Economics

On the Role of In-House R&D and External Knowledge Acquisition in Firm's Choice for Innovation Strategy: Evidence from Transition Economies

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ABSTRACT. This paper explores the existing interrelationships between distinct types of innovation inputs and outputs in transition economies. Specifically, on the basis of BEEPS V dataset and using modified CDM model, we have investigated the existence of possible variation in the impacts of various types of innovation inputs (in-house R&D and external knowledge acquisition) on the different modes of innovation outputs (product, process and non-technological innovations). The results of the study show that firm's decisions on in-house and out-house knowledge development processes are highly interdependent and generally share the same determinants. Further, based on the results of previous studies, we have formulated and tested hypotheses that internal R&D is linked mainly to product innovation, while external knowledge acquisition to process and non-technological innovation modes. The hypotheses testing, generally, supports these expectancies. However, contrary to some of our expectations, the study results suggest that implementation of internal R&D strategy can stimulate not only product innovations but also process innovative activity; as well as that external knowledge acquisition input is a significant predictor of product innovation. The analysis of marginal effects reveals that the in-house R&D input is the key determinant of the product innovation strategy; while external knowledge acquisition is the only innovation input that enhances the likelihood of non-technological innovations. Both innovation inputs effect the probability of process innovation almost with equal magnitude. *© 2016 Bull. Georg. Natl. Acad. Sci.*

Key words: R&D, external knowledge acquisition, innovation, CDM, transition economies.

Since Zvi Griliches's seminal paper [1], the role of knowledge generation activities as determinants of innovation has been recognized widely in academic literature. Griliches explicated the link between innovation inputs and innovation outputs through introduction of a 'knowledge production function' to the traditional Cobb-Douglass production framework. The main assumption of this approach is that past and current knowledge investments (inputs) are necessary for generating a new knowledge (outputs), which in turn affects the firm's output growth. This line of research has been further extended by Crepon, Duguet, and Mairesse [2]. The model, henceforth referred as CDM, distinguishes innovation input (research and development investments) and innovation output (knowledge). Employing structural recursive model, CDM explains productivity by the knowledge or innovation output and innovation output by research and development investments.

At present stage, innovation literature distinguishes two main sources of innovation inputs: investments in internal R&D and investments in acquisition of machinery and external knowledge (EKA); as well as four types of innovation outputs (product innovation; process innovation; organizational innovation; and marketing innovation) [3].

Recent studies of the link between R&D, innovation and firm's productivity [4-8], based on the CDM model, generally has proved the main findings of Crepon et al. study [2]. It is worth mentioning, that the limitation of the majority of empirical innovation research, based on CDM model, is that they focus mainly on in-house R&D activity as a primary innovation input. The same time, only small number of studies explores the contribution of EKA to firms' innovation strategy. Thus, the role and the joint impact of these two types of innovation inputs on the firm's capabilities to produce various types of innovation outputs remains relatively unstudied. The underestimation of the role of EKA in firm's innovative activity is especially acute for the studies focused on the catching-up economies. For instance, the recent comprehensive innovation study in transition economies conducted by EBRD [9], uses only the internal R&D activity as an innovation input in the structural model.

The main purpose of this paper is to fill this gap using the Enterprise Surveys database (Business Environment and Enterprise Performance Survey (BEEPS V) - https://www.enterprisesurveys.org/), which covers 29 transition economies. In this study we account for simultaneous occurrence of different types of innovation inputs (in-house R&D and EKA) and explore their impacts on the various modes of innovation outputs for firms in transition economies.

Literature Review. The empirical research of the relationship between in-house and out-house knowledge generation activities shows mixed results. A bulk of empirical studies confirms complementarity hypothesis and reveals that internal and external innovation inputs have a different significance for the different types of innovation outputs. For instance, Parisi et al. [10] exploiting a rich dataset of Italian firms, reveals that R&D spending enhances the probability of introducing a new product, while fixed capital spending is associated with the introduction of a process innovation. The authors argue that the effect of the fixed investment on the process innovation is complemented by internal R&D.

Similarly, Conte and Vivarelli [11] using CIS (Eurostat's Community Innovation Survey) dataset comprising more than 3000 Italian manufacturing companies, discuss the role of the company's investment in R&D and acquisition of technology (TA) in the introduction of new product and/or process innovations. The results of the study suggest that while R&D is connected mainly with increasing the probability of product innovation, the technology acquisition plays important role in enhancing likelihood of the process innovation. The authors argue that the relative importance of R&D and technology acquisition depends on such characteristics of the firm as size and the technological domain of a sector.

The results of above research, generally, suggests that while internal R&D favors more complex product innovation strategy, investments in external knowledge is associated mainly with process innovations. However, some studies came to slightly different conclusions with regard to the role which innovation inputs play in enhancing the probability of different types of innovation outputs. Chudnovsky et al. [12] analyzing the sample of Argentinian firms, find that R&D increases the odds of both product and process and only product innovations vis a vis only process innovations, while technology acquisition does not affect the relative likelihood of the innovation output outcomes.

Despite its importance, a number of issues, in this stream of research, still requires further attention from scholars. First, the existing studies are mainly focused on the developed markets, while the relationships between innovation inputs and innovation outputs in the realities of transition economies received very sparse attention. Second, the impact of innovation inputs on firm's non-technological innovations strategy also remains unexplored.

The main contribution of this paper is that it, exactly, focuses on these issues. In particular, in this study, we investigate the specificity of the impacts of in-house and external innovation inputs on various innovation strategies, including non-technological innovations, in catching-up economies.

In our study we distinguish the following three innovation strategies: product innovation, process innovation and non-technological innovation (marketing and/or organizational innovations). Based on the results of the existing empirical studies we expect that internal and external types of innovation inputs will have distinct impacts on various types of innovation outputs. In particular, we hypothesize that for firms in transition economies:

H1: In-house R&D enhances probabilities of the adoption of product innovation, while External Knowledge Acquisition increases the likelihood of the adoption of process or/and non-technological innovation.

Research Methodology. In order to study structural relationships between internal R&D and external knowledge acquisition on the one hand, and various type of non-exclusive modes of innovation strategies on the other, we apply a modified version of CDM model (in our earlier study we explored the impact of innovation inputs on the exclusive modes of innovation outputs [13]). This model is modified by inclusion of a new equation for external knowledge acquisition, which serves as a determinant of innovation output along with internal R&D activity. Since, in this study we concern only with the impact of innovation inputs on innovation outputs, the productivity equation is not considered in the model. Also, the stages that accounts for the quantitative dimensions of investments in R&D or in EKA are omitted here. The proposed model represents a simultaneous-equation model estimated by Maximum Likelihood. Below, the model is presented as a recursive system of the following five equations:

$$\begin{cases} y_{1i} = 1 if\ y_{1i}^{*} = \ {}'_{1}x_{1i} + £_{1i} > 0; \\ \qquad and\ y_{1i} = 0 otherwise, \\ y_{1i} = 1 if\ y_{1i}^{*} = \ {}'_{1}x_{1i} + £_{1i} > 0; \\ \qquad and\ y_{1i} = 0 otherwise, \\ y_{3i} = 1 if\ y_{3i}^{*} = \sim_{3} y_{1i} + ¥_{3} y_{2i} + \ {}'_{3}x_{3i} + £_{3i} > 0; \\ \qquad and\ y_{3i} = 0 otherwise, \\ y_{4i} = 1 if\ y_{4i}^{*} = \sim_{4} y_{1i} + ¥_{4} y_{2i} + \ {}'_{4}x_{4i} + £_{4i} > 0 \\ \qquad and\ y_{4i} = 0\ otherwise, \\ y_{5i} = 1 if\ y_{5i}^{*} = \sim_{5} y_{1i} + ¥_{5} y_{2i} + \ {}'_{5}x_{5i} + £_{5i} > 0; \\ \qquad and\ y_{5i} = 0 otherwise. \end{cases} \tag{1}$$

Here, the yki's (with k= 1,…,5) are endogenous choice variables and the y^*_{ki}'s (with k= 1,…,5) are respective latent decision variables. In particular, y_{1i} - is an indicator variable that equals to 1 if firm decides to invest in R&D and equals to zero otherwise; y_{2i} - is an indicator variable that equals to 1 if firm decides to invest in external knowledge acquisition and equals to zero otherwise; y_{3i}, y_{4i} and y_{5i} - stand for innovation output variables, which are proxied by three dummy variables: product, process and non-technological innovation respectively. The vectors of explanatory exogenous variables are denoted by x_{ki} (with k= 1,…,5); $'_{k}$ (with k= 1,…,5) is vector of parameters and $\sim_3$, $\sim_4$, $\sim_5$ and $¥_3$, $¥_4$, $¥_5$ are single parameters to be estimated. Random error terms, which are assumed to be multivariate normal with zero mean and variance equal to 1, are defined as $£_{ki}$ (with k= 1,…,5); and i=1,….., n is an index of surveyed firms.

The first two equations estimate a firm's decision to get engaged in knowledge development activities. Each of these two equations is specified as a Probit regression. The vectors x_{1i} and x_{2i} include the independent exogenous variables, which explain the firm's decision to get engaged in R&D and in EKA respectively. In our model, both vectors generally share the same set of variables, with the only exception: while important determinant of the decision to invest in R&D is patent protection, in EKA equation this variable is replaced by intensity of computers usage. The explanatory variables included in x_{1i} and x_{2i} vectors are described in more detail in Table 1. We assume that error terms $\pounds_{1i}$ and $\pounds_{2i}$ are correlated with correlation coefficient $°_{12}$.

The next three equations in the system 1 involve the estimation of the 'knowledge production function'. Each of these three equations uses dummy variables to reflect firm's decision to undertake product, process and/or non-technological (organizational and marketing) innovation strategy respectively. Like previous equations, each of them is specified as Probit regression, which along with vector of exogenous regressors incorporates two endogenous variables - internal and external innovation inputs. The description of exogenous variables is presented in the Table 1.

The system of equation (1) is a simultaneous-equations type recursive model without feedback effects. The potential endogeneity of internal R&D, external knowledge acquisition and innovations are accounted for by simultaneous estimation of all equations and through correlations in the error terms. In the first two equations some exclusion variables or 'instruments' (these are: 'patent', 'use of computers' and 'subsidy' variables) are assumed, which allows for identification.

Following Mairesse and Robin [14] this system is estimated simultaneously by Simulated Maximum Likelihood estimation technique. Ignoring parameters to be estimated, the log-likelihood takes the following form:

$$\begin{aligned} lnL &= lnL\left(y_1, y_2, y_3, y_4, y_5 | x_1, x_2, x_3, x_4, x_5\right) = \\ & l_1\left(y_1|x_1\right) * l_2\left(y_2|x_2\right) * l_3\left(y_3|x_3, y_2, y_1\right) * \\ & l_4\left(y_4|x_4, y_2, y_1\right) * l_5\left(y_5|x_5, y_2, y_1\right) \end{aligned} \qquad (2)$$

The likelihood function (2) comprises only Probit models. Since the system of equation (1) represents seemingly unrelated equations model, the contributions to likelihood function discussed above are connected by the various correlation coefficients of the error terms. The log-likelihood function is maximized using the Conditional Mixed Process program (CMP) [15], which applies GHK-type numerical simulation algorithm.

Data Sample. The main source of the data for the research is the micro-level dataset from the fifth round of the Business Environment and Enterprise Performance Survey (BEEPS V). The survey was conducted by the European Bank for Reconstruction and Development (EBRD) and the World Bank Group (the World Bank) for 15,523 firms in 29 countries in the European and Central Asian regions in the period of 2012-2014. The sample was selected using stratified random sampling techniques. Three levels of stratification were used in all countries: industry, establishment size and region. The more detailed description of the sampling methodology can be found in the Sampling Manual (http://www.enterprisesurveys.org/ /~/media/GIAWB/EnterpriseSurveys/Documents/ Methodology/Sampling_Note.pdf).

Study Results. The estimation results of the simultaneous equation system 1 are presented in the table 2.

Innovation input stage. The first stage of CDM model comprises bivariate SUR probit model (the first two equations of the system 1), which specifies the probabilities of investing in R&D and acquiring external knowledge (EKA). First, the results of the analysis presented in table 2, reveal that these two decisions are interdependent within the establishment, since the residuals of the corresponding equations are significantly correlated with each other. Thus joint estimation of these two equations seems to be an appropriate decision. Further, we find that possessing of formal protection (patents, trademarks, licenses) and having educated human resource stimulate investments in R&D (both effects are statistically significant at $p<0.01$ level). Regular use of computers and foreign ownership, in turn, increases the probability of the external knowledge acquisition (significant at 1% level). In accordance, with the

Table 1. List of the variables used in the study

Name of Variables	Description of variables
Endogenous Variables	
R&D investments	is the dummy variable that equals to 1 if firm decides to invest in R&D
EKA investments	is the dummy variable that equals to 1 if firm decides to invest in EKA
Product innovations	is the dummy variable that equals to 1 if firm undertakes product innovations
Process innovations	is the dummy variable that equals to 1 if firm undertakes process innovations
Non-technological innovations	is the dummy variable that equals to 1 if firm undertakes organizational or/and marketing innovations
Exogenous Variables	
Patent (establishment has ever been granted a patent)	is a dummy variable, which shows whether establishment has ever been granted a patent (included in x_{1i} vector but not in x_{2i} vector)
Percentage of workforce that use computers regularly	percentage of workforce that use computers regularly (included in x_{2i} vector but not in x_{1i} vector)
University degree (percentage)	percent of full-time employees with university degree, reflects the quality of human capital employed by establishment
Working capital financed from external funds (percent)	financing of working capital variable; this variable reflects the percentage of working capital financed by banks and non-bank institutions and is used to control for the imperfections of the financial markets
Subsidy	is a dummy variable, which shows whether establishment has received any subsidies from national, regional or local government of from European Union sources over the last three years
Firm's age	log of the age of the establishment in years
Firm's size	*firm's* size, which contain three dummy variables: small (6-19 employees), medium (20-99 employees), and large (100 and more employees)
Foreign ownership	dummy variable, which shows whether the foreigners have a majority in the ownership
State ownership	dummy variable, which indicates whether the state has a majority in the ownership
Exporting	dummy variable, which indicates whether the firm participates at export markets
Main market	comprises three indicators – *local*, *national*, *international* – which signify that main product is sold no local, national or international markets respectively
Email	dummy variables, means that the establishment uses e-mail for communications with its business partners
Industry	dummy variables, which reflect industry fixed effects; list of industries: Manufacturing (Food; Wood; Publishing, printing and recorded media; Chemicals; Plastics&Rubber; Non-metallic mineral products; Fabricated metal products; Machinery and equipment; Electronics; Precision instruments; Furniture); Retail; Other Services (Wholesale; IT; Hotel and restaurants; Services of motor vehicles; Construction section; Transport; Supporting transport activities; Post and telecommunications)
Country	dummy variables, which reflect country fixed effects; list of countries (Albania, Armenia, Azerbaijan, Belarus, Bosnia, Bulgaria, Croatia, Czech, Estonia, Georgia, Hungary, Kazakhstan, Kosovo, Kyrgyzstan, Latvia, Lithuania, Macedonia, Moldova, Montenegro, Poland, Romania, Russia, Serbia, Slovakia, Slovenia, Tajikistan, Turkey, Ukraine, Uzbekistan)

Schumpeterian approach to innovation [16] and findings from recent studies, the estimation results suggest that the firm's size is important determinant of the firm's decision to invest in R&D and to acquire external knowledge. Larger establishments, enjoying economies of scale and scope and having greater market power, possess better opportunities to mobilize necessary financial resources, and thus they show higher propensity for innovation. Small and medium size establishments substantially reduce probability of such investments (statistically significant at 1% level in both equations), compared to large companies. As expected, the probabilities of decisions to invest in R&D and to acquire external knowledge are also positively affected by availability of subsidies from government or international sources (statistically significant at $p<0.01$ in both equations); development of credit markets (significant at 1% level in R&D equation and at 10% level in EKA equation); and participation at export markets (significant at 1% level). Providing access to finance and ensuring transfer of external knowledge and skills (foreign owner-

Table 2. Estimation of the system of simultaneous equations

Variables	Innovation Input equations		Innovation output equations		
	Dependent variables				
	Internal R&D	External Knowledge Acquisition	Product Innovation	Process Innovation	Non-tech Innovation
Internal R&D (dummy)	-	-	1.480*** (.1173)	.7865*** (.1551)	-.1022 (.1666)
EKA (dummy)	-	-	.5616*** (.1302)	.8184*** (.1362)	1.179*** (.1252)
Patent (establishment has ever been granted a patent)	.4045*** (.0514)	.	-	-	-
Percentage of workforce that use computers regularly	-	.0054*** (.0007)	-	-	-
Subsidy	.2262*** (.0543)	.2857*** (.0546)	-	-	-
Working capital financed from external funds	.0027*** (.0007)	.0013* (.0008)	-.0002 (.0007)	.0021*** (.0007)	.0027*** (.0007)
University degree	.0047*** (.0007)	.0010 (.0008)	-.0002 (.0007)	-.001 (.0007)	.0008 (.0007)
Firm's size (small)	-.2476*** (.0552)	-.2771*** (.0566)	.2813*** (.0479)	.0838 (.0518)	.0012 (.0518)
Firm's size (medium)	-.1577*** (.0498)	-.1619*** (.0514)	.0339 (.0451)	-.0485 (.0486)	-.1476*** (.0476)
Log of Firm's age	-.0199 (.0242)	.0228 (.0246)	-.0055 (.0202)	.0099 (.0215)	-.0099 (.0211)
Foreign ownership	.0564 (.0643)	.1568** (.0639)	.0024 (.0561)	-.0086 (.0606)	.1559** (.0609)
State ownership	-.0873 (.1428)	.0931 (.1424)	-.1059 (.1189)	.0543 (.1287)	-.0308 (.1262)
Exporting (dummy)	.2714*** (.0455)	.1548*** (.0469)	-.0067 (.0434)	.0327 (.0458)	.0274 (.0451)
Main market: local	-	-	.0457 (.0338)	.0318 (.0381)	.0180 (.0364)
Email	-	-	.2008*** (.0659)	.2318*** (.0739)	.2939*** (.0700)
Country effects	Yes		Yes		
Industry effects	Yes		Yes		
Correlation of residuals (Rho)					
Rho (R&D)	1				
Rho (EKA)	.214***(.026)	1			
Rho (Product Innovation)	-.677***(.078)	-.232***(.076)	1		
Rho (Process Innovation)	-.168*(.089)	-.276***(.079)	.374***(.031)	1	
Rho (Non-tech Innovation)	.246***(.089)	-.529***(.081)	-.023 (.022)	.301***(.029)	1
N (number of observations): 6,548					
Notes: Robust standard errors in parentheses; *** — significant at $p < 0.01$ level; ** — significant at $p < 0.05$ level; * — significant at $p < 0.1$ level.					

ship) for the companies, these factors increase their propensities for innovation. Other controls, such as firm's age and ownership type exert no influence on R&D and EKA decisions.

Innovation output stage. According to Table 2 (equations 3-5 of the system 1), in-house R&D activity is an important predictor of product and process types of innovation strategy (both effects are statistically significant at 1% level), while its impact on the non-technological innovation strategy is non-significant. External knowledge acquisition positively influences all three types of innovation outputs (statistically significant at $p<.01$). The results of the study, generally, provide support for our expectancies that internal innovation inputs positively influence product innovations, while external innovation input is a

Table 3. Estimation of the marginal effects of the innovation inputs on innovation outputs

Innovation Inputs	**Innovation Outputs**		
	Product Innovation	Process Innovation	Non-Technological Innovation
In-house R&D	.4747*** (.0318)	.2526*** (.0466)	-.0325 (.0531) ns.
External Knowledge Acquisition	.1801*** (.0410)	.2629*** (.0413)	.3754*** (.0377)
Notes: Robust standard errors in parentheses; *** — significant at $p < 0.01$ level; ** — significant at $p < 0.05$ level; * — significant at $p < 0.1$ level; ns.- non-significant.			

good predictor of process and non-technological innovations. However, despite our expectations that in-house knowledge development will enhance probabilities of product innovation only, the analysis of hypothesis testing shows that internal R&D strategy can be considered as an effective instrument for promoting process innovation strategy as well. Similarly, contrary to our anticipations, empirical findings suggest that external knowledge acquisition is an important determinant of product innovation.

Along with hypotheses testing, a big interest for the sake of current research represents estimation of the size of the effects of innovation inputs on various types of innovation strategies. Table 3 presents estimations of the marginal effects of in-house R&D and EKA on the corresponding innovation outputs. According to the data, when a firm is engaged in in-house R&D activity the probability that it implements product innovation increases by 47.4 percentage points. The external knowledge acquisition also does matter for a firm's decisions to introduce a new product. Still, the impact of the EKA is substantially lower, it increases the likelihood of the product innovation only by 18 percentage point. Thus, in-house R&D is apparently more effective predictor of product innovation compared to EKA. The same time, internal and external inputs exert almost equal effect on the probability of process innovation (25.3 and 26.3 percentage points correspondingly). While external knowledge acquisition is the only innovation input that enhances the likelihood that a firm will undertake non-technological innovation strategy (37.5 percentage points).

Summary and Conclusions. This paper explores the existing interrelationships between distinct types of innovation inputs and outputs in transition economies. Specifically, on the basis of BEEPS V dataset and using modified CDM model, we have investigated the existence of possible variation in the impacts of various types of innovation inputs (in-house R&D and external knowledge acquisition) on the different modes of innovation outputs (product, process and non-technological innovations).

Based on the results of previous studies, we have formulated and tested hypotheses that internal R&D is linked mainly to product of innovation, while external knowledge acquisition to process and non-technological innovation modes. The hypotheses testing, generally, supports these expectancies. However, contrary to some of our expectations, the study results suggest that implementation of internal R&D strategy can stimulate not only product innovations but also process innovative activity; as well as that EKA input is significant predictor of product innovation. The analysis of marginal effects reveals that the in-house R&D input is the key determinant of the product innovation strategy; while EKA is the only innovation input that enhances the likelihood of non-technological innovations. Both innovation inputs effect the probability of process innovation almost with equal magnitude.

We think that main policy implication stemming from these study results is that providing ease access to financial resources is a crucial prerequisite necessary for promoting knowledge development activity in transition economies. In support of existing findings, we reveal that internal R&D activity is highly dependent on the patent protection. Thus the enhancement of the legal framework and establishing the rule of law that secure property rights, can be considered as important ways for stimulating firm's R&D investment decisions. This is especially true for the countries where firms' innovation activity is very low and property rights guaranteeing mechanisms are very poor.

ეკონომიკა

ფირმის ინოვაციური სტრატეგიის არჩევანში შიგა სამეცნიერო-კვლევითი და საცდელ-საკონსტრუქტორო სამუშაოებისა და გარე ცოდნის შეძენის როლის შესახებ: გარდამავალი ეკონომიკის მქონე ქვეყნების მაგალითზე

გ. ბერულავა და თ. გოგოხია

ივანე ჯავახიშვილის სახელობის თბილისის სახელმწიფო უნივერსიტეტი, პ. გუგუშვილის ეკონომიკის ინსტიტუტი, თბილისი, საქართველო

(წარმოდგენილია აკადემიის წევრის ვ. პაპავას მიერ)

წარმოდგენილ სტატიაში შესწავლილია გარდამავალი ეკონომიკის ქვეყნებში ფირმის დონეზე არსებული განსხვავებული ტიპის ინოვაციური დანახარჯებისა და სხვადასხვა ტიპის ინოვაციური შედეგების ურთიერთკავშირები. კერძოდ, BEEPS V-ის მონაცემების გამოყენებით და მოდიფიცირებულ CDM მოდელზე დაყრდნობით გამოკვლეულია სხვადასხვა ტიპის ინოვაციურ შედეგზე (პროდუქტულ, პროცესულ და არატექნოლოგიურ ინოვაციებზე) სხვადასხვა ინოვაციური დანახარჯის (შიგა სამეცნიერო-კვლევითი და საცდელ-საკონსტრუქტორო სამუშაოების (სკსსს) და გარე ცოდნის შეძენის) ზეგავლენის შესაძლო ვარიაციების არსებობა. კვლევის შედეგებმა გვიჩვენა, რომ ფირმის გარე და შიგა წყაროებიდან ცოდნის მიღებასთან დაკავშირებული გადაწყვეტილებები ძალზე მჭიდროდ არის ერთმანეთზე დამოკიდებული და ზოგადად ერთნაირი დეტერმინანტებით არის განპირობებული. გარდა ამისა, სხვადასხვა კვლევის შედეგების საფუძველზე ჩამოვაყალიბეთ შესაბამისი ჰიპოთეზები, რომ შიგა სკსსს უკავშირდება ძირითადად პროდუქტულ ინოვაციას, ხოლო გარე ცოდნის შეძენა — პროცესულ და არატექნოლოგიურ ინოვაციებს. ჰიპოთეზების ტესტირების შედეგებმა ზოგადად დაგვიდასტურეს ჩვენი მოლოდინები. თუმცა, ზოგიერთი მოლოდინის საპირისპიროთ, ტესტირებამ დაადგინა, რომ სკსსს-ზე ორიენტირებული სტრატეგიის განხორციელებას შეუძლია სტიმული მისცეს არა მხოლოდ პროდუქტული ინოვაციების დანერგვას, არამედ აგრეთვე გამოიწვიოს პროცესული ინოვაციების გააქტიურება, ისევე, როგორც გარე ცოდნის შეძენას შეუძლია მნიშვნელოვნად განაპირობოს პროდუქტული ინოვაციების განხორციელება. ზღვრული ეფექტების ანალიზმა გამოავლინა, რომ შიგა სკსსს-ი არის პროდუქტულ ინოვაციაზე ორიენტირებული სტრატეგიის საკვანძო დეტერმინანტი; ხოლო გარე ცოდნის შეძენა არის ერთადერთი ინოვაციური დანახარჯი, რომელიც აძლიერებს არატექნოლოგიური ინოვაციების განხორციელების შესაძლებლობას. ორივე ინოვაციური დანახარჯი (სკსსს და გარე ცოდნის შეძენა) თითქმის ერთნაირი მასშტაბით განაპირობებს პროცესული ინოვაციის დანერგვის შესაძლებლობას.

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