# Assessing the Moderating Role of Organizational Culture on the Effect of Knowledge Networks on Firm Innovation in Visegrad Countries: The Perspective of Knowledge Production Function

**Emmanuel Ebo Arthur and Jan Stejskal**
University of Pardubice, Pardubice, Czech Republic

emmanuel.arthur@upce.cz
jan.stejskal@upce.cz

**Abstract:** Among the elements of Knowledge Production Function (KPF), R&D remains one of the highly studied factors. In an era of interdependence and collaborations, no firm or enterprise can survive the prevailing highly competitive business environment by not networking with firms of similar interest, values, and goals. The unanswered question in prior literature on firm co-operation is what kind of firm co-operation best works? In finding an answer to fill this gap in literature, we examined the impact of R&D co-operation, innovation co-operation (excluding R&D) and co-operation based on other business activities on radical and incremental innovations. We further examined the moderating role of organizational culture on the effect of firm co-operation on innovation. Our study is based on open innovation theory and the KPF. Adopting the 2018 cross-sectional CIS data from the Eurostat database for the four Visegrad countries (Czech Republic, Poland, Hungary, and Slovakia), the OLS regression and Average Marginal Effects models were used for the analysis. We confirmed that when firms co-operate on R&D, there is a positive and significant effect on radical innovation but negative significant effect on incremental innovation. Firm co-operation on innovation activities excluding R&D has positive and significant effect on both radical and incremental innovations. Other business co-operations had positive and significant effect on incremental innovation but not on radical innovation. We further confirmed a positive significant moderating role on the effect of R&D co-operation on radical innovation. We proposed theoretical and practical implications of our study to firm managers, government, and policy formulators.

**Keywords**: R&D co-operation, Training and Development, Radical and Incremental Innovations, OLS, Visegrad

## 1. Introduction

Firms network or co-operate for varied reasons. Some include knowledge sharing, cost sharing and joint projects and other activities of mutual interest. Firm co-operation through strategic alliances spurs innovation and firm performance. Over the years, firms have co-operated in the areas of information technology and biotechnology (Boh, Huang & Wu, 2020). Effective firm co-operation has seen firms gained in the areas of creativity and innovation, market expansion and access, risk and cost sharing and enhanced competitiveness. (Boh, Huang & Wu, 2020; Shafi, 2021; Singh, 2022). One key area identified by extant literature for firm co-operation is on R&D and its impact on general innovation. Van Beers and Zand (2014) used the random-effects panel Tobit estimates, in Netherlands and found that, partner diversity in R&D had positive impact on radical and incremental innovations. But in Portugal, investments act as a constraint to SMEs collaboration in R&D towards product innovation (Paiva, Ribeiro & Coutinho, 2020). Despite the growing literature on R&D, Negassi (2004) argues that firm network and R&D co-operation remain limited. With the existence of few studies on R &D co-operation and innovation (Negassi, 2004; Pham et al., 2021; Bragoli, Cortelezzi, & Rigon, 2024; Peiró-Signes, Díez-Martínez & Segarra-Oña, 2024), the empirical relevance of the moderating role of organizational culture has rarely been considered. Not only that, but the diversity in R&D and non-R&D cooperation has also not been studied. The emphasis has been on firm heterogeneity in R&D co-operation. The neglect of examining the varied R&D and non-R&D firm co-operation is an issue because the other forms of firm network or co-operation also play a role in firm innovation performance.

The objective of this paper is to examine how networking or co-operation in the determinants of knowledge production function (R&D co-operation and non-R&D co-operation) impact on radical and incremental innovations in the Visegrad countries. We further aim to produce evidence on the moderating effect of organizational culture (expenditure on training and development) on the relationship between R&D co-operation and innovation. Our study contributes to the body of literature in three diverse ways. First, we prove that variations in firm co-operation (R&D and non-R&D) have heterogeneity effect on radical and incremental innovations. It is important to differentiate the impact of R&D co-operation on innovation and from that of non-R&D to give effective alternative to firm managers and stakeholders. It helps to inform and direct investment decisions on the kind of co-operation to engage. Second, we add to the understanding of existing literature on organizational culture by examining the extent to which it moderates the relationship between R&D cooperation and innovation in the Visegrad region. Thirdly, the study contribute enhances the KPF

concept, Resource Based View (RBV) and Collaborative Advantage Theory (CAT). We explained R&D as a knowledge-based determinant of KPF. Our study is based on RBV and CAT. RBV strides on the axiom, firm co-operate to leverage complimentary resources and capabilities they cannot realised internally. On the other hand, CAT posits that, firms that co-operate achieve optimal performance and competitive advantage. This study asserts that firms that network and co-operate improves their resources and capabilities, competitive advantage, and performance.

The rest of the study is framed as Section 2, literature, and framework of the study; Section 3, methodology, results and discussions in Section 4 and conclusion in Section 5.

## 2. Literature and Framework of the Study

### 2.1 Linking Firm Co-Operation, Organizational Culture, and Innovation.

There are several bases for firm co-operation either internally or internally. The mutual benefits associated with firm co-operation spur firms to make decisions to either co-operate or not. Firms that lack a resource, the capability to perform an activity or produce a product usually network or co-operate. The co-operation of firms is in various forms, but this study focuses on R&D co-operation, innovation co-operation (excluding R&R) and other business activities co-operation. R&D co-operation involves firms engage in strategic alliances for long term research projects with universities and other public research institutions. Park and Lee (2023) argue that firm horizontal R&D co-operation is effective when there is economic risk and lack of market knowledge regarding the introduction of a new product to the market. Several empirical studies show positive and insignificant impact of R&D co-operation on firm innovation (Žítek & Klímová, 2020; Choi & Choi, 2021). The effect of R&D co-operation on firm innovation has never been in dispute but, the direction and significance of the impact and the type of innovation have been in dispute owing to the discrepancies in the findings over the years. Innovation co-operation includes firms collaborating on innovation joint venture, feasibility of introducing new projects, acquiring patents and licenses and software introduction (Sohag, Chukavina & Samargandi, 2021). This excludes all research and development activities. Innovation activities improve product and process innovation (Madrid-Guijarro, Martin & García-Pérez-de-Lema, 2021) however, Rammer (2023) argues that there is no significant impact on process innovation output when firms co-operate on innovation activities. It suggests that, acquiring external knowledge is not certain for achieving process innovation. Firms also co-operate on other business activities. This form of co-operation is in the domain of sales and distribution, sustainable initiatives, manufacturing, marketing, and promotion. Firms that co-operate experience considerable innovation in marketing, sales, and distribution (Xian & Jiang, 2023). To sum the issues in existing literature, there are varied and inconclusive arguments on the impact of firm co-operation (R&D, innovation activities and other business activities) on innovation. We therefore hypothesized that:

*H1a: Firm R&D co-operation improves radical and incremental innovation in the Visegrad region.*

*H1b: Firm co-operation on innovation activities excluding R&D enhances radical and incremental innovation in the Visegrad region.*

*H1c: The more firms co-operate on other business activities, the better it is for radical and incremental innovation in the Visegrad region.*

Organizational culture defines the shared values, norms, beliefs, standards, leadership, teamwork, and artefacts that is associated with the organization (Srisathan et al., 2020). It influences how people talk, act, and behave in an organization. There is no significant relationship between organizational culture and open innovation performance (Alassaf et al., 2020). Organizational culture may be an improbable but a subtle obstacle to innovation. Some firms have the culture of spending on the training and development of their employees. The purpose is to enhance the skills and capabilities of the employee. While prior literature focuses on using organizational culture as explanatory variable, our study uses it as a moderator. We therefore suggest that:

H2: *Organizational culture positively moderates the relationship between R&D firm co-operation and innovation.*

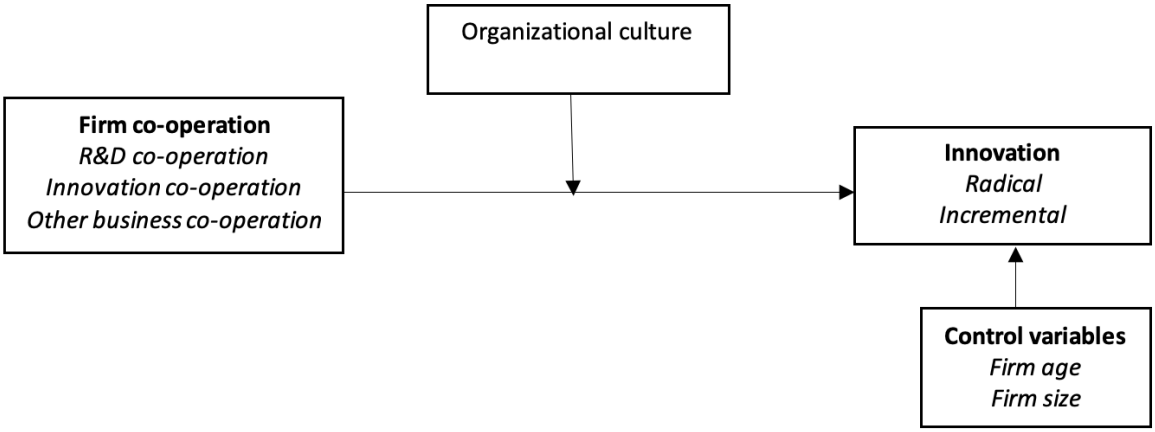


**Figure 1: Conceptual framework**

## 3. Methodology

### 3.1 Data Source and Variables Description

The study used 2018 Community Innovation Survey (CIS) cross-sectional data from the Eurostat database for the analysis. The Eurostat database is credible and reliable site and has been used by several empirical studies. The context of our study in the Visegrad region. It comprises four European countries namely, the Czech Republic, Poland, Hungary, and Slovakia. A total of 31859 firms from these countries participated in the study (Refer to Table 2 for details). According to the European innovation scoreboard 2023, the countries in the Visegrad region fall within emerging and moderate innovators. It is of immense interest to examine the influence of firm co-operation in R&D, innovation activities and other business activities on incremental and radical innovations in the region.

Our independent variable is innovation. Two indicators were used to measure innovation. One is products new to market and new to the firm is used to measure radical innovation while products new to firm only is used as proxy for incremental innovation. We used three indicators to measure firm co-operation. They are firm R&D co-operation, firm innovation co-operation excluding R&D and firm co-operation on other business activities. Expenditure on training and development is the proxy for organizational culture. We controlled for firm age, firm size, and country fixed effects. Firm size is classified into small firms (10-49 employees), medium firms (50-249 employees) and large firms (more than 250 employees). Firm age is coded as firms established in 2016 or later= 1, from 2010-2015 =2 and 2009 or before= 3. All other variables used are dummy in nature. It means they take the value 1 for "Yes" if the activity occurred and 0 for "No" if it did not occur. Refer to Table 1 for the details of variables used including literature sources.

### 3.2 Methods

We used the OLS regression to assess our hypothesis because it is a base line model for several empirical studies. The OLS model is presented as:

$$Inn\ (Z_1) = \beta_0 + \beta_1\ parameters + firm\ characteristics\lambda + \varepsilon_i \quad [1]$$

$InnZ_1$ represents "1" if the firm introduced a new product and "0" if it did not introduce a new product. $\beta_0$ is constant, $\beta_1$ parameters, firm characteristics $\lambda$ is the vector and $\varepsilon_i$ is the random error term.

We first assessed the issues of multicollinearity and heteroskedasticity which could be associated with our data and beset our findings. We used Variance Inflation Factor (VIF). The smaller the VIF values the better it is for the model. A VIF value above 10 indicates multicollinearity issues in the variables being studied. The VIF produced and average value of 1.16 indicating that multicollinearity is not an issue with our data. The Breusch-Pagan test for heteroskedasticity showed a P- value of 0.110 for incremental innovation and 0.240 for radical innovation. This insignificant p-values in the BP test implies the likelihood of less or not issues of heteroskedasticity. In the first stage of our analysis, we conducted an OLS regression analysis to examine the impact of firm co-operation (R&D, innovation activity and other business activities) on radical and incremental

innovations. Radical innovation is model 1 and incremental innovation is model 2. In the second stage of our analysis, we did a robustness test using the average marginal effect estimation to check the reliability and validity of the results in Table 5. We introduced expenditure on training and development as an interaction variable to the model in stage 3 of the analysis.

**Table 1: Variable description**

| Variable | Indicators | Data source | Literature source |
|---|---|---|---|
| ***Dependent variable***<br>Innovation- Radical and incremental | Innovation product new to market<br>Innovation product new to firm | CIS 2018 | Van Beers & Zand at al., (2021) |
| ***Independent variable***<br>Firm co-operation | Co-operation on R&D<br>Co-operation on innovation (excludes R&D)<br>Co-operation on other business activities | CIS 2018 | Paiva et al., (2020).<br>Nagassi, (2004) |
| ***Control variables***<br>Firm age<br>Firm size<br>Country | Year of establishment<br>Number of employees<br>Visegrad countries | CIS 2018 | Alassaf et al., (2020); Nagassi, (2004) |
| ***Moderating variable***<br>Organizational culture | Expenditure on staff training | CIS 2018 | Alassaf et al., (2020); Srisathan et al., (2020). |

**Table 2: Firms per country**

| Country | Number | Percent | Cumulative percent |
|---|---|---|---|
| Poland | 15495 | 48.64 | 48.64 |
| Czech Republic | 5749 | 18.05 | 66.68 |
| Hungary | 7377 | 23.16 | 89.84 |
| Slovakia | 3238 | 10.16 | 100.00 |
| Total | 31859 | 100.00 | |

Own calculations

**Table 3 Multicollinearity diagnostic test**

| Variables | VIF | SQRT VIF |
|---|---|---|
| Co-operation on R&D | 1.28 | 1.13 |
| Co-operation on other innovation activities (excluding R&D) | 1.39 | 1.18 |
| Co-operation on other business activities | 1.29 | 1.13 |
| Firm expenditure on training and development | 1.00 | 1.00 |
| Firm age | 1.04 | 1.02 |
| Firm size | 1.08 | 1.04 |
| Country | 1.09 | 1.04 |
| Innovation product new to market | 1.16 | 1.04 |
| Innovation product new to firm | 1.15 | 1.07 |
| Mean | 1.16 | |

Own calculation

## 4. Results and Discussion

Table 4 shows the descriptive statistics of the study. On the average, firms in Visegrad region reported 54.6% radical innovation and 81.5% incremental innovation. They also agree to have had 6.8% R&D co-operation,

7.6% co-operation on innovation (excluding R&D) and 9.8% co-operation on other business activities. Averagely, only 4% of the firms agree to have spent on the training and development of their employees. With a firm size mean of 1.394, it implies that majority the firms in the study were medium firms with 50-249 employees. Most firms involved in the study were established from 2010 to 2015.

The OLS regression analysis results in Table 5 help to evaluate hypothesis H1a, H1b and H1c. There is positive significant effect of R&D co-operation on radical innovation but negative significant effect on incremental innovation. It implies that, there is 10.2% improvement in radical innovation and surprisingly, 1.7% reduction in incremental innovation for every unit of R&D co-operation firms undertake. This partially supports hypothesis H1a. It also confirms the assertion of Choi and Choi (2021) that R&D co-operation has positive and significant impact on innovation although they did not classify the effect on radical and incremental innovations.

**Table 4: Summary statistics**

| Variable | Obs. | Mean | Std. dev. | Min | Max |
|---|---|---|---|---|---|
| Co-operation on R&D | 29138 | 0.068 | 0.251 | 0 | 1 |
| Co-operation on other innovation activities (excluding R&D) | 29138 | 0.076 | 0.265 | 0 | 1 |
| Co-operation on other business activities | 26110 | 0.098 | 0.297 | 0 | 1 |
| Firm expenditure on staff training and development | 26094 | 0.004 | 0.130 | 0.130 | 18.283 |
| Firm age | 31859 | 2.728 | 0.538 | 1 | 3 |
| Firm size | 31859 | 1.394 | 0.648 | 1 | 3 |
| Country | 31859 | 1.948 | 1.059 | 1 | 4 |
| Innovation product new to market | 31859 | 0.546 | 0.233 | 0 | 1 |
| Innovation product new to firm | 31859 | 0.815 | 0.181 | | 01 |

Own calculations

Again, the results support the argument that R&D co-operation is effective when the economic risk of introducing the new product is high (Park & Lee, 2023). The economic risk associated with radical innovation is higher than incremental innovation. By implication, it is not surprising to find the impact of R&D co-operation on radical innovation stronger and positive in relation to incremental innovation. Firms' co-operations on innovation activities excluding R&D had positive and significant impact on both radical and incremental innovations. This fully supports hypothesis H1b. It confirms existing studies that co-operation on innovation activities enhances product and process innovations (Madrid-Guijarro, Martin & García-Pérez-de-Lema, 2021) even though our finding is on radical and incremental innovations. However, it is contrary to the findings of Rammer (2023) that there is no significant impact on process innovation by firms' co-operating in innovation activities excluding R&D. We partially confirm hypothesis H1c in Table 5 that, firms co-operating on other business activities positively and significantly impact incremental innovation but did not radical innovation. This partially confirms the argument by Xian and Jiang (2023) that firms that co-operate on non-R&D and non-innovative activities such as marketing, sales and distribution promote innovation. We found that this is true for incremental innovation but not radical innovation. To give unbiased results, we controlled for firm age, firm size, and country level effects in all our analyses.

**Table 5: OLS regression analysis of the R&D and non- R&D co-operation and innovation**

| Variables | Model 1 Radical innovation | Model 2 Incremental innovation |
|---|---|---|
| Co-operation on R&D | 0.102*** (0.006) | -0.017*** (0.005) |
| Co-operation on other innovation activities (excluding R&D) | 0.043*** (0.005) | 0.009* (0.004) |
| Co-operation on other business activities | 0.001 (0.005) | 0.025*** (0.004) |
| Firm age | 0.003 (0.002) | - 0.001 (0.002) |
| Firm size | -0.010*** (0.001) | 0.005** (0.002) |
| Country level fixed effect | Yes | Yes |
| _cons | 0.538*** (0.007) | 0.826*** (0.006) |
| R-sqr. | 0 .017 | 0.0039 |
| Adjusted R-sqr. | 0.016 | 0.0037 |
| Obs. | 31859 | 31859 |

Note: Standard error in parenthesis * p< 0.1; ** p < 0.05; *** p < 0.01

Own calculations

In Table 6, we further conducted robustness test using the average marginal effect estimation to assess the reliability and validity of our results in Table 5. The results confirm that firm co-operation in R&D and innovation activities have significant and positive impact on innovation but insignificant impact on co-operation on other business activities. Thus, for a unit change in R&D co-operation, firms achieve 16.3% improvement in innovation and 8.3% for firm co-operation on innovation activities.

In testing hypothesis H2, we interacted expenditure on staff training and development and firm co-operation on R&D, we found that organizational culture positively and significantly moderates the relationship between R&D co-operation and radical innovation but not incremental innovation. This supports hypothesis H2 but disagrees with Alassaf et al., (2020) that there is no significant relationship between organizational culture and open innovation We reported only the positive results (Radical innovation) on the interaction effect.

**Table 6: Robustness test results on the R&D and non- R&D co-operation and innovation using average marginal effect method.**

| Variables | Delta Method dy/dx |
|---|---|
| Co-operation on R&D | 0.163*** (0.020) |
| Co-operation on other innovation activities (excluding R&D) | 0.083*** (0.019) |
| Co-operation on other business activities | 0.006 (0.019) |
| Firm age | 0.020 (0.013) |
| Firm size | -0.027*** (0.010) |
| Country level fixed effect | Yes |
| Obs. | 5038 |

Note: Standard error in parenthesis * p< 0.1; ** p < 0.05; *** p < 0.01

Own calculations

**Table 7: Interaction effect of expenditure on staff training on the relationship between R&D co-operation and innovation**

| Variables | Model 1 Radical innovation |
|---|---|
| Co-operation on R&D | 0.107*** (0.007) |
| Expenditure on staff training and development | 0.004 (0.010) |
| Expenditure on staff training and development * Co-operation on R&D | 0.335* (0.121) |

| **Variables** | **Model 1** Radical innovation |
|---|---|
| Co-operation on other innovation activities (excluding R&D) | 0.049*** (0.007) |
| Co-operation on other business activities | -0.003 (0.005) |
| Firm age | 0.003 (0.002) |
| Firm size | -0.010*** (0.002) |
| Country level fixed effect | Yes |
| _cons | 0.540*** (0.007) |
| R-sqr.<br>Adjusted R-sqr.<br>Obs. | 0.0174<br>0.0171<br>26094 |

Note: Standard error in parenthesis * p< 0.1; ** p < 0.05; *** p < 0.01

Own calculations

### 4.1 Discussion

Our first hypothesis H1a sought to examine how firm R&D co-operation improves radical and incremental innovation in the Visegrad region. We confirmed that R&D co-operation enhances radical innovation but surprisingly it retards incremental innovation. This provides an insight into the missing link existing in current literature (Žítek & Klímová, 2020; Choi & Choi, 2021) which mostly focus on R&D co-operation and its impact on general innovation. It is pertinent to state that, firm co-operation in R&D is effective in terms of Radical innovation but not incremental innovation. We also sought to find out the impact of non-R&D innovation on radical and incremental innovations in our hypothesis H1b. This was fully confirmed by our findings that when firms co-operate on innovation activities excluding R&D, is promotes both radical and incremental innovations. We refute Rammer's (2023) are argument that when firms co-operate on innovation activities, it does not necessarily lead to innovation. We extend the understanding in firm co-operation that, policy statements of firms that seek to achieve both radical and incremental innovation should give attention to co-operating on innovation activities excluding R&D with firms of mutual interest that have the resources and capabilities to carry out the co-operation agenda. Furthermore, we assert that, firm co-operation on other business activities excluding R&D and innovation promote only incremental innovation. Such co-operation does not impact on radical innovation. This was confirmed by hypothesis H1c that firm co-operation in other business activities did not have significant impact on radical innovation but was significant on incremental innovation. The essence of assessing the moderation role of organizational culture in the relationship between R&D co-operation was confirmed in hypothesis H2. We proved that, when firms focus on the culture of training and developing their employees and co-operate with other firm on R&D, they promote radical innovation. Firm co-operation is important and costly. It involves great investments. Hence, policy statements on firm co-operation should focus on the kind of co-operation to engage in, the kind of organizational culture to develop because they have a bearing on radical and incremental innovation.

## 5. Conclusion

The aim of our study is to examine firm co-operation in the determinants of knowledge production function and the impact on innovation. Also, we assessed the moderation role of organizational culture (expenditure on training and development) on the relationship between firm co-operation and innovation. The reason for the purpose of our study is due to the research gap in finding answers to specific firm co-operations and how they impact specific types of innovation. We partially confirmed our first hypothesis that firm R&D co-operation positively and significantly impact on radical innovation but negatively impact on incremental innovation. The second hypothesis was fully supported that firm co-operation on innovation activities excluding R&D positively and significantly impact on both radical and incremental innovations. The third hypothesis was partially confirmed that firm co-operation other business activities excluding R&D and innovation activities positively impact on only incremental innovation and not radical innovation. We confirmed our final hypothesis that an interaction between expenditure on training and development and firm co-operation on R&D positively and significantly impact on radical innovation. Practically, the implications of our findings suggest that firms that aim at achieving radical innovation succeed when they co-operate on R&D.

Because the economic risk in radical innovation requires committed investments policies on R&D and an effective triple helix system. Again, managers of firms that seek to achieve both radical and incremental innovations should have a policy direction towards co-operation on innovation activities. Besides, other business activities co-operation (excluding non-R&D and innovation activities) promotes incremental innovation. Finally, managers of firms that want to succeed with the introduction of a product new to both market and the firm should prioritize the culture of employee training and development as well as co-operating with other firms on R&D. Theoretically, these findings contribute to collaborative advantage theory (CAT), the knowledge production concept (KPF), and the Resource Based View Theory (RBV). From the point of CAT we confirm that when firms are open to co-operation, there is an inflow of new knowledge promotes innovation and the kind of co-operation firms undertake determine the kind of innovation the achieve. We further established that, value of organizational culture in interacting with the determinants of KPF to promote radical innovation in the Visegrad region. From the perspective of RBV, we affirm that new knowledge is a vital resource towards innovation and its acquisition is through various forms of co-operation. Firm co-operation must be done cautiously to achieve the optimal benefit. Regardless of the findings, our study is without limitations. The study focused on only four countries in the Visegard region. Therefore, generalising the findings should be done cautiously as it might not be a true reflection in the European region. Our data is also cross-sectional in nature sourced from the 2018 CIS. The results do not allow for longitudinal assessment over a period. The possibility of endogeneity and cross-sectional dependency issues cannot be ruled out in the data used. We suggest that future studies include all countries in Europe and use panel data for the analysis. We also suggest the that other determinants of KPF should be included in future studies to determine the consistencies and variations in the findings.

## Acknowledgements

This work was supported by the Student Grant Competition of the University of Pardubice SGS_2024_013

## References

Alassaf, D., Dabić, M., Shifrer, D., and Daim, T. (2020). The impact of open-border organization culture and employees' knowledge, attitudes, and rewards with regards to open innovation: an empirical study. *Journal of Knowledge Management*, Vol 24, No.9, pp 2273-2297.

Boh, W. F., Huang, C. J., and Wu, A. (2020). Investor experience and innovation performance: The mediating role of external cooperation. *Strategic Management Journal*, Vol 41, No1, pp 124-151.

Bragoli, D., Cortelezzi, F., and Rigon, M. (2024). Firms' innovation and university cooperation. New evidence from a survey of Italian firms. *Oxford Economic Papers*, Vol 76 No 1, pp 136-161.

Choi, J., and Choi, J. Y. (2021). The effects of R&D cooperation on innovation performance in the knowledge-intensive business services industry: focusing on the moderating effect of the R&D-dedicated labor ratio. *Technology Analysis & Strategic Management*, Vol *33 No.* 4, pp 396-413.

Madrid-Guijarro, A., Martin, D. P., and García-Pérez-de-Lema, D. (2021). Capacity of open innovation activities in fostering product and process innovation in manufacturing SMEs. *Review of Managerial Science*, Vol *15 No* 7, pp 2137-2164.

Negassi, S. (2004). R&D co-operation and innovation a microeconometric study on French firms. *Research policy*, Vol *33 No* 3, pp 365-384.

Paiva, T., Ribeiro, M., and Coutinho, P. (2020). R&D collaboration, competitiveness development, and open innovation in R&D. *Journal of Open Innovation: Technology, Market, and Complexity*, Vol 6 No 4, pp 116.

Pham, P. T., Popesko, B., Quddus, A., & Nguyen, N. T. K. (2021). Innovation and bank efficiency in Vietnam and Pakistan. *Scientific Papers of the University of Pardubice, Series D: Faculty of Economics and Administration*.

Park, B., and Lee, C. Y. (2023). Does R&D cooperation with competitors cause firms to invest in R&D more intensively? evidence from Korean manufacturing firms. *The Journal of Technology Transfer*, Vol 48 *No* 3, pp 1045-1076.

Peiró-Signes, Á., Díez-Martínez, I., and Segarra-Oña, M. (2024). The drivers of cooperation for innovation and the role of environmental orientation. *Corporate Social Responsibility and Environmental Management*.

Rammer, C. (2023). Measuring process innovation output in firms: Cost reduction versus quality improvement. *Technovation*, Vol *124*, 102753.

Shafi, M. (2021). Sustainable development of micro firms: examining the effects of cooperation on handicraft firm's performance through innovation capability. *International Journal of Emerging Markets*, Vol *16 No* 8, pp 1634-1653.

Singh, R., Chandrashekar, D., Hillemane, B. S. M., Sukumar, A., and Jafari-Sadeghi, V. (2022). Network cooperation and economic performance of SMEs: Direct and mediating impacts of innovation and internationalisation. *Journal of Business Research*, Vol 148, pp 116-130.

Sohag, K., Chukavina, K., and Samargandi, N. (2021). Renewable energy and total factor productivity in OECD member countries. *Journal of Cleaner Production*, Vol *296*, 126499.

Srisathan, W. A., Ketkaew, C., and Naruetharadhol, P. (2020). The intervention of organizational sustainability in the effect of organizational culture on open innovation performance: A case of thai and chinese SMEs. *Cogent business & management*, Vol *7* No 1, 1717408.

Van Beers, C., and Zand, F. (2014). R&D cooperation, partner diversity, and innovation performance: an empirical analysis. *Journal of Product Innovation Management*, Vol 31 N*o* 2, pp 292-312.

Xiang, Y., and Jiang, Y. (2023). Co-evolution of firm innovative capability and external network: entrepreneurial orientation as antecedent–a longitudinal case study of the CHINT group. *Asian Journal of Technology Innovation*, Vol *31 No* 2, pp 397-421.

Žítek, V., & Klímová, V. (2020). Regional resilience redefinition: Postpandemic challenge. *Scientific Papers of the University of Pardubice. Series D. Faculty of Economics and Administration*, *28*(4).