Journal of Management & Organization (2024), **30**, 2474–2494
doi:10.1017/jmo.2024.13

ANZAM
AUSTRALIAN & NEW ZEALAND ACADEMY OF MANAGEMENT

RESEARCH ARTICLE

The relationship between innovation and organizational performance: A meta-analysis

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(Received 20 September 2022; revised 8 February 2024; accepted 1 April 2024)

Abstract
This meta-analytic study aims to assess the relationship between innovation and organizational performance. Examining studies published from 2012 to 2021 using a specific protocol resulted in selecting 180 effect sizes from 143 studies. Comprehensive Meta-Analysis Software (CMA2) (2.2.064) software facilitated data analysis. Findings reveal a positive and significant relationship between innovation and organizational performance. Moderating analysis identifies country, continent, year of publication, and innovation type as moderating variables. Additionally, recent years exhibit a noteworthy convergence in the relationship trend between innovation and organizational performance. Enhancing organizational performance remains a critical concern. The study's outcomes offer valuable insights for managers, especially in international organizations to improve the planning and management of innovation and performance in their various branches and projects in different continents and countries.

Keywords: innovation; organizational performance; meta-analysis; moderators; year of publication; continent; country; innovation type

Introduction

A firm's ability to innovate is one of the factors that characterize its sustainability and potential for growth (Dukeov, Pekka Bergman, Heilmann, & Nasledov, 2020). The adoption of innovation entails organizational adaptation for the purpose of facilitating the fulfillment of goals, especially under the intense competition conditions, rapidly changing markets, scarce resources, and increasing demands for higher-quality products and services (Boyne, Farrell, Law, Powell, & Walker, 2003; David Osborne, 1993; Pollitt & Bouckaert, 2011). Despite numerous studies on the relationship between innovation and organizational performance, different studies have reported different and conflicting reports for this relationship (Hu, Hu, & Parsa, 2015; Prima Lita, Faisal & Meuthia, 2020). Although the overall view of this relationship is important, due to the growing globalization of industries and businesses and the development of virtual teams and international companies, understanding the difference in intensity of this relationship in different societies is very much needed. Moreover, creating a comparative perspective for this relationship with regard to the types of innovation is necessary for future research and applications. Furthermore, considering the rapid developments of societies, it seems necessary to examine the changes in this relationship in recent years.

The studies on the impact of innovation on organizational performance have used different methods, tools, and samples. A study conducted in China in 2014 confirmed the relationship between innovation and organizational performance in its universities with a high effect size (Cheng, 2014). Matjaž Maletič et al. demonstrated the positive and strong relationship between innovation and organizational performance (Maletič, Maletič, Dahlgaard, Mi Dahlgaard-Park, & Gomišček,

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https://doi.org/10.1017/jmo.2024.13 Published online by Cambridge University Press

2016). Another study was conducted in Spain and estimated a medium effect size for the relationship between innovation and organizational performance in technology companies (Martín-Rojas, Garrido-Moreno, & García-Morales, 2020).

Han and Huang (2012) analyzed the effect of innovation on the organizational performance and concluded that increased innovation has a slightly significant effect on their organizational performance (Han & Huang, 2012). Although previous studies reported the positive effect of job satisfaction on job performance, Hsin Hui et al. concluded that marketing innovation has a negative relationship with organizational performance (Hu et al., 2015). Moreover, in some other studies, an insignificant relationship between innovation and organizational performance was reported (Ilmudeen, Bao, Mubarak Alharbi, & Zubair, 2020; Prima Lita et al., 2020). Considering the difference in the results of previous researches, it has been important for researchers to conduct a meta-analysis to achieve a unified result. Liao, Liu, and Liu (2021) examined the relationship between environmental innovation and performance from January 1985 to December 2019 using English databases (Liao et al., 2021).

Feng, Ma, and Jiang (2020) conducted a meta-analysis between service innovation and performance from 1986 to 2019 in English databases and their results illustrated that service innovation has a negative relationship with organizational performance (Feng et al., 2020). Thao Nguyen, Huang, and Tian (2021) examined the relationship between open innovation and performance based on a comprehensive data set of 2,377,123 firms and sub-firm units in 171 studies published from 2003 to 2018 and showed that open innovation activities, including user participation, significantly contribute to firm performance (Nguyen et al., 2021). Damapanpour, Sabat, and Evan (1989) examined the relationship between type of innovation and performance. They focused on the administrative and technical innovations. Damanpour used public libraries data in six northeast states in the United States data during the 1970s (Damapanpour et al., 1989). Bowen, Rostami, and Steel (2010) investigated the relationship between innovation and firm performance meta-analytically using 158 effect sizes from 55 empirical studies in both temporal sequences, and the result illustrated that the effect size of this relationship is 0.16 (Bowen et al., 2010).

The affluence of research conducted on this relationship demonstrates its importance (Bowen et al., 2010; Feng et al., 2020). The difference in the results of past researches has determined the necessity of conducting meta-analytical researches in this field. However, previous meta-analyses have been focused on a specific type of innovation or performance (Liao et al., 2021) or were published years ago (Damapanpour et al., 1989) that do not provide a comprehensive and comparative view, which given the changes in societies in recent years, it is necessary to re-examine this relationship meta-analytically. Furthermore, this study presents a novel approach compared to other meta-analyses in the field. Unlike previous studies that have categorized different types of innovation, this research has avoided the categorization of innovation types to ensure the independent examination of each type of innovation. By adopting this approach, the analysis aimed to maintain the separation and distinctiveness of the various types of innovation, avoiding potential confounding effects that could arise from their integration. In addition to creating a comprehensive view of this relationship, this study has provided researchers with an understanding of the difference in this relationship in different fields by identifying variables such as country, continent, types of innovation, and the year of publication as moderator.

The results of this study can enable the managers of different industries to have a more comprehensive view of the subject and have better planning to improve their organization's performance through innovation. Furthermore, the results of this research are useful for researchers especially in Spain, China, Iran, Brazil, South Korea, and the UAE to investigate the reason for the difference in this relationship in those countries and to localize the results of international research. Moreover, clarifying the trend of changes and fluctuations in this relationship during recent years is one of the other achievements of this research, which can be useful for managers and researchers. This study aims to integrate and analyze the results of published studies on the relationship between innovation and organizational performance from January 2012 to January 2022 using meta-analysis and achieve

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a consistent result with high statistical power. In 'Literature review', the review of the literature is presented. The methodology of the meta-analysis is presented in 'Methodology'. Results and reports of searching the databases, software outputs are presented in 'Results'. Discussions and limitations are provided in 'Discussion and implications'. Finally, the conclusion is presented in 'Conclusion'.

Literature review

Innovation

Innovation, defined as the creation or significant improvement of a new product (product or service), process, new marketing method, or organizational method, is seen as a tool to increase corporate performance and competitive advantage (Shanker, Bhanugopan, van der Heijden, & Farrell, 2017). Research demonstrated that employees' innovation positively contributes to the success of an organization (Douglas & Sutton, 2010). In another study on small- and medium-sized enterprises in the manufacturing sector of Malaysia, a significant relationship between innovation and organizational performance was found (Zakaria, Chew Abdullah, & Zien Yusoff, 2016). In a separate study conducted on technology managers in Spain, the relationship between innovation and organizational performance with high impact size was confirmed (Martín-Rojas et al., 2020).

Organizational performance

Performance is a multidimensional concept that defines the position of the organization relative to its competitors (López-Nicolás & Meroño-Cerdán, 2011). Organizational performance refers to the process of explaining the effectiveness of prior actions (Neely, Gray, Kennerley, & Marr, 2006). Therefore, organizational performance is related to how much an organization achieved its goals (Li, Ragu-Nathan, Ragu-Nathan, & Rao, 2006). Currently, evaluating the performance of organizations, which involves the process of quantifying the effectiveness of previous activities, gains significance (Tangen, 2004). By evaluating performance, organizations can understand the current situation and examine future challenges (Wang & Noe, 2010). One of the key factors determining organizational performance is divided into two categories: the factors related to internal and external environment. Internal factors related to internal environment encompass strategy, structure, leadership, development and innovation, information technology, performance measurement, quality, and staff. External factors related to external environments refer to customers, competitors, and suppliers (Gavrea, Liviu, & Stegerean, 2011; Mokhber, Khairuzzaman, & Vakilbashi, 2018).

Innovation and organizational performance

Today, innovation is considered as an important mechanism for achieving competitive advantage and survival in global business (Ayoko, 2021; Sadikoglu & Zehir, 2010). The ability to innovate provides organizations with a strategic orientation to achieve a sustainable competitive advantage (Wiklund & Shepherd, 2011). Different organizations and even countries seek to rely on innovation to increase productivity and improve the economic conditions which contribute to the growing significance of innovation and increasing competition among communities and organizations (Jin, Hewitt-Dundas, & Thompson, 2004). In the relationship between technology-based innovations and competitive advantage is often shaped by organizational competencies that enable firms to exploit the results of their technological assets (Garcia-Morales & Esmeralda, 2018). This leads to the first hypothesis.

Hypothesis 1: Innovation relates positively with organizational performance.

Refined articles from databases have been made in different countries and years. Furthermore, cultural background of societies can boost innovation and thus accelerate competitiveness (Petrakis, 2016).

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Metcalfe (1998) stated that when the flow of newness and innovations desiccates, firms' economic structure settles down in an inactive state with little growth. Therefore, innovation plays a significant role in creating the differences of performance and competition among firms, regions, and even countries (Metcalfe, 1998). For instance, the study by Fagerberg, Mowery and Nelson (2004) revealed that innovative countries had higher productivity and income than the less-innovative ones (Fagerberg et al., 2004). The Organisation for Economic Co-operation and Development (OECD) reports pointed out that companies that developed innovations in a more decisive way and rapidly, had also more qualified workers, paid higher salaries, and provided more conclusive future plans for their employees. In fact, the effects of innovations on firm performance differ in a wide spectrum from sales, market share, and profitability to productivity and efficiency (OECD Oslo Manual, 2005). Industry and business administrations in different countries may use different innovations according to the culture and language of the employees. On the other hand, the performance of employees in different countries is not the same. Different results of studies in different countries and years lead to the second, third, and fourth hypothesis.

Hypothesis 2: Continent is a moderation variable for the relationship between Innovation and organizational performance.

Hypothesis 3: Country is a moderation variable for the relationship between Innovation and organizational performance.

Hypothesis 4: Publication year is a moderation variable for the relationship between Innovation and organizational performance.

Innovation encompasses various types, each with different impacts on organizational performance. Cheng Zhu, Isaac, and Edmund (2022) examined the relationship between innovation and firm performance, highlighting the importance of innovation for competitiveness and economic growth (Zhu et al., 2022). The results show that innovation has positive influence on the performance of Chinese enterprises ($\beta = 0.059$, $p < .01$), and suggesting that innovative efforts by Chinese firms have impact on their performance. This is consistent with previous findings by Syed et al. (Rehman Khan et al., 2022) and Guo et al. (Guo, Chao, Zhongfeng, & Donghang, 2020), where it was established that innovation fosters enterprise productivity. Zhon Liao et al. conducted a meta-analysis between environmental innovation and firm performance and reported that the environmental innovation has a significantly positive effect on both firms financial and environmental performance (Liao et al., 2021). This conclusion is consistent with the results that Ong et al. (Ong, Lee, Heng The, & Bakhsh Magsi, 2019) and Xue, Boadu, and Xie (2019) reported. Changli Feng et al. conducted a meta-analysis and demonstrated that relationship between service innovation and firm performance is significantly affected by the economic region. The results of the meta-analysis have indicated that service innovation has a more significant effect on firm performance in developing regions than in developed regions (Feng et al., 2020). The relationship between innovation and organizational performance can be influenced by various types of innovation, leading to the formulation of the fifth hypothesis.

Hypothesis 5: Type of innovation is a moderator variable for the relationship between innovation and organizational performance.

Methodology

Meta-analysis is a statistical method that integrates the results of several independent studies that are 'combinable' (Egger, Smith, & Phillips, 1997). Qualitative review studies could provide insights into expanding the literature in this area. Qualitative review studies contribute to the development

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of theories, but do not provide generalizable result. Quantitative and systematic review studies are gaining significance due to providing generalizable results and following a specific goal to prevent bias and introduce various areas for future research studies. Moreover, quantitative review studies could more effectively bridge research gaps (Rowley & Paul, 2021; Singh, Dhir, Gupta, Mukunda Das, & Sharma, 2020).

The current study aims to investigate the relationship between innovation and organizational performance. The quantitative procedures in meta-analysis studies eliminate the challenges caused by multiple responses given to a particular question in various studies. Meta-analysis combines the numerical results of several studies, makes an accurate estimation of descriptive statistics to explain incongruities, and discovers moderators and mediators. It enables the researchers to obtain the results that are more accurate and valid compared to what is achieved in a preliminary study or a non-quantitative validity investigation (Rezaian, 2005).

In the process of conducting a meta-analysis, first thorough and required searches are performed among past studies; next, the information and data are extracted from studies that have been identified based on a specific protocol. Then the results of this extracted information are combined. After analyzing these data, various factors such as homogeneity or heterogeneity of them, biases, and identifying the moderator variable are examined (Borenstein, Hedges, Higgins, & Rothstein, 2011). The next step is conducting necessary examinations and analyses, the results of which are reported as effect sizes. The value that represents the magnitude of the relationship between two variables is the effect size.

Moreover, for readers to make the right decisions in scientific terms there must be an appropriate criterion. This criterion is the observed magnitude of the effects, which a quantitative amount that must be reported by scientific processes. The obtained index summarizes effect sizes of findings in meta-analysis (Grissom & Kim, 2005). Cohen (1992) defined a criterion for describing the magnitude of the effect size. Basically, for this criterion, the effect size of 0.5 means a large relationship, 0.3 means a medium relationship, and 0.1 means a small relationship. The relationship is also significant and reaches a 95% confidence level when the p-value is less than .05 (Cohen, 1992).

The strategy of searching the literature

A systematic and comprehensive search was conducted on ASCE, ScienceDirect, and Scopus databases. In addition, the Magiran Persian database was searched to prevent linguistic bias. The current study investigated the studies published between January 2012 and January 2022. The keywords searched in this process included 'innovation' and 'organizational performance'. The search field of keywords was title, keywords, and abstract.

Inclusion and exclusion criteria

The current study can be classified as a documentary research study that applied a quantitative approach and a descriptive strategy to comprehensively investigating the studies with a certain hypothesis and obtaining a specific conclusion. The studies were downloaded from four databases. According to the Fig. 1, articles that were overlapping in databases were removed, then qualitative research studies were excluded. In the next step, the studies need to observe the following criteria for data analysis purposes: making a hypothesis or raising a question, using a reliable and valid data collection instrument, having a completely specified population, and using convenient statistical tests. Based on the flowchart illustrated in Fig. 1, 424 studies were identified in the databases. However, 254 studies were missing, and 175 articles were repetitive (a study was repeated three times and other studies were repeated twice), which led to the elimination of 88 studies. In the next phase, 308 qualitative articles were discarded. Then, 631 studies were eliminated since they neither investigated their intended hypothesis nor conformed to the protocol defined in the current study. Finally, 143 studies were selected and the required data were extracted.

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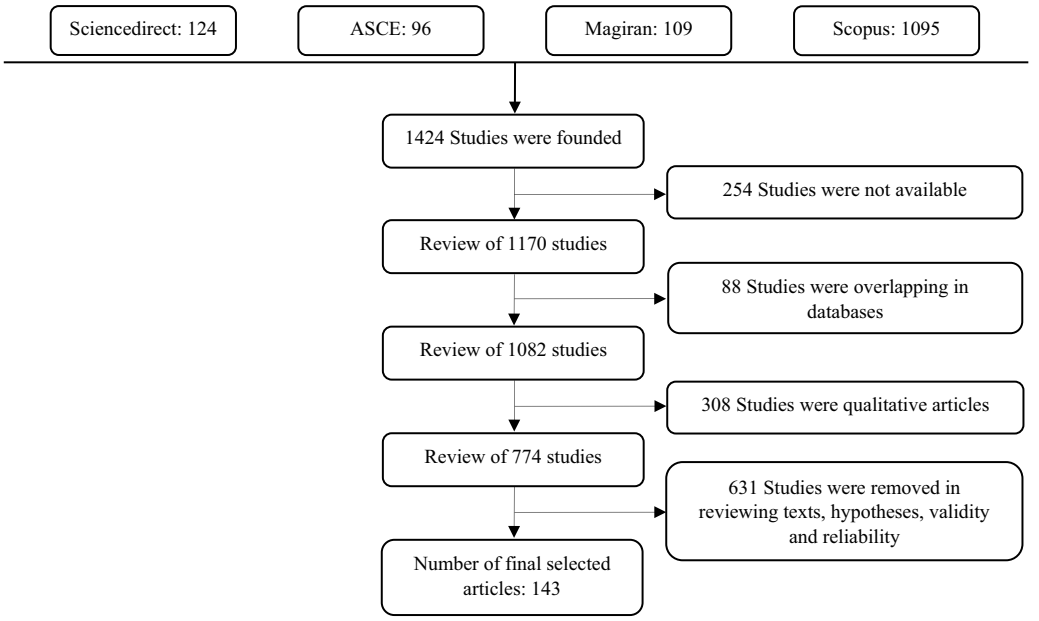


Figure 1. Flow diagram for the identification and exclusion of studies.

Data extraction

Based on the aforementioned points, the articles were selected according to the Fig. 1. After the articles were selected, the patterns of the correlation coefficient and the sample size were used for software input insertion. Some articles reported the β value instead of the correlation coefficient. Formula 1 was used to convert it into the correlation coefficient (Peterson & Brown, 2005).

$$\mathrm{r} = 0.98\beta + 0.05\lambda \quad \begin{cases} if\,\beta > 0\ \lambda = 1 \\ if\,\beta < 0\ \lambda = 0 \end{cases} \tag{1}$$

Data analysis process

The data were analyzed by Comprehensive Meta-Analysis Software (CMA2). To this end, the magnitude of the relationship between the two variables is measured by effect size. In addition, Cohen's coefficient (1992) was applied to interpret effect sizes (Cohen, 1992). Thus, $r < 0.3$ indicated a low effect size, $0.3 < r < 0.5$ indicated a medium effect size, and $r > 0.5$ indicated a high effect size. In addition, the current study used the funnel chart and Egger's regression intercept test (Egger et al., 1997) to assess publication bias. Furthermore, Duval and Tweedie's trim and fill method and the classic fail-safe N were applied to determine the number of missing studies, whereas the test of heterogeneity was used to detect moderator variables. The important results of each test will be presented in the Results section. In addition, the Q-test, I-square, and τ-square procedures were applied to analyze the homogeneity of the studies (Borenstein, Hedges, & Rothstein, 2009; 2011).

Results

An introduction of the reason and necessity of conducting this meta-analysis on the relationship between innovation and organizational performance was discussed in the previous sections. A summary of the results of the previous studies and a literature review of the issue were provided. The tests applied in this study were also described, along with the research methodology. The descriptive

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and inferential statistics are explained in this section. Inferential statistics are also used to describe more accurate information about the articles and to obtain the separated results of analyzes and tests.

The features of the selected articles

As described in the 'Research Methodology' section, a specific protocol was used to select the articles. Finally, out of 1,170 articles, 143 articles with 180 data were selected. Selected articles include various statistical populations such as bank employees, telecommunication center employees, automotive industry managers, restaurant employees, hotel staff, university faculty members, public sector employees, SMEs company managers, hospital and medical center employees, IT managers of companies as well as the owners, and employees of manufacturing companies.

The articles were published from 2012 to 2022 and conducted in countries such as China, Iran, UAE, Saudi Arabia, Pakistan, India, Taiwan, Indonesia, Malaysia, South Korea, Germany, Spain, Serbia, Netherlands, Turkey, French, Romania, United States, Brazil, South Africa, Ghana, etc. Questionnaires and surveys were used as data collection tools in these articles. Some selected studies reported more than one data source and sample size due to the type and number of the reported data.

The statistics of the selected articles

As stated in advance, given the systematic review processes, reporting the features of articles is required after identifying them by following the predefined protocol. Then, the Pearson's correlation coefficient, homogeneity tests, correction fitting by Dual and Tweedie's method, the Egger's test and funnel plot, the Rosenthal's fail-safe N test, and the moderator variable analysis, are described in this section. Moreover, the obtained results, such as point estimates, upper limits, lower limits, p-values, Z-values, and effect sizes are described in Fig. 2. It should be noted that some articles are observed in more than one row because they were reported in the results at least twice.

Tests of homogeneity

To analyze the homogeneity of the studies, Cochran's Q, τ-squared, and I-squared tests were applied (Borenstein et al., 2009). Then, two hypotheses were considered:

Null hypothesis: There is no significant difference between the obtained effect sizes.

Hypothesis (I): There is a significant difference between the obtained effect sizes.

The null hypothesis indicated a lack of significance for the obtained effect sizes, while the other hypothesis implied a significant difference between the obtained effect sizes. Since the level of significance at the 95% confidence interval was lower than the error margin (5%), H0 was rejected and H(I) was confirmed. In other words, a significant difference existed between the obtained effect sizes which indicated the heterogeneity of the obtained effect sizes. In addition, the I-squared and τ-squared values that are convenient criteria to determine the homogeneity or heterogeneity of data pinpointed a high degree of data heterogeneity (Table 1).

The meta-analysis results

In meta-analysis, the magnitude of the relationship between two variables is measured by effect size (Kelley & Preacher, 2012). The meta-analysis demonstrated a significant relationship between innovation and organizational performance. The random-effects and fixed-effects models are illustrated in Table 1. The appropriate model is developed by identifying the homogeneity or heterogeneity of the

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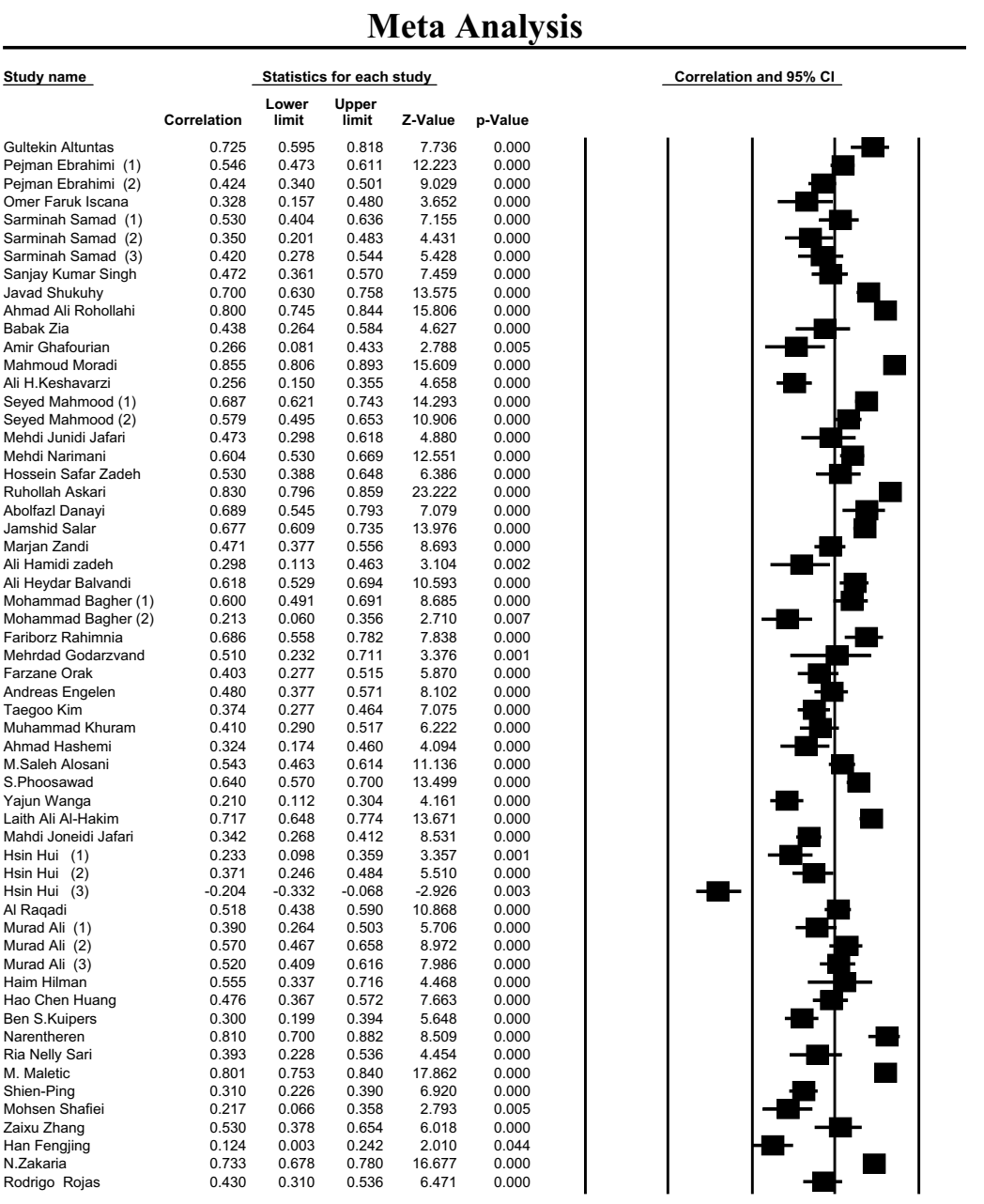


Figure 2. Forest plot.

data. Furthermore, the results of Q and I^2 Cochrane tests, which are related to data homogeneity, were used to select fixed-effects or random-effects models. The heterogeneity observed between the studies (Q test: $p = .000$ and $I^2 = 94.316\%$) indicates that the data were random; therefore, the random-effects model was employed. The random-effects model demonstrates that the research studies were conducted randomly (Borenstein, Hedges, Higgins, & Rothstein, 2010, 2011).

The effect size value obtained for this relationship is 0.492 (95% CI = 0.462–0.522; $p = .000$). The finding supports H1 supposing that innovation relates positively with organizational performance.

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Chaminda Wijethilake	0.439	0.311	0.551	6.177	0.000
Irfan Ullah (1)	0.467	0.310	0.599	5.333	0.000
Irfan Ullah (2)	0.316	0.140	0.472	3.442	0.001
Irfan Ullah (3)	0.468	0.311	0.600	5.347	0.000
Matjaz Maletic	0.847	0.786	0.892	13.239	0.000
Lorena Para (1)	0.429	0.309	0.536	6.438	0.000
Lorena Para (2)	0.416	0.294	0.524	6.216	0.000
Rodrigo Martin Rojas	0.500	0.388	0.597	7.729	0.000
Amjad Iqbal	0.523	0.419	0.614	8.497	0.000
Feng Zhou (1)	0.560	0.462	0.643	9.399	0.000
Feng Zhou (2)	0.413	0.298	0.516	6.522	0.000
Feng Zhou (3)	0.383	0.265	0.490	6.003	0.000
Sandra Dewi	0.530	0.377	0.655	5.963	0.000
Jing Wen Huang (1)	0.177	0.082	0.268	3.644	0.000
Jing-Wen Huang (2)	0.608	0.544	0.665	14.377	0.000
Antonio L.Rodriguez	0.393	0.246	0.523	4.949	0.000
Samma Faiz Rasool (1)	0.225	0.123	0.322	4.264	0.000
Samma Faiz Rasool (2)	0.195	0.092	0.294	3.680	0.000
Samma Faiz Rasool (3)	0.236	0.134	0.333	4.481	0.000
Yanfang Jiang	0.310	0.208	0.406	5.725	0.000
Gede Riana	0.346	0.182	0.491	4.002	0.000
Yunis	0.569	0.450	0.668	7.833	0.000
Eric T.G. Wang (1)	0.350	0.184	0.497	3.987	0.000
Eric T.G. Wang (2)	0.370	0.206	0.514	4.237	0.000
Ting Wang (1)	0.220	0.103	0.331	3.655	0.000
Ting Wang (2)	0.214	0.097	0.325	3.552	0.000
Nazlina Zakaria	0.733	0.679	0.779	16.937	0.000
Guillermo Davila	0.476	0.329	0.600	5.766	0.000
Encarnacion Garcia	0.341	0.196	0.471	4.451	0.000
Ala aldin Alrowwad	0.220	0.109	0.325	3.841	0.000
Kuo En Houng	0.766	0.701	0.819	13.947	0.000
Ming Feng Su (1)	0.350	0.230	0.460	5.457	0.000
Ming Feng Su (2)	0.420	0.306	0.522	6.685	0.000
Hima Gupta	0.854	0.798	0.895	14.093	0.000
Irsym Asri Putra	0.757	0.684	0.815	12.706	0.000
Abdus Sattar Abbasi	0.680	0.606	0.743	12.764	0.000
Guillermo Antonio	0.593	0.457	0.702	7.090	0.000
Ruiz Jimenez (1)	0.775	0.717	0.823	15.353	0.000
Ruiz Jimenez (2)	0.206	0.077	0.328	3.107	0.002
Laith Ali Yousif	0.736	0.669	0.791	13.872	0.000
Fabio Miguel Junges	0.686	0.609	0.750	12.436	0.000
Marko Slavkovic (1)	0.720	0.592	0.812	7.860	0.000
Marko Slavkovic (2)	0.670	0.526	0.777	7.021	0.000
Mirian Oliveira	0.667	0.615	0.714	17.715	0.000
Somyos Phoosawad	0.639	0.569	0.700	13.469	0.000
Thi Trang Nhung	0.278	0.173	0.377	5.035	0.000
Yang cheng	0.862	0.829	0.889	22.118	0.000
Ben Q.Honyenuga	0.128	-0.027	0.277	1.623	0.105
Bilal Ahmad Khan	0.397	0.300	0.486	7.456	0.000
Noorlailie Soewarno	0.609	0.407	0.754	5.047	0.000
Sri Gustina Pane	0.663	0.577	0.734	11.203	0.000
Ubaid Ur Rehman	0.432	0.340	0.515	8.412	0.000
Tamayo Torres	0.387	0.264	0.498	5.788	0.000
M. Migdadi	0.455	0.356	0.544	8.083	0.000
Muhammad Nazim	0.552	0.468	0.626	10.706	0.000
Chengedzai Mafini	0.341	0.231	0.442	5.826	0.000
Suparjo	0.271	0.144	0.389	4.094	0.000
Ali M.S.Al Raqadi	0.597	0.526	0.659	13.045	0.000
Muhammad Imran	0.271	0.163	0.373	4.782	0.000
Ali Noruzy	0.330	0.221	0.431	5.706	0.000
Aboobucker (1)	0.736	0.674	0.788	14.919	0.000
Aboobucker (2)	0.689	0.618	0.749	13.404	0.000
Bahadur Ali Soomro	0.371	0.278	0.457	7.361	0.000
Phainphin	0.828	0.787	0.862	19.668	0.000
Li Xiaoran (1)	0.516	0.410	0.608	8.292	0.000

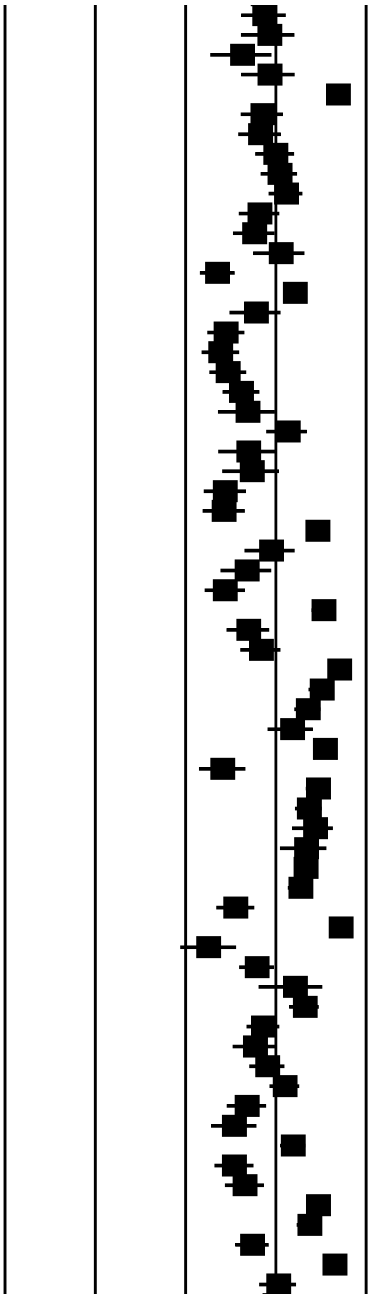


Figure 2. (Continued.)

As noted, Cohen (1992) determined the effect sizes equal to 0.1 as small; 0.3 as a medium; and 0.5 as large effect sizes (Cohen, 1992; Jing, 2018). The obtained effect size is between 0.3 and 0.5; therefore, it is concluded that the effect size is medium. Moreover, the obtained *p*-value is less than 0.05, which demonstrates the significance of this relationship with a medium effect size. The correlation coefficients and the combined results are represented by a forest plot (Borenstein et al., 2011). The forest plot of the random-effects model is also illustrated in Fig. 2.

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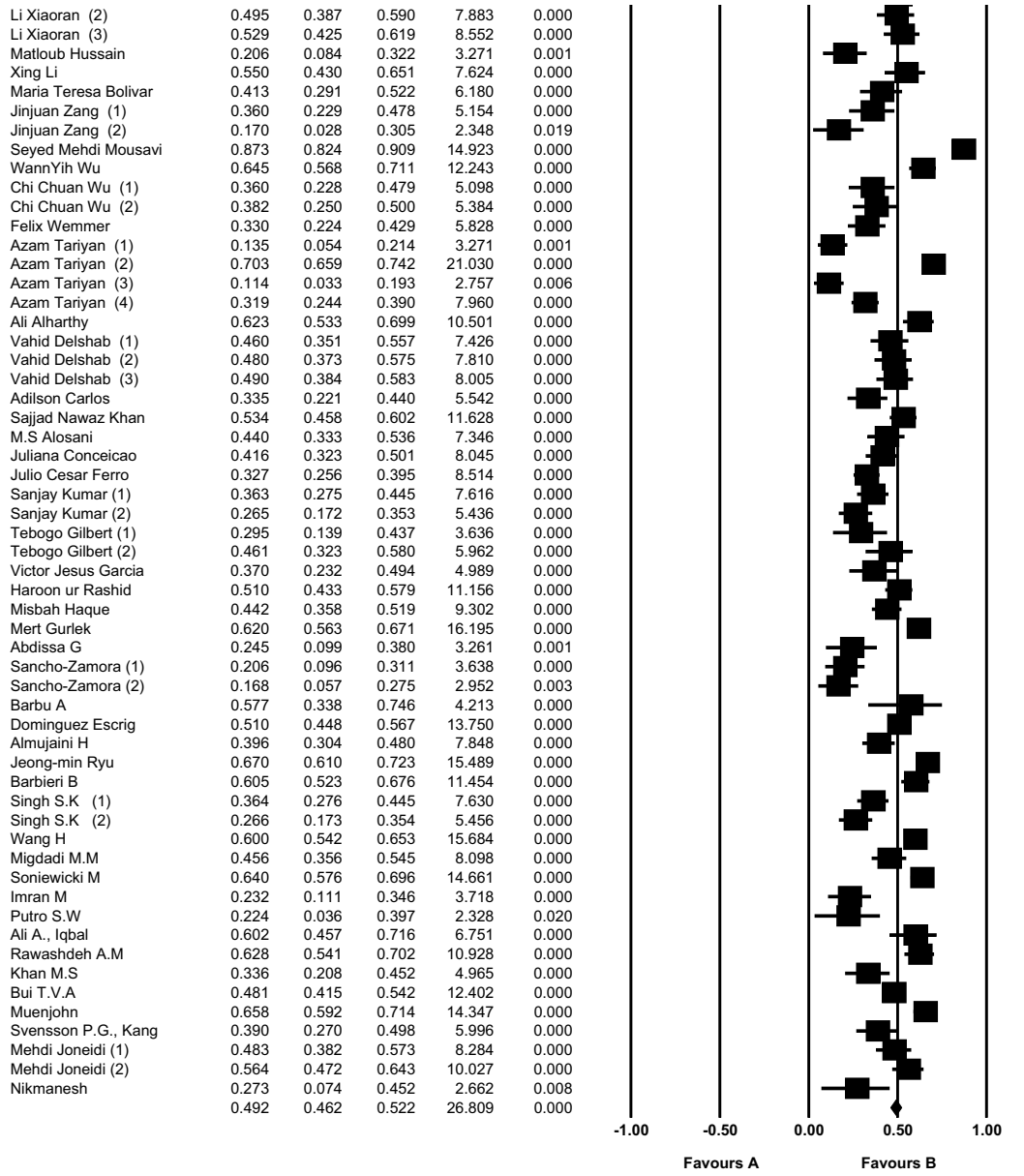


Figure 2. (Continued.)

Analysis biases

Selection bias

Selection bias occurs when the researcher removes or selects studies based on personal judgment (Egger & Smith, 1998). As stated in the 'Research Methodology' section, an appropriate and specific process and protocol have been applied to prevent selection bias.

Citation bias

Citation bias occurs when researchers use just one database or journal to receive articles from. This bias also occurs when researchers try to cite the articles with more significant or larger effect sizes

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Table 1. The results of the meta-analysis

Results	Model	Point estimate	Lower limit	Upper limit	*Z*-value
Model	Fixed	0.481	0.474	0.488	110.265*
	Random	0.492	0.462	0.522	26.809*
Heterogeneity	*Q*-value	*df* (Q)	Tau-square	*I*-squared	*p*-Value
	3149.317	179	0.068	94.316	.000
Regression method		*p*-value (one domain)	*p*-value (two domain)	*T*-value	Standard error
		.06346	.12692	1.53354	1.26135
Duval and Tweedie's method		POMST's**	Studies trimmed		*Q*-value
		Left of mean	0		3149.31–3149.31
		Right of mean	30		3149.31–4936.14
Rosenthal's fail-safe N test		*Z*-value	Alpha	*Z* for alpha	NOMST's***
		108.43311	0.050000	1.95996	10755

*p-value = .000, **Place of looking for missing studies, ***Number of missing studies that would bring p-value to alpha.

and ignore the articles with non-significant or smaller effect sizes (Jannot, Agoritsas, Gayet-Ageron, & Perneger, 2013). Four databases have been examined, and the magnitudes of the effect sizes reported in the articles have not been considered as a removing criterion in the protocol to prevent citation bias in the present study.

Linguistic bias

Language bias means that due to the lack of familiarity with other languages, the researcher may consider only one specific language and skip examining studies in different languages (Egger et al., 1997). It should be pointed out that the focus of some databases is on indexing English journals instance, more than 90% of the articles indexed in Scopus are English (Albarillo, 2014). Thus, merely limiting the search of a structured review to a database such as Scopus will bring about linguistic bias. In the current study, three English databases and a Persian database (Magiran) were used to avoid linguistic bias.

Publication bias

Articles with small effect sizes are less likely to be published than those with large or medium effect sizes. Scholars commonly refuse to publish articles with small effect sizes; this occurrence is called publication bias (Egger et al., 1997). The symmetry or asymmetry in the studies depends on the p-value in both one-tailed and two-tailed states; if this value is less than .05, it means that publication bias has occurred in the research (Borenstein et al., 2011). The null hypothesis in this test was the symmetry of the studies, confirmed at the 95% confidence interval, since the p-value was above .05 (Table 1, p-value (1-tailed) = .06346 & p-value (2-tailed) = .12692). Thus, based on the funnel plot as illustrated in Fig. 3, the variables of the study were accumulated at the top and no publication bias was detected.

Fitting correction by Duval and Tweedie's method

Duval and Tweedie's trim and fill technique was introduced to evaluate and modify publication bias in small samples. The findings demonstrated that 30 articles had to be added to the right side of the funnel plot to make it symmetric. This confirms the existence of publication bias in this study. The findings obtained from Egger's test confirmed the lack of any publication bias,

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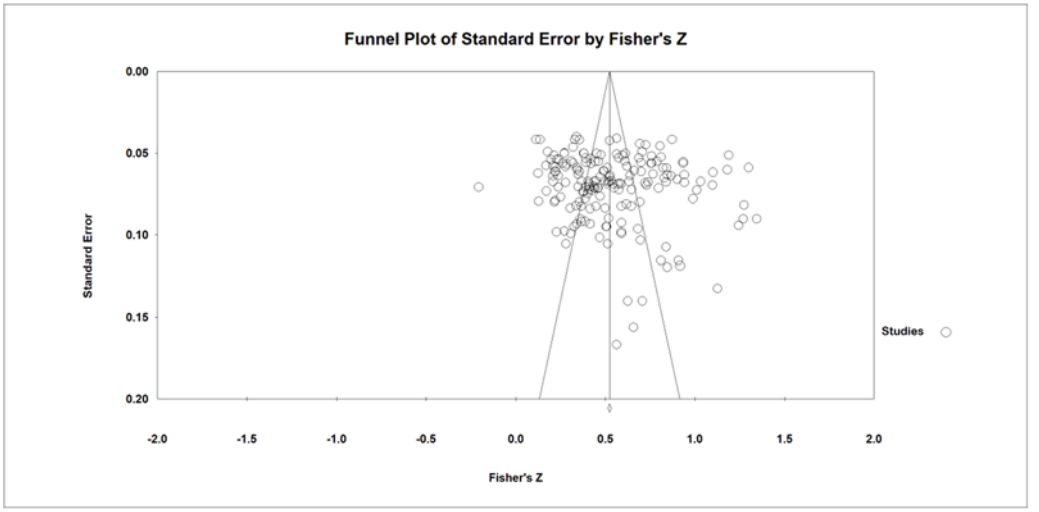


Figure 3. Funnel plot of standard error by fisher's z.

though Duval and Tweedie's method pointed to a contradictory result. This indicated a weakness of the method for justifying publication bias and proved to be inconvenient for the current study. Another shortcoming was that the method failed to prove the insignificance of the results when the missing studies are added. Thus, classic fail-safe N was applied to examine the reliability of the findings.

Rosenthal's fail-safe N test

The 'fail-safe N' test demonstrates the number of required studies that, if added to the analyses, a statistically insignificant overall effect will be obtained (Borenstein et al., 2011). Table 1 illustrates the results of the classic fail-safe N test. According to Table 1, the Rosenthal's fail-safe N value is equal to 10,755. Accordingly, 10,755 studies had to be added to make the results insignificant. According to a study by Rosenberg (2005), if the fail-safe N value in a study is higher than 500, the study will be highly validated (Rosenberg, 2005).

On the other hand, according to the formula presented by Rosenthal (1986) if the fail-safe N value ($N = 10755$) is higher than 625, the validity will be approved (Rosenthal, 1986). Furthermore, based on the formula $N/(5K + 10) > 1$ where K (180) indicates the number of studies and N (10755) indicates the value of the classic fail-safe N, the lack of any publication bias and the accuracy and reliability of the results can be proven (Mullen, Muellerleile, & Bryant, 2001).

Moderator variables

A variable that can directly affect the direction or extent of the relationship between independent and dependent variables is called the moderator variable and it is noteworthy that the results of these effects are measurable (Borenstein et al., 2011). In the context of meta-analysis, the Q test or Cochran's Q test is used to assess heterogeneity among the effect sizes of different studies. The null hypothesis for the Q test is that all studies are evaluating the same effect, meaning there is no heterogeneity (Borenstein et al., 2009). If the Q statistic is large and the associated p-value is small (typically less than .05 or .1), this provides evidence to reject the null hypothesis, indicating that there is significant heterogeneity among the studies. This could suggest the presence of a moderator variable that is causing the differences in effect sizes among the studies (Cochran, 1950; Conover, 1999).

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According to the large *Q*-value and the small *p*-value (*Q*-value = 3149.31, *p*-value = .0001), the current study considered the country, continent, publication year, and innovation type as the hypothesized moderator variables (Table 2). The first and second moderating variables were the country and the continent in which the study was conducted. Therefore, each effect size was coded into 32 countries and 4 categories of continent (North United States, South United States, Europe, Asia, and Africa). Two papers were not considered in any group because they were from countries of different continents.

The third moderator was year of publication. Finally, the variable of innovation type was examined as the fourth moderator variable. In this study, the types of innovation were not grouped in order to independently examine the impact of each type on firm performance, allowing for the investigation of moderators of innovation types on organizational performance. This approach enables a detailed analysis of the differential effects of various innovation types on firm performance, contributing to a more comprehensive understanding of the relationship between innovation and organizational outcomes. A total of 180 data examined the relationship between 47 different types of innovation and organizational performance. Innovation types with insufficient data points, especially less than three, were excluded from the analysis in the moderator analysis section. According to Table 2, the relationship between 13 types of innovation and organizational performance was investigated separately.

The examination of moderating variables in the study reveals that country, continent, publication year, and type of innovation all have a moderating effect on the overall effect size, with varying degrees of intensity. Table 2 lists the major information about each country and the results confirm the country (Q_B = 351.033, p = .0000) and continent (Q_B = 54.057, p = .0000) as a moderator variable. The finding supports H2 and H3 supposing that continent and country is a moderator variable for the relationship of innovation and organizational performance. For interpretation purposes, only those countries that contributed five or more effect sizes will be discussed. The results illustrated that Indonesia (r = 0.511, p = .000), Malaysia (r = 0.549, p = .000), Iran (r = 0.526, p = .000), and South Korea (r = 0.515, p = .000) moderate the overall effect size with a high effect intensity. Furthermore, Brazil (r = 0479, p = .000), China (r = 0.434, p = .000), UAE (r = 0.360, p = .000), Pakistan (r = 0.490, p = .000), Spain (r = 0.417, p = .000), Taiwan (r = 0.419, p = .000) moderate the overall effect size with low effect intensity.

The continents of Asia (r = 0.494, p = .000) and Europe (r = 0.513, p = .000) moderate the overall effect size with a high effect intensity, whereas the continents of Africa (r = 0.298, p = .000) and South United States (r = 0.479, p = .000) moderate the overall effect size with low impact intensity.

The year of publication was identified as a marginal moderating variable and H4 was supported (Q_B =15.652, p = .0745). According to the findings from the 'Test of difference between moderator level' it can be observed that the categorization of articles into subgroups based on publication year demonstrates a marginally moderating effect (Q_B=15.652, $p < .1$) on the association between innovation and organizational performance. The analysis of Table 2 and Fig. 4 reveals that among the articles published in the past decade, those from 2014 exhibited the most substantial effect size (r = 0.704), indicating a noteworthy contribution that strengthens the overall impact (r = 0.492).

As can be seen in Table 2 and Fig. 4, the papers published in 2013 (r = 0.647, p = .000) and 2014 (r = 0.704, p = .000) had the highest effect size in the last 10 years, while the papers recently published in 2019 (r = 0.442, p = .000), this effect size reached its lowest level in the last 10 years.

Finally, the type of innovation was identified as a moderating variable in this study and the results confirmed H5 (Q_B =35.418, p = .0012). For interpretation purposes, only those types that contributed seven or more were reported will be discussed. Table 2 provides the information about each innovation type. The results illustrated that organizational innovation (r = 0.527, p = .000) moderate the overall effect size with a high effect intensity, while the Product/service innovation (r = 0.475, p = .000), Process innovation (r = 0.417, p = .000), Open innovation (r = 0.423, p = .000), Administrative/Management innovation (r = 0.477, p = .000), and Green/Environmental innovation (r = 0.398, p = .000) moderate the overall effect size with a low effect intensity.

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Table 2. Categorical moderator analysis results

Moderator	Q_B	Level	*k*	*r*	95% CI	*Z*
Country	351.031***					
		Brazil	6	0.479	0.3470.593	6.396***
		China	21	0.434	0.3200.536	6.827***
		Emirates	8	0.360	0.283–0.432	8.640***
		Ethiopia	1	0.245	0.099–0.380	3.261*
		French	1	0.510	0.433–0.579	11.156***
		Germany	2	0.406	0.249–0.542	4.785***
		Ghana	1	0.128	−0.027–0.277	1.623
		India	1	0.854	0.7980.895	14.093***
		Indonesia	8	0.511	0.3220.661	4.802***
		Iraq	2	0.726	0.6800.767	19.472***
		Italy	1	0.605	0.5230.676	11.454***
		Jordan	4	0.450	0.2740.597	4.672***
		Lebanon	1	0.569	0.4500.668	7.833***
		Malaysia	7	0.549	0.3630.693	5.111***
		Netherland	1	0.300	0.1990.394	5.648***
		Oman	2	0.559	0.4770.631	10.987***
		Pakistan	16	0.490	0.4270.548	13.188***
		Poland	1	0.640	0.5760.696	14.661***
		Iran	39	0.526	0.4510.593	11.662***
		Romania	1	0.577	0.3380.746	4.213***
		Saudi Arabia	1	0.623	0.5330.699	10.501***
		Serbia	2	0.696	0.6040.770	10.523***
		Slovenia	1	0.847	0.7860.892	13.239***
		South Africa	3	0.364	0.2710.451	7.193***
		South Korea	5	0.515	0.3790.629	6.557***
		Spain	12	0.417	0.3040.519	6.666***
		Sri Lanka	1	0.439	0.3110.551	6.177***
		Taiwan	15	0.419	0.2690.548	5.144***
		Thailand	2	0.640	0.5910.683	19.069***
		Turkey	3	0.576	0.3560.736	4.531***
		USA	1	0.390	0.2700.498	5.996***
		Vietnam	2	0.387	0.1720.566	3.415***
		Multi-Country	8	0.564	0.4310.674	7.015***
Continent	54.058***					
		Asia	138	0.494	0.459–0.529	22.953***
		Europe	28	0.513	0.437–0.581	11.403***

(*Continued*)

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Table 2. (*Continued.*)

Moderator	Q_B	Level	*k*	*r*	95% CI	*Z*
		Africa	5	0.298	0.192–0.397	5.325***
		South United States	6	0.479	0.347–0.593	6.396***
		North United States	1	0.390	0.270–0.498	5.996***
Year of publication	15.652†					
		2012	16	0.479	0.394–0.555	9.718***
		2013	10	0.647	0.498–0.758	6.771***
		2014	**7**	**0.704**	**0.559–0.808**	7.017***
		2015	14	0.444	0.286–0.579	5.096***
		2016	21	0.498	0.395–0.589	8.268***
		2017	16	0.522	0.404–0.624	7.514***
		2018	19	0.466	0.395–0.532	11.289***
		2019	31	0.442	0.375–0.505	11.554***
		2020	22	0.479	0.400–0.551	10.435***
		2021	24	0.456	0.387–0.519	11.586***
Innovation type	35.418**					
		Administration Innovation	3	0.520	0.357–0.652	5.570***
		Culture innovation	3	0.462	0.366–0.549	8.442***
		Exploitative innovation	4	0.410	0.256–0.544	4.902***
		Explorative innovation	5	0.418	0.361–0.472	12.944***
		Innovation performance	**7**	**0.655**	**0.428–0.804**	4.707***
		Management innovation	6	0.435	0.266–0.578	4.732***
		Open innovation	4	0.610	0.290–0.808	3.382**
		Organizational innovation	80	0.531	0.488–0.572	19.820***
		Process innovation	9	0.417	0.284–0.534	5.738***
		Product innovation	8	0.446	0.262–0.599	4.439***
		Radical innovation	3	0.426	0.299–0.538	6.085***
		Service innovation	4	0.559	0.325–0.729	4.202***
		Technological innovation	3	0.579	0.527–0.626	17.413***
		Overall random-effect size	180	0.492	0.492–0.462	26.829***

Q_B = test of difference between moderator level, *k* = number of data, *r* = mean correlation, *z* = between group difference. (marginally) † $p < .1$, * $p < .05$, ** $p < .01$, *** $p < .001$.

Discussion and implications

Meta-analyses provide a more comprehensive view of the impact of diverse variables by integrating the results of different studies conducted on various samples. This study examines the relationship between innovation and organizational performance. This study offers a unique approach compared to other works in the field. Unlike previous research that categorized various types of innovation, this investigation focused on the independent examination of each type of innovation. By adopting

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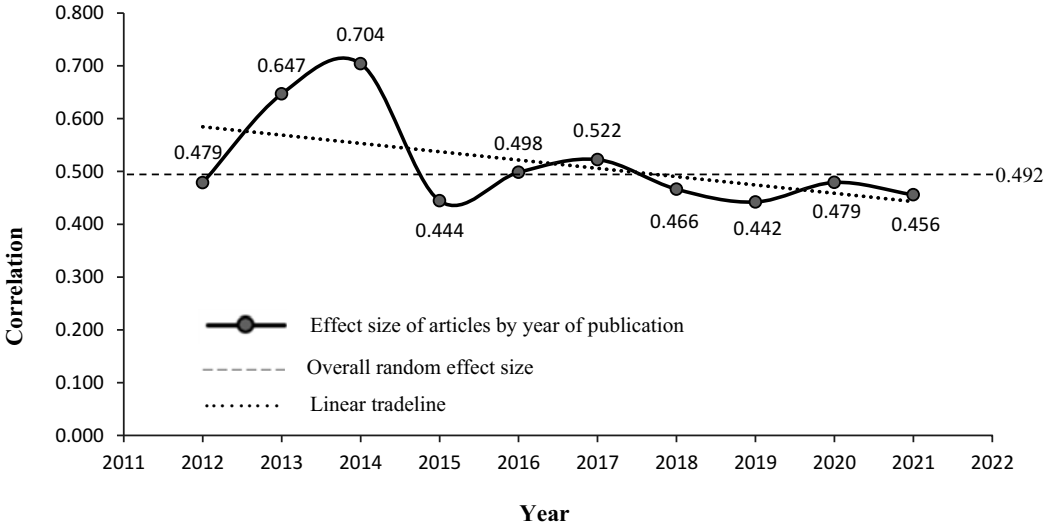


Figure 4. Correlation between innovation and OP from 2012 to 2022 (January).

this approach, the analysis aimed to: (1) Maintain the separation and distinctiveness of the different types of innovation and (2) Avoid potential confounding effects that could arise from integrating the types of innovation. This methodological choice emphasizes the importance of considering the specific types of innovation in the context of organizational performance and highlights the need for further research to better understand the relationship between innovation and organizational outcomes.

Significant heterogeneity was detected in the data after conducting the necessary examinations, and consequently, a 'random-effects model' was applied to continue the work. Finally, the relationship between innovation and organizational performance was calculated to be significant (sig ≤ 0.01) and medium ($r = 0.492$) according to Cohen's criterion.

The findings of this meta-analysis were illustrated to be in line with some of the investigated studies. The findings by Hang et al. (2016) demonstrated that innovation as a key component of knowledge management increasingly determines the competitive advantages of companies. In addition, they argued that a significant relationship exists between innovation and organizational performance (with a correlation coefficient of 0.492). The results of this research are consistent with the results of Bowen's research conducted in 2010. Bowen et al. evaluated the relationship between performance and innovation based on the actual temporal sequence and revealed this relationship is significantly positive ($r = 0.16$), which this effect size is increased in this research. (Bowen et al., 2010). Widjaja, Wihardja Sumintapura, and Yani (2020) demonstrate that there is not always a significant relationship between organizational performance and innovation, emphasizing the importance of additional research and the consideration of contextual factors (Widjaja, Sumintapura, and Yani 2020).

Inconsistencies in the results of previous research can make it difficult for researchers to draw conclusions. Therefore, one of the academic implications of this systemic review is that it addresses this research gap and provides a single response to the relationship between innovation and organizational performance. Furthermore, researchers can compare the results of their research on the relationship between innovation and organizational performance with the results of the present study to exert further analysis. Considering the overall integrated findings associated with this relationship can be useful in developing theories as well as creating new frameworks and models for future research agendas.

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Different types of biases including selection, citation, linguistic, and publication biases were investigated. Based on the obtained results, the lack of any publication bias and the accuracy and reliability of the results were proven.

In the moderator identification section, four moderator variables of country, continent, year of publication, and types of innovation were found. The results demonstrated that from among the countries with five or more data reports, the effect size of the relationship between innovation and organizational performance in Iran ($r = 0.526, k = 39$), Indonesia ($r = 0.511, k = 8$) and South Korea ($r = 0.515, k = 5$) was higher, while the lowest effect size belonged to the UAE ($r = 0.360, k = 8$). From among the continents, Europe ($r = 0.513, k = 28$) had the largest effect size between innovation and organizational performance, while the lowest effect size belongs to Africa ($r = 0.298, k = 5$).

Moreover, the results of moderating analysis demonstrated that there is a less significant relationship between innovation and organizational performance in Spain ($r = 0.4173, k = 12, p = .0000$) than in other European countries ($r = 0.585, k = 17, p = .0000$). Thus, Spain was identified as a moderating variable in Europe ($Q_B = 6.1006, p = .0135$).

As illustrated in Fig. 4, the impact of innovation on organizational performance has decreased in recent years; therefore, this amount reached below the overall impact factor in the last 4 years. According to the tradeline (Fig. 4), whereas there are significant differences between the annual results obtained in the first half of the graph, in the second half, a significant convergence between the results in recent compatible years is observed. Therefore, the results and the viewpoints of researchers have been made compatible with each other in recent years. The results demonstrated that innovation performance strengthens the overall effect size among various types of innovation and this illustrate that innovation performance plays a significant role in enhancing the relationship between innovation and firm performance. This is consistent with prior research indicating the positive impact of innovation on organizational outcomes, and it underscores the importance of effectively managing and leveraging innovation activities to achieve superior performance.

As revealed by the review conducted by the publication year moderator, the relationship between innovation and organizational performance in research conducted before 2016 exhibited considerable fluctuations. However, recent years have seen a dearth of comprehensive studies examining this relationship across diverse work domains and various types of innovation. Consequently, conducting an all-encompassing investigation became imperative. Notably, this research introduces several innovative aspects, including the consideration of moderators such as the publication year, country, continent, and type of innovation.

Interestingly, past meta-analysis articles, which typically encompassed research up to 2012 and even as far back as 1989, reported a weaker relationship compared to the findings of this study (Bowen et al., 2010; Feng et al., 2020). The divergence could be attributed to the heightened significance of innovation, rapid technological advancements, and the emergence of new project management methodologies that foster creativity – such as the agile method – in recent years. The experimental findings of the current study demonstrated several applicable outcomes for the managers. First, innovation stimulates companies to actively seek external resources, cooperate with external partners, improve the productivity of innovation, and shorten the time to respond to the market. On the other hand, innovation influences customers' knowledge of the quality of trademarks and indirectly improves customer loyalty. Though companies usually consider innovation as a positive instrument for organizations, the relationship between innovation and performance is still an open question (Liao & Rice, 2010). Thus, managers should pay specific attention to innovation, encourage customer participation, and merge internal and external resources. Second, the relationship between innovation and performance is influenced by the attitudes of a company toward risks.

Innovation performance in areas with weaker uncertainty avoidance is better than the areas in which uncertainty avoidance is dominant. Therefore, managers should pay enough attention to lay the grounds for accepting modern innovations and encourage their employees to move away from their 'comfort zone' to innovate with audacity. In general, an organization that can present new ideas

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will be able to adopt changes well and act as an agent of change. Thus, organizations should adopt creativity and innovation. Otherwise, they will be forced out of the competition.

Limitations and suggestions

The current study suffers from both temporal and database limitations. The search process was conducted in four databases – Scopus, ASCE, ScienceDirect, and Magiran (2012–2022). In addition, the current study attempted to counteract the publication bias by including unpublished studies. However, access to such experimental studies was constrained. Nevertheless, it is not expected that a strong normative bias exists on the side of reviewers and editors concerning the publication of non-significant or the establishment of negative relationships between innovation and performance. The addition of such unpublished studies will certainly establish a stronger context for the empirical generalization of their impacts.

Different tests concerning the assessment of effect size, publication bias, and homogeneity indicated the accuracy of the findings. Furthermore, four moderator variables that are among the most important findings were found in this meta-analysis. Thus, detecting other moderator variables can be considered and future researchers may attempt to detect them in their studies. The investigations conducted in the current study led to the discovery of different aspects of innovations. Performing a systematic review for each aspect can be useful. Finally, it should be stated that the current study attempted to investigate the relationship between innovation and organizational performance by the integration of effect sizes. However, this is not enough, and the same study should be replicated using other databases, periods, and instruments, and preferably the qualitative methodologies in order to compare the obtained results with the findings of the current study.

Conclusion

The current meta-analysis was conducted to determine the combined effect size of the relationship between innovation and organizational performance. English and Persian articles published from 2012 to 2022 were explored in four databases. One hundred and forty three articles were selected for analysis by CMA2, and it was illustrated that the total combined effect sizes of innovation on organizational performance for fixed- and random-effects models are 0.481 and 0.492, respectively. The results of Cochran's Q test demonstrated that the data are heterogeneous. Thus, the average effect size obtained from the random-effects model (0.492) was considered as the final approach. Cohen's coefficient was demonstrated that the strength of the relationship between innovation and organizational performance is medium considering the approach taken by the random-effects model.

Different types of biases including selection, citation, linguistic, and publication biases were investigated. Based on the obtained results, the absence of any publication bias and the accuracy and reliability of the results were proven. The upper and lower limits expressed in this study have a wide range. This range demonstrates that the relationship between innovation and organizational performance may vary depending on the moderating variables. The analysis was conducted to find the moderator variable.

Finally, country, continent, year of publication, and innovation type were identified as the moderator variables. Based on the results, researchers can conduct more extensive studies on these modulatory variables. Furthermore, the results of this study can enable managers of different departments in different industries to have a more comprehensive view of the issue, and a better planning for improving their organization performance through innovation.

The results illustrated a significant difference in the relationship between innovation and organizational performance in different countries and continents. Therefore, researchers can continue the research with a new range of research to investigate the reasons for this discrepancy. In addition, the results demonstrated a declining trend in the relationship between innovation and organizational

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performance over the past 10 years. Researchers are encouraged to investigate the reason for this declining trend and identify new factors that have a growing impact on organizational performance. Investigating the mediating and moderating role of innovation in organizational performance could be a valuable objective for future meta-analysis studies.

Competing interest. No conflict of interest exists. We wish to confirm that there are no known conflicts of interest associated with this publication and there has been no significant financial support for this work that could have influenced its outcome.

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Cite this article: Katebi, A., Hosseinkhah Eghdam, H., Baseri, H., and Salehi, A. M. (2024). The relationship between innovation and organizational performance: A meta-analysis. *Journal of Management & Organization*, 30(6), 2474–2494. https://doi.org/10.1017/jmo.2024.13

https://doi.org/10.1017/jmo.2024.13 Published online by Cambridge University Press