategies with a contextual perspective. The findings from this study highlight the need to tailor business practices to the specifics of the Jordanian market. The positive relationships observed in this context highlight the potential for businesses to thrive by leveraging alliances and innovation, while the mediation and facilitation effects underscore the importance of crafting strategies that are attuned to the specific Jordanian business environment. In summary, the findings of this study underscore the transformative potential of international strategic alliances and technological innovation in the Jordanian business landscape. By cultivating alliances, fostering innovation, and strategically linking these factors to competitiveness, companies can navigate the complexities of Jordanian international business with a competitive advantage. The findings of this study provide a roadmap for decision makers

to lead their organizations to success, growth, and sustainability in the dynamic and evolving Jordanian market.

## References

- Adebayo, T. S., & Kirikkaleli, D. (2021). Impact of renewable energy consumption, globalization, and technological innovation on environmental degradation in Japan: application of wavelet tools. *Environment, Development and Sustainability*, 23(11), 16057-16082.
- Alhawamdeh, A. M., Al-habash, M. A., Zraqat, O., Hussien, L. F., Taha, I. B., Alhawamdeh, H., & Alkhalwaldeh, B. Y. (2023). The Effect of Religious and Ethnic Values on Executive Compensation in Jordanian Firms. *KEPES*, 21(3), 604-622.
- Alkhalwaldeh, B. Y. S., Al-Zeaud, H. A., & Almarshad, M. N. (2022). Energy Consumption as a Measure of Energy Efficiency and Emissions in the MENA Countries: Evidence from GMM-Based Quantile Regression Approach. *International Journal of Energy Economics and Policy*, 12(5), 352-360.
- Alkhalwaldeh, B. Y., & Mahmood, S. (2021). The Effect of Government Support for Fuel and Wheat on Economic Growth in Jordan: An Application of Dynamic Autoregressive-Distributed Lag.
- Alkhalwaldeh, B. Y., Mahmood, S., & Jakada, A. H. (2020). An empirical assessment of the effect of taxes and interest rate on economic growth in Jordan: an application of dynamic autoregressive-distributed lag. *Research in World Economy*. 11 (3), 1, 7.
- Alkhalwaldeh, B., Alhawamdeh, H., Al-Afeef, M., Al-Smadi, A., Almarshad, M., Fraihat, B., ... & Alaa, A. (2023). The effect of financial technology on financial performance in Jordanian SMEs: The role of financial satisfaction. *Uncertain Supply Chain Management*, 11(3), 1019-1030.
- Aloisi, A., & De Stefano, V. (2020). Regulation and the future of work: The employment relationship as an innovation facilitator. *International Labour Review*, 159(1), 47-69.
- Andrushchenko, H., Alkema, V., Hrynko, P., Portna, O., & Koliesnik, T. (2020). Transnational corporations as entities of international entrepreneurship. *Journal of Entrepreneurship Education*, 23(1), 1-6.
- Bamel, N., Pereira, V., Bamel, U., & Cappiello, G. (2021). Knowledge management within a strategic alliances context: past, present and future. *Journal of Knowledge Management*, 25(7), 1782-1810.
- Borowski, P. F. (2021). Digitization, digital twins, blockchain, and industry 4.0 as elements of management process in enterprises in the energy sector. *Energies*, 14(7), 1885.
- Cacciolatti, L., Rosli, A., Ruiz-Alba, J. L., & Chang, J. (2020). Strategic alliances and firm performance in startups with a social mission. *Journal of Business Research*, 106, 106-117.
- Cappiello, A. (2020). The digital (r) evolution of insurance business models. *American Journal of Economics and Business Administration*, 12(1), 1-13.
- Casciani, D., Chkanikova, O., & Pal, R. (2022). Exploring the nature of digital transformation in the fashion industry: opportunities for supply chains, business models, and sustainability-oriented innovations. *Sustainability: Science, Practice and Policy*, 18(1), 773-795.
- Chen, J., Ye, J., Zhuang, C., Qin, Q., & Shu, Y. (2022). Liner shipping alliance management: overview and future research directions. *Ocean & Coastal Management*, 219, 106039.
- Chen, Y., & Lee, C. C. (2020). Does technological innovation reduce CO2 emissions? Cross-country evidence. *Journal of Cleaner Production*, 263, 121550.
- Cheng, Y., Awan, U., Ahmad, S., & Tan, Z. (2021). How do technological innovation and fiscal decentralization affect the environment? A story of the fourth industrial revolution and sustainable growth. *Technological Forecasting and Social Change*, 162, 120398.
- Cohen, C. (2019). *Implementing Smart Specialisation: an analysis of practices across Europe*. Publications Office of the European Union, Luxembourg, doi, 10, 759464.

- Dinesh, K. K., & Sushil. (2019). Strategic innovation factors in startups: results of a cross-case analysis of Indian startups. *Journal for Global Business Advancement*, 12(3), 449-470.
- Donner, M., & de Vries, H. (2021). How to innovate business models for a circular bio-economy?. *Business Strategy and the Environment*, 30(4), 1932-1947.
- Emami, A., Welsh, D. H., Davari, A., & Rezazadeh, A. (2022). Examining the relationship between strategic alliances and the performance of small entrepreneurial firms in telecommunications. *International Entrepreneurship and Management Journal*, 1-26.
- Evplova, E. V. (2019). Social characteristics of personal and corporate competitiveness of future specialists: results of sociological research. *The Education and science journal*, 21(2), 132-154.
- Ferreira, A., & Franco, M. (2020). The influence of strategic alliances on human capital development: A study applied to technology-based SMEs. *EuroMed Journal of Business*, 15(1), 65-85.
- Fraihat, B. A. M., Alhawamdeh, H., Younis, B., Alkhawaldeh, A. M. A., & Al Shaban, A. (2023). The Effect of Organizational Structure on Employee Creativity: The Moderating Role of Communication Flow: A Survey Study.
- Gilmore, A. (2020). SME marketing networking. *Handbook of Entrepreneurship and Marketing*, 35.
- Goyal, S., Ahuja, M., & Kankanhalli, A. (2020). Does the source of external knowledge matter? Examining the role of customer co-creation and partner sourcing in knowledge creation and innovation. *Information & Management*, 57(6), 103325.
- Gretsch, O., Salzmann, E. C., & Kock, A. (2019). University-industry collaboration and front-end success: the moderating effects of innovativeness and parallel cross-firm collaboration. *R&D Management*, 49(5), 835-849.
- He, Q., Meadows, M., Angwin, D., Gomes, E., & Child, J. (2020). Strategic alliance research in the era of digital transformation: Perspectives on future research. *British Journal of Management*, 31(3), 589-617.
- He, Q., Meadows, M., Angwin, D., Gomes, E., & Child, J. (2020). Strategic alliance research in the era of digital transformation: Perspectives on future research. *British Journal of Management*, 31(3), 589-617.
- He, Q., Meadows, M., Angwin, D., Gomes, E., & Child, J. (2020). Strategic alliance research in the era of digital transformation: Perspectives on future research. *British Journal of Management*, 31(3), 589-617.
- He, Q., Meadows, M., Angwin, D., Gomes, E., & Child, J. (2020). Strategic alliance research in the era of digital transformation: Perspectives on future research. *British Journal of Management*, 31(3), 589-617.
- Ho, M. H. W., Ghauri, P. N., & Kafouros, M. (2019). Knowledge acquisition in international strategic alliances: The role of knowledge ambiguity. *Management International Review*, 59, 439-463.
- HUTABARAT, C., SUHARYONO, S., UTAMI, H. N., & PRASETYA, A. (2021). Servant leadership, business transformation, and corporate competitiveness. *The Journal of Asian Finance, Economics and Business (JAFEB)*, 8(2), 1091-1099.
- Jiang, Q., & McCabe, S. (2021). Information technology and destination performance: Examining the role of dynamic capabilities. *Annals of Tourism Research*, 91, 103292.
- Jiao, H., Yang, J., Zhou, J., & Li, J. (2019). Commercial partnerships and collaborative innovation in China: the moderating effect of technological uncertainty and dynamic capabilities. *Journal of Knowledge Management*, 23(7), 1429-1454.
- Jum'a, L., Ikram, M., Alkalha, Z., & Alaraj, M. (2022). Do companies adopt big data as determinants of sustainability: Evidence from manufacturing companies in Jordan. *Global Journal of Flexible Systems Management*, 23(4), 479-494.

- Linde, L., Sjödin, D., Parida, V., & Wincent, J. (2021). Dynamic capabilities for ecosystem orchestration A capability-based framework for smart city innovation initiatives. *Technological Forecasting and Social Change*, 166, 120614.
- Liu, Y. (2020). The micro-foundations of global business incubation: Stakeholder engagement and strategic entrepreneurial partnerships. *Technological Forecasting and Social Change*, 161, 120294.
- Lyu, Y., Zhu, Y., Han, S., He, B., & Bao, L. (2020). Open innovation and innovation "Radicalness"—the moderating effect of network embeddedness. *Technology in Society*, 62, 101292.
- Martínez-Peláez, R., Ochoa-Brust, A., Rivera, S., Félix, V. G., Ostos, R., Brito, H., ... & Mena, L. J. (2023). Role of Digital Transformation for Achieving Sustainability: Mediated Role of Stakeholders, Key Capabilities, and Technology. *Sustainability*, 15(14), 11221.
- Myung, J. K., An, H. T., & Lee, S. Y. (2019). Corporate competitiveness index of climate change: a balanced scorecard approach. *Sustainability*, 11(5), 1445.
- Neumann, O., Matt, C., Hitz-Gamper, B. S., Schmidhuber, L., & Stürmer, M. (2019). Joining forces for public value creation? Exploring collaborative innovation in smart city initiatives. *Government information quarterly*, 36(4), 101411.
- Oyedele, A., & Firat, F. (2020). Institutions, small local firms' strategies, and global alliances in sub-Saharan Africa emerging markets. *International Marketing Review*, 37(1), 156-182.
- Qiu, L., Jie, X., Wang, Y., & Zhao, M. (2020). Green product innovation, green dynamic capability, and competitive advantage: Evidence from Chinese manufacturing enterprises. *Corporate Social Responsibility and Environmental Management*, 27(1), 146-165.
- Ranta, V., Aarikka-Stenroos, L., & Väisänen, J. M. (2021). Digital technologies catalyzing business model innovation for circular economy—Multiple case study. *Resources, Conservation and Recycling*, 164, 105155.
- Robson, M. J., Katsikeas, C. S., Schlegelmilch, B. B., & Pramböck, B. (2019). Alliance capabilities, interpartner attributes, and performance outcomes in international strategic alliances. *Journal of World Business*, 54(2), 137-153.
- Robson, M. J., Katsikeas, C. S., Schlegelmilch, B. B., & Pramböck, B. (2019). Alliance capabilities, interpartner attributes, and performance outcomes in international strategic alliances. *Journal of World Business*, 54(2), 137-153.
- Sadegh, M. H., Shah Hosseini, M. A., & Heidari, A. (2020). Extracting the Effective Factors on Corporate Governance Formation in Strategic Alliances with Focus on International Joint Ventures through Systematic Literature Review. *Journal of Business Management*, 12(1), 64-93.
- Shahzad, M., Qu, Y., Zafar, A. U., & Appolloni, A. (2021). Does the interaction between the knowledge management process and sustainable development practices boost corporate green innovation?. *Business Strategy and the Environment*, 30(8), 4206-4222.
- Shuwaikh, F., & Dubocage, E. (2022). Access to the corporate investors' complementary resources: A leverage for innovation in biotech venture capital-backed companies. *Technological Forecasting and Social Change*, 175, 121374.
- Spieth, P., Laudien, S. M., & Meissner, S. (2021). Business model innovation in strategic alliances: a multi-layer perspective. *R&D Management*, 51(1), 24-39.
- Sukumar, A., Jafari-Sadeghi, V., Garcia-Perez, A., & Dutta, D. K. (2020). The potential link between corporate innovations and corporate competitiveness: evidence from IT firms in the UK. *Journal of Knowledge Management*, 24(5), 965-983.
- Sun, H., Edziah, B. K., Kporsu, A. K., Sarkodie, S. A., & Taghizadeh-Hesary, F. (2021). Energy efficiency: The role of technological innovation and knowledge spillover. *Technological Forecasting and Social Change*, 167, 120659.

- Sun, H., Edziah, B. K., Kporsu, A. K., Sarkodie, S. A., & Taghizadeh-Hesary, F. (2021). Energy efficiency: The role of technological innovation and knowledge spillover. *Technological Forecasting and Social Change*, 167, 120659.
- Usman, M., & Hammar, N. (2021). Dynamic relationship between technological innovations, financial development, renewable energy, and ecological footprint: fresh insights based on the STIRPAT model for Asia Pacific Economic Cooperation countries. *Environmental Science and Pollution Research*, 28(12), 15519-15536.
- Zayani, M. (2021). Digital journalism, social media platforms, and audience engagement: The case of AJ+. *Digital journalism*, 9(1), 24-41.
- Zhao, J., Shahbaz, M., Dong, X., & Dong, K. (2021). How does financial risk affect global CO2 emissions? The role of technological innovation. *Technological Forecasting and Social Change*, 168, 120751.