







“Exploring determinants of innovation potential of enterprises in Kazakhstan”

AUTHORS	Anel Kireyeva   Akan Nurbatsin  Aigerim Yessentay  Nazyken Bagayeva  Sharbanu Turdalina
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Aigerim Yessentay, Nazyken Bagayeva,
Sharbanu Turdalina, 2021

Anel Kireyeva, Ph.D. in Economics,
Head of the Department of
Information and Implementation
of Research Results, "Institute of
Economics" Science Committee of
the Ministry of Education of the
Republic of Kazakhstan, Kazakhstan.
(Corresponding author)

Akan Nurbatsin, Ph.D. Student,
Finance and Accounting Department,
University of International Business,
Kazakhstan.

Aigerim Yessentay, Ph.D. Student,
Economics Department, World
Economy Faculty, Al-Farabi Kazakh
National University, Kazakhstan.

Nazyken Bagayeva, Ph.D. in
Economics, Leading Researcher,
"Institute of Economics" Science
Committee of the Ministry of
Education of the Republic of
Kazakhstan, Kazakhstan.

Sharbanu Turdalina, Ph.D. Student,
Higher School of Economics and
Business, Al-Farabi Kazakh National
University, Kazakhstan.



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Anel Kireyeva (Kazakhstan), Akan Nurbatsin (Kazakhstan), Aigerim Yessentay (Kazakhstan),
Nazyken Bagayeva (Kazakhstan), Sharbanu Turdalina (Kazakhstan)

EXPLORING DETERMINANTS OF INNOVATION POTENTIAL OF ENTERPRISES IN KAZAKHSTAN

Abstract

The study aims to analyze the innovation potential of enterprises, explain the use of the binary regression methodology, and explore different indicators of the enterprises in the regions of Kazakhstan for building an effective management strategy. Methodological substantiation is based on the complex survey data analysis, provided by the World Bank Enterprises Survey (WBES) for Kazakhstan. WBES database has covered a sociological survey of enterprises, which was conducted using a random survey and representativeness among 1,296 enterprises, mainly in the production sector. Besides, the data were collected among companies regarding their experience in environmental perception (including innovation activity), in which they worked. The results have demonstrated that the age of the company, exporter status, type, sector, or activity – all these have a positive influence on the company's tendency to innovations. However, as part of the study, it has found out that competitors in the marketplace and regions of activity of enterprises predominantly negatively affect the prospects of introducing innovation. It was also in evidence that the same factors (foreign ownership, advanced training, type, size, and sector of an enterprise) are essential determinants of product, technology, R&D, ICT, and innovation. Obtained results can be used by enterprises for building an effective management strategy of own business innovative development, as well as by local authorities to upgrade the competitive performance.

Keywords

innovation, new technologies, enterprises, determinants,
regression, small and medium-sized enterprises,
Kazakhstan

JEL Classification

O30, O31, M50

INTRODUCTION

Nowadays it is crucial to accelerate the introduction of innovations in production, using flexible organizational structures and management forms, as well as monitoring and implementing innovative projects. Stable operations of enterprises guarantee an increase in the welfare of the population and an improvement in the quality of life. So-called determinants must consider forming management strategies for the sustainable development of innovation. In general, determinants are factors that define the direction of development of the enterprise, the possibilities, and the intensity of updating products and production equipment. Since innovation strategies depend on the overall strategies of the enterprise, the determinants should consider this when forming management strategies. Nevertheless, considering the specifics it is necessary to identify specific innovative determinants. In this study, such determinants include innovative products, research and development personnel potential, availability of reserves in the form of results of already completed R&D, the structure of products, considering market shares, stages of the life cycle, and ICT indicators.

Recently, new data sources have emerged, such as the World Bank Group Enterprise Survey, which was widely used to study the elements

that influence innovation distribution in developed countries (Grossman & Helpman, 1993; Fabrizio, 2009; Hajduova et al., 2021). Such studies have revealed a wide range of specific factors for companies and industries that have shown the influence of innovations in both developed and developing countries. To increase the absorption potential of regions, it is important to implement programs managing the support and development carried out by businesses, as well as improve the quality of human capital (Kireyeva et al., 2020). However, the level of influence of these factors on innovation, especially in developing countries such as Kazakhstan, remains unexplored and needs further investigations.

It is necessary to improve innovative activities of enterprises for sustainable development by aligning them with the needs of the market and the capabilities of the economic entities. Following the literature review, it is concluded that such topics as enterprise potential and factors of innovation contribution especially in developing countries such as Kazakhstan are not studied widely. Empirical studies of micro-economics remain sparse. While exploring these factors (also called determinants) the focus is mainly put on large companies but not on SMEs. Further, the focus is switched from engineering and economic problems to the decision-making process. This pragmatic approach combines economic theory with engineering practice. Thus, a detailed analysis of the level of determinants of innovation should be carried out, considering their impact on SMEs.

This study consists of the following parts: a review of the literature in the sphere of innovation and analysis of its determinants, description of the methodology, obtained results, and finally conclusions that focus on key findings of this study.

1. LITERATURE REVIEW

Innovation systems are becoming boundless, and regional economics are becoming interdependent. In the XXI century, the economic state of the world depends on innovation development. Today, to beat the competition, many companies are implementing strategies to promote innovation. Due to this, innovation allows companies to increase sales growth, market share, and profits, which in turn affect their overall performance (Shashi et al., 2019). Meanwhile, recent findings in the sphere of operational management show the key role innovations have in promoting the effectiveness and competitiveness of the enterprise. Many empirical studies have been conducted to determine the positive impact of innovation on company efficiency (Zemplinerova & Hromadkova, 2012; Ortiz-Villajos & Sotoka, 2018).

Product innovation is associated with the update of products, services, and concepts to meet the needs of markets. Process innovation is considered the advancement or initiation of updated processes (Knight, 1967; Utterback, 1971). Kotabe and Murray (1990) assumed that as sources of long-term competitive advantage, product and process innovations aspire to condense the inno-

vation lead-time. Dijk et al. (1997) found that innovations provide companies with large monopoly profit, necessary for financing studies pave the way towards business expansion. Damanpour (2010) implied that process innovation is a decrease of delivery time or reduction of operational costs, whereas the purpose of product innovation is to react to customer demands for new products or the desire to catch new markets. Therefore, the purpose of innovation processes is to facilitate knowledge exchanges, which contribute to innovation growth.

Schuch et al. (2012) and Kireyeva et al. (2020) explored the interaction of various factors outside or within all forms of network cooperation. Zemplinerova and Hromadkova (2012) found that there are two concepts of innovation, which focus on innovation management. The first concept states that big enterprises seem to benefit from adopted innovations and financial stability. In this regard, such enterprises show higher productivity and efficiency comparing to uncompetitive or small ones. On the contrary, the second concept states that competing enterprises gain more success than monopolistic ones; competition is actively capturing world markets. At the same time, Alderman and Davies (1990) and Zhang (2018) noted that innovation is depend-

ent on diffusion in the innovation process; it is a parallel process based on rational judgments, not on belief.

The process of learning is essential for the introduction and use of innovations, which in turn influences company performance (Calantone et al., 2002). Moreover, the influence of internal and external R&D might be different contingent on the company life course: young enterprises must make more R&D efforts for surviving, and internal R&D investment might be important for their performance. The major inference is that successful innovation develops company competitiveness, which in turn, results in above-average profits, growth, and further innovation. Griliches (1985) proved that R&D positively influences the productivity of enterprises as they obtain a relatively high rate of return. Therefore, there is a need for studies focused on other determinants of productivity (apart from R&D). Simultaneously, when enterprises spend their resources on R&D, the findings of such activities seem to be more profitable and useful comparing to the situation when the state finances such activities that does not result in breakthroughs.

Khan (2021) emphasized that determinants at the workplace motivate employees to apply innovations. In addition, they assist organizations in becoming competitive in the market. Similarly, a wide range of specific factors for companies and industries, which influence innovation activity in both developed and developing economies, was identified. Innovations are not adopted and accepted by all individuals or companies at the same period. Innovations somewhat are much different due to the impact of such factors as environment and opportunities. Acceptance of new ideas is conditioned by the interaction of various external and internal factors (Zemplinerova & Hromadkova, 2012).

Gorodnichenko and Schnitzer (2013) presented the conceptual explanations on why enterprises devoid of access to finance are less likely to capture innovative activities. It was revealed empirically that financially restricted local companies are explicitly suppressed to innovate. A broadband network infrastructure serves as a driver for innovation in the field of ICT. Different virtual ap-

plications, cloud services, and social networks are useless without broadband infrastructure.

Selective factors (determinants) are crucial for innovative enterprises. They include age, size, and strategic management of the enterprise. In addition, competition, orientation on international markets, obstacles to the financing of innovations, the economy of a country, and the state support of R&D are also important. At the same time, Griffith et al. (2006) established that workforce productivity is a key factor, which influences innovations. Božić and Mohnen (2016) showed that innovation activities are present in-service-sector companies. They must not be similar to those applied in the manufacturing industry; at the same time, if medium and small service-sector companies want to become successful, they should put significant efforts into this process. That is why such companies must conduct R&D activities.

In principle, the leaders of innovative technologies are biopharmaceutical and medical companies (Allan et al., 2009). Factors such as a strong leadership role played by each university at the national level and in its respective biotechnology cluster, as well as other factors such as the internal dimension that puts goals at the center of public policy in science and technology were found (Schuch et al., 2012). It should be noted that similar studies have been conducted on the analysis of developing and less developed economies. For example, Dotun (2015) proved that productivity is a significant determinant of innovations.

In addition, it was found that the financial capabilities of companies are crucial for influencing their innovative activity. Thus, Mahendra et al. (2015) found that financing considerably affects the innovation and other related activities of the company. In turn, according to Choi (2017), exporting industries tend to invest more in innovation. It was shown that strategic management has a positive effect on business innovation in the developed countries. Bhattacharya and Bloch (2004) used a survey of business activity in the Australian economy and found that most variables, e.g. R&D activities, market structure, and size of the enterprise are beneficial for technology companies. Further, Wan et al. (2005) showed a positive and considerable influence on the market size and the

availability of organizational means. It was stated that innovations are required, along with a readiness to accept risks and share knowledge and thoughts about innovations.

Adedamola et al. (2016) studied determinants of company innovation in Nigeria. It was shown that intervention in R&D, investment in machines, and market introduction positively affect innovations. The success factors of China's innovation through global integration are represented by manufacturing know-how, consumables purchases, financial strength, investment experience, and retail technologies and networks; benefits of location are mainly in the cost of labor (Yunshi & Jiancheng, 2007). Further, Merono-Cerdan and Lopez-Nicolas (2017) studied innovation drivers using data from the Spanish innovation community survey and found that reduced response time and lower costs, new business processes, and external connections are significant driving forces of innovation. Integration innovation at the international level between China and Japan is also beneficial. Thus, regional innovation needs to be developed to the benefit of all ingress parties. Abdu and Jibir (2018) described another set of variables based on the determinants of innovation from the Enterprise Survey conducted by the World Bank dataset (WBES) in Nigeria. These data confirm that R&D, advanced training, competitiveness, size, type, and company activities have a positive influence on innovative development. Thus, as a distinctive feature of these results, it is necessary to highlight that any company that wants to be innovative should pay great attention to investment in R&D.

The correlation and regression between economic growth and innovation potential, often in terms of GDP per capita, have been studied thoroughly. On the contrary, this study evaluates some variables that were not taken into consideration by previous studies. Secondary data were taken from a survey of firms provided by the World Bank Enterprises Survey (WBES) for Kazakhstan, additional data were collected among firms based on their environmental perception (including innovation activity). This study aims to explore the innovation potential of enterprises, explain the use of the binary regression methodology, and explore different indicators of the enterprises in the regions of Kazakhstan for

building an effective management strategy. The study of these additional variables gives a more complete picture and allows assessing a larger number of variables.

However, the majority of companies use common determinants of innovation, namely size, age, and strategic characteristics, such as its orientation on foreign markets, obstacles to the financing of innovations, market competition, and the economic situation in the country. This study used modern econometric analysis. Thus, the significant displacement and impact of subsidies on R&D by innovations are highlighted. Solution of these tasks is an important factor in improving economic growth, the quality of citizens' life, and studying engineering economics-oriented activities to ensure the competitiveness of products and production.

2. METHODOLOGY

Methodological substantiation is based on the data analysis complex. The data were taken from the survey of enterprises provided by the World Bank Enterprises Survey (WBES) for Kazakhstan during the period January-October, 2019. It was shown that there are many studies investigating data using the determinants of company innovation, innovation community survey, probit and tobit regression models (Adedamola et al., 2016; Merono-Cerdan & Lopez-Nicolas, 2017; Abdu & Jibir, 2018). However, the focus is put mainly on European countries or a specific subgroup of countries. However, there are extraordinarily few scientific studies aimed at a thorough analysis of enterprises in the developing countries of the CIS, and especially in Kazakhstan. Besides, the data were collected among companies regarding their experience in environmental perception (including innovation activity), in which they worked. To do this, data were obtained from as many different enterprises in Kazakhstan as possible to gain a better understanding of the impact on innovation potential.

Kazakhstani enterprise survey was conducted using a random survey and representativeness among 1,296 enterprises, mainly in the production sector. Table 1 shows the classification of enterprises in Kazakhstan by size.

Table 1. Classification of enterprises in Kazakhstan by their size

Source: World Bank (2020)

The size of the enterprise	Number of enterprises	In percentage (%)
Large	200	15.43
Average	425	32.79
Small	671	51.77
Total	1296	100.00

There were 1,296 surveyed enterprises in Kazakhstan, out of which 51.77% (671) were small firms, according to managers who responded to the questionnaire. Analysis of the main performance indicators of enterprises shows that there are available data from the WBES. It should be noted that the government of Kazakhstan is pursuing an active economic policy to ensure economic diversification and sustainable economic growth by increasing the role of SMEs.

Table 1 shows that 32.79% and 15.43% (425 and 200 firms respectively) of surveyed enterprises were medium and large firms, respectively.

Table 2. Occurrence of innovations in enterprises of Kazakhstan

Source: World Bank (2020).

Innovation	Total	Small	Medium	Large
The percentage by the dimension of companies				
Product	25.07	45.54	26.37	19.08
Technology	13.5	35.43	39.43	25.14
R&D	9.79	40.16	36.22	23.62
ICT	53.85	41.55	38.97	19.48
The percentage by sector				
Product	25.07	7.69	20.00	72.31
Technology	13.5	6.86	19.43	73.71
R&D	9.79	4.72	14.17	81.10
ICT	53.85	10.32	20.92	68.77

Based on the provided data it is obvious that there is a prevalence of innovation by type of company and sector, as well as the share of companies, which innovate products, new technology, R&D, and ICT. The results show that ICT innovation companies account for the largest enterprises (53.85% of the total sample), followed by product innovation companies (25.07%), and technology innovation companies (13.5%). Moreover, about 9.79% of the selected enterprises invested in R&D. Thus, it can be seen that the most innovative are small and medium-sized enterprises, whereas large enterprises are the least innovative.

As for the company sector, the most innovative ones are production companies, followed by service-sector and finally retail enterprises. Thus, it can be concluded that small and medium companies or production and service enterprises are the drivers of innovation in Kazakhstan.

Following the main goals of the study, qualitative methods with a probit model were used. The probit model is used for product assessment, new technology, R&D, and ICT, considering that variables are binary dummy variables. Therefore, the probit model formula is defined as formula (1).

$$Pr(i=1/X=x_i)=\theta(\beta_0+\beta_1FCS_i+\beta_2HCV_{ii}+\beta_3FIA_i+\beta_4ICS_i+\varepsilon), \quad (1)$$

where i , $Pr(i)$ – company propensity to innovate, θ – standard normal integral distribution of functions (CDF), FCS_i – vector of individual characteristics, HCV_i – vector of human capital variables, FIA_i – vector of innovation activity, ICS_i – vector of industry features, ε – model error.

The tobit regression model is used to assess the determinant of innovation using a broad indicator of innovativeness expressed as the aggregate of product, R&D, technological, and ICT models. Thus, the regression is described under formula (2).

$$Innv_i = \beta_0 + \beta_1FCS'_i + \beta_2HCV'_i + \beta_3FIA'_i + \beta_4ICS'_i + \varepsilon_i, \quad (2)$$

where $Innv_i = 0$, if $Innv_i^* \leq 0$, $Innv_i = 0$, $Innv_i = Innv_i^*$, if $Innv_i^* > 0$.

Dependent variables take on discrete values, which express any qualitative character. Explicative variables can be both discrete and continuous. As a rule, a dummy variable is an indicator variable reflecting qualitative characteristics. As determinants of innovation development of an economic system based on the official statistical indices, reflecting the real situation of the territories, their calculation contributes to the identification of imbalances. Foreign ownership and export according to the World Bank documentation given in percentages, the share of participation, and the volume of export in percentages, respectively, are

taken into consideration. Hence, they have a value of 1 in the presence of these factors in the enterprise, and a value of 0 in the opposite case. Regular linear regression for such variables is not applied, because it allows both negative values and values above one. Consequently, integral values are used. When constructing probit and tobit models, due to the multicollinearity of dummy variables, one of them is not included in the model (sectors and regions). The correspondence of the forecasts obtained using the model based on real data directly depends on the choice of the distribution function.

3. RESULTS

The analysis of companies in Kazakhstan is provided using the binary regression model method. Table 3 shows marginal findings of probit models

on the determinants of innovation at the company level in Kazakhstan.

It can be concluded that the key elements influencing the capabilities of launching a new or considerably improved product are size, age, advanced training, and sector of the enterprise. Model 1 shows that increasing foreign ownership and company size by a percentage point influence capabilities to innovate a product by 19.44 and 0.39 percentage points, respectively.

In comparison to manufacturing enterprises, service-sector companies are 13.47 percentage points less likely to develop a product (40.08). Companies that provide advanced training to their staff have a 58.29 percentage point higher chance of implementing product innovation than those that do not. Large companies have a 12.43 percentage

Table 3. Probit models applied to the determinants of innovation

Source: World Bank (2020).

Variable	(1) Product	(2) Technologies	(3) R&D	(4) ICT
Age	-.0088 (.0629)	.0554 (.0737)	.0271 (.079)	.0953* (.058)
Size	.1944 (.1671)	-.0255 (.1933)	-.7266 (.302)	.1754 (.1722)
Foreign ownership	.1986 (.1536)	.0855 (.1702)	-.0492 (.1927)	.3366 (.1632)
Export company	-.4352*** (.0810)	-.3639*** (.096)	-.0166 (.103)	-.2797*** (.0738)
Advanced training	.0039 (.0629)	.0608 (.0713)	.0414 (.0776)	.1744*** (.060)
Competitors	.5859*** (.0912)	.6390*** (.1018)	.5788*** (.1128)	.2904*** (.0907)
Small company	.0023 (.1217)	.0886 (.1405)	.0518 (.1526)	.2438** (.113)
Medium-sized company	.1243 (.2160)	.2223 (.2418)	.3402 (.2599)	.0439 (.205)
Manufacturing sector	.4008** (.1335)	.4180 (.166)	.7139*** (.2025)	0.257* (.112)
Service sector	.1347 (.1506)	.1089 (.1864)	.1790 (.2290)	.0348 (.129)
_cons	-.9784*** (.224)	-1.8744*** (.2702)	-2.2632*** (.3134)	-.8993*** (.2055)
Pseudo R2	0.0766	0.0979	0.0827	0.0788
Prob > chi2	0.0000	0.0000	0.0000	0.0000
LR chi2	111.71	100.39	68.74	140.80
_hat	1.207*** (.255)	1.0576*** (.392)	.6064 (.5588)	1.0754 (.1034)
_hatsq	.1748 (.198)	.0292 (.191)	-.1653 (.2298)	-.2164 (.155)
Log likelihood	-673.4476	-462.521	-380.988	-822.507
Predicted Pr(x-bar)	.251	.133	.095	.540
Observations	1294	1294	1294	1294

point higher chance of inventing a product. Age, size, exports, advanced training, and manufacturing and service-sector companies are all major predictors of technical innovation at the company level in Kazakhstan, as shown in Model 2 of Table 4.

In addition, when a percentage increase is observed in age and size, the likelihood to innovate new technology increases by 5.54 and 6.08 percentage points, respectively. If employees finished advanced training, they are 63.90 percent more

likely to innovate in technology comparing to employees who have not done this.

Service-sector enterprises are 10.89 percentage points to apply innovations comparing to manufacturing enterprises. Model 3 of Table 4 shows that advanced training, age, size, and manufacturing and service-sector companies are driving forces of R&D innovation in Kazakhstan. A percentage increase in age and size increases the likelihood of it innovating in R&D by 2.71 and 4.14 percentage points, respectively.

Table 4. Tobit models applied to aspects that influence overall outcomes of innovation

Source: World Bank (2020).

Variable	(1)	(2)	(3)	(4)	(5)
Age	.0115 (.010)	.0118 (.010)	.0125 (.0098)	.0118 (.010)	.0143 (.0099)
Size	.0313*** (.0054)	.0212** (.0102)	.0196* (.0101)	.020* (.010)	.0284*** (.0102)
Foreign ownership	.0101 (.0287)	.0101 (.0287)	.0057 (.0283)	.0094 (.0285)	.0091 (.0284)
Export company	.0744*** (.0259)	.0744*** (.0259)	.0518** (.0258)	.0617 (.0260)	.0633 (.0257)
Advanced training	.1306*** (.0154)	.1313*** (.0154)	.1419*** (.0153)	.1338*** (.0154)	.1195*** (.0157)
Competition	-.0770*** (.0127)	-.0775*** (.0127)	-.0770*** (.0126)	-.0787*** (.0128)	-.0670*** (.0132)
Small company		.1466 (.1609)	.1314 (.1586)	.1334 (.1598)	.0650 (.1571)
Medium-sized company		.1759 (.1632)	.1614 (.1609)	.1670 (.1621)	.0902 (.1595)
Large company		.1799 (.1677)	.1779 (.1653)	.1773 (.1665)	.1048 (.1638)
Nutritional sector				.0246 (.0177)	.0168 (.0176)
Textile sector				.1037** (.0412)	.0838** (.0407)
Publishing house				.0062 (.0432)	-.0032 (.0425)
Recycling sector				.0580 (.1585)	.0548 (.1558)
Non-metallic products				.0330 (.0226)	.0337 (.0224)
Car sector				.1121*** (.0335)	.1095*** (.0333)
Furniture sector				.0092 (.0328)	.0178 (.0329)
Transport sector				-.01682 (.0331)	-.0012 (.0330)
Akmolinsk region					-.0036 (.0316)
Aktyube region					-.1126*** (.0306)
Almaty city					.0674** (.0286)
Almaty region					.0471 (.0305)

Table 4 (cont.). Tobit models applied to aspects that influence overall outcomes of innovation

Variable	(1)	(2)	(3)	(4)	(5)
Atyrau region					-.0008 (.0333)
Eastern Kazakhstan					-.0039 (.0308)
Kostanay region, Pavlodar region, North Kazakhstan					-.0053 (.0317)
Kyzylorda region, Zhambyl region, South Kazakhstan					-.0511* (.0282)
Mangystau region and West Kazakhstan					-.0402 (.0307)
Nur-Sultan city					.0271 (.029)
Manufacturing sector			.0902*** (.0191)		
Service sector			.0131 (.0221)		
Constant	.1296*** (.0264)	-.0006 (.161)	-.0473 (.1597)	.0331 (.1605)	.0437 (.1593)
Sigma	.0509 (.002)	.0508 (.0019)	.04933 (.0019)	.0500 (.0019)	.0479 (.0018)
Pseudo R2	5.4963	5.5693	6.5159	6.0444	7.4379
Prob > chi2	0.0000	0.0000	0.0000	0.0000	0.0000
Observations	1296	1296	1296	1296	1296

A company that invests in specialized employee training is 57.88 percentage points more likely to create R&D than one that does not. Exporting companies have a lower likelihood of developing R&D than non-exporting firms by 4.92 percentage points, while foreign-owned companies have a lower likelihood of developing R&D by 72.66 percentage points.

In a similar vein, SMEs are 34.02 and 5.18 percentage points more likely to invent R&D comparing to other enterprises. Model 4 of Table 4 shows that age, size, advanced training, foreign ownership, exports, medium-sized businesses, and service and manufacturing businesses are the main driving forces of innovations.

A specification test was conducted. As can be seen in Table 4, the models are specified as linear because value *hat* is significant while value *_hatsq* is not.

Model 1 of Table 4 depicts a basic model of the determinant of broad innovation, which implies that age, size, exports, advanced training, and foreign ownership influence the overall innovative behavior of Kazakhstani enterprises. At the same time, they had a beneficial impact on the likelihood that enterprises will be generally inventive, while the presence of competitors in the market had a -7.70

percentage point negative impact on overall enterprise innovation. Those who have received advanced training are 13.6 percentage points more likely to innovate than employees who have not received advanced training. Small, medium and large businesses all employ ICT advancements in nearly identical ways, with 14.66, 17.59, and 17.99 percentage points, respectively.

Finally, service-sector companies are 9.02 percentage points less likely than manufacturing ones to innovate in ICT, which has a detrimental impact on the overall innovation trend of enterprises. Model 2 indicated that the same variables were statistically valuable and had the same features as Model 1 when the type of companies was controlled. Model 2 demonstrates that small, medium and large businesses are all equally innovative. Simultaneously, Model 3 revealed that both companies and primary sector activities, as well as the same variables, were statistically significant and preserved their characteristics, as in Models 1 and 2. Model 3 assumed, however, that businesses in the retail and other service sectors were less likely to innovate in general than those in the manufacturing sector.

Model 4 of Table 4 showed the sphere and type of the company. It proves that the same variables were statistically valuable. Thus, their features are preserved

in Models 1, 2, and 3. An enterprise that operates in the spheres of textile and manufacturing of equipment is more likely to be generally inventive than enterprises engaged in other sectors of the economy. Model 5 considers the type of enterprises and regional specifics. It was concluded that companies tend to become more profitable applying innovations while functioning in the competitive markets rather than on monopolistic ones. It is revealed that enterprises in Almaty and Nur-Sultan metropolitan areas, as well as the Almaty region, tend to apply innovations heavily comparing to companies in other regions. Showing -11.26 percentage points, companies of Aktobe region are not likely to adopt innovations.

This study discovered that one of the most important determinants of innovation is advanced

training offered to employees. This finding is consistent with Bhattacharya and Bloch (2004), Mahendra et al. (2015), and Abdu and Jibir (2018). Results showed that a good management strategy is necessary for any company that is willing to adopt innovations regarding any product, process, organizational structure, or marketing strategy. In this regard, it is vital to invest in R&D. Moreover, R&D is a driving force for main research breakthroughs in both developed and developing countries. It is concluded that competitiveness is another important driver of innovations; this finding complies with Artes (2009), Zemplerova and Hromadkova (2012). If the company wants to stay on the market and get profit, it must widely apply innovations.

CONCLUSION

The literature review showed that analysis of innovation determinants shows the actual situation and helps to identify gap imbalances, as well as determine a wide range of specific factors for companies and economic sectors, which influence the innovation activity of enterprises. As a result, the goals of this study are to examine the potential for companies to innovate, explain the binary regression methodology, and investigate numerous indicators of enterprises in Kazakhstani regions to develop an effective management strategy. The study goals were addressed using econometric methodologies such as binary probit and tobit regression models. During the inquiry, certain facts about Kazakhstani invention were discovered.

It is shown that the dummy variable is an indicator variable reflecting qualitative characteristics. Determinants of innovation development of an economic system are based on the official statistical indices, exploring the innovation gap between enterprises in the regions. In addition, some integral indices are used. When constructing probit and tobit models, due to the multicollinearity of dummy variables, one of them is not included in the model (sectors and regions). The correspondence of the forecasts obtained using the model based on real data directly depends on the choice of the distribution function. Furthermore, it has been discovered that rivals have little influence on product development, new technology, R&D, ICT, and innovation. In exceptional cases, the export status of companies has been an important factor influencing ICT and innovations.

Calculations showed that enterprises whose employees have completed advanced training are 13.6 percentage points more likely to innovate than enterprises whose employees have not completed such training. Small, medium and large businesses all employ ICT advancements in nearly identical ways, with 14.66, 17.59, and 17.99 percentage points, respectively. Furthermore, service-sector companies are 9.02 percentage points less likely to innovate in ICT than manufacturing ones, which has a negative impact on the overall trend of company innovation. Big cities in Kazakhstan are the most receptive to innovation among all regions, as they are scientific, cultural, financial, and economic centers. At the same time, competition, certain types of activities, and location in certain regions (almost everywhere, except for the cities of Almaty and Nur-Sultan, and the Almaty region) make the company less inclined to innovation. Therefore, management strategies are determined by the general strategies of the enterprise, and the determinants should consider when forming of strategy for the territory.

AUTHOR CONTRIBUTIONS

Conceptualization: Anel Kireyeva, Akan Nurbatsin.
Formal analysis: Anel Kireyeva.
Funding acquisition: Akan Nurbatsin.
Investigation: Anel Kireyeva, Akan Nurbatsin, Aigerim Yessentay, Nazyken Bagayeva.
Methodology: Anel Kireyeva, Akan Nurbatsin.
Project administration: Anel Kireyeva, Sharbanu Turdalina.
Resources: Akan Nurbatsin, Aigerim Yessentay, Nazyken Bagayeva, Sharbanu Turdalina.
Software: Aigerim Yessentay, Nazyken Bagayeva, Sharbanu Turdalina.
Supervision: Anel Kireyeva, Nazyken Bagayeva.
Visualization: Anel Kireyeva, Aigerim Yessentay, Nazyken Bagayeva.
Writing – original draft: Anel Kireyeva.
Writing – review & editing: Anel Kireyeva, Sharbanu Turdalina.

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REFERENCES

1. Abdu, M., & Jibir, A. (2018). Determinants of firms innovation in Nigeria. *The Kasetsart Journal Social Sciences*, 39(3), 448-456. <https://doi.org/10.1016/J.KJSS.2017.07.006>
2. Adedamola, D. A., Oluseye, O. J., Adekemi, J. O., & Folake, S. A. (2016) Micro-level determinants of innovation: analysis of the Nigerian manufacturing sector. *Innovation and Development*, 6(1), 1-14. <https://doi.org/10.1080/2157930X.2015.1047110>
3. Albers J. A., & Brewer S. (2003). Knowledge management and the innovation process: the eco-innovation model. *Journal of Knowledge Management Practice*. Retrieved from <http://www.tlainc.com/articl52.htm>
4. Alderman, N., & Davies, S. (1990) Modeling Regional Patterns and Innovation Diffusion in the UK Metalworking Industries. *Regional Studies*, 24(6), 513-528. <https://doi.org/10.1080/00343409012331346184>
5. Artes, J. (2009). Long-run versus short-run decisions: R&D and market structure in Spanish firms. *Research Policy*, 38(1), 120-132. <https://doi.org/10.1016/J.RESPOL.2008.10.014>
6. Bhattacharya, M., & Bloch, H. (2004). Determinants of innovation. *Small Business Economics*, 22(2), 155-162. <https://doi.org/10.1023/B%3ASBEJ.0000014453.94445.DE>
7. Božić, L., & Mohnen, P. (2016). Determinants of innovation in Croatian smes – Comparison of service and manufacturing firms. *Market*, 28(1), 7-27. Retrieved from <https://ideas.repec.org/a/zag/market/v28y2016i1p7-27.html>
8. Calantone, R. J., Cavusgil, S. T., & Zhao, Y. (2002). Learning orientation, firm innovation capability, and firm performance. *Industrial Marketing Management*, 31(6), 515-524. <https://doi.org/10.1016/S0019-8501%2801%2900203-6>
9. Choi, J. (2017). *Create or buy: Internal vs. external source of innovation and firm productivity* (Working Paper No. 8121). World Bank. <https://doi.org/10.1596/1813-9450-8121>
10. Damanpour, F. (2010). An integration of research findings of effects of firm size and market competition on product and process innovations. *British Journal of Management*, 21(4), 996-1010. <https://doi.org/10.1111/j.1467-8551.2009.00628.x>
11. Dijk, B. V., Hertog, R. D., Menkveld, B., & Thurik, R. (1997). Some new evidence on the determinants large and small firm determinants. *Small Business Economics*, 9(4), 335-343. <https://doi.org/10.1023/A%3A1007995919950>
12. Dotun, F. O. (2015). The key determinants of innovation in SMEs in southwestern Nigeria. *European Scientific Journal*, 11(13), 465-479. <https://core.ac.uk/download/pdf/328024938.pdf>
13. Fabrizio, K. R. (2009). Absorptive capacity and the search for innovation. *Research Policy*, 38(2), 255-267. <https://doi.org/10.1016/J.RESPOL.2008.10.023>
14. Gorodnichenko, Y., & Schnitzer, M. (2013). Financial Constraints and Innovation: Why Poor Coun-

- tries Don't CatchUp. *Journal of the European Economic Association*, 11(5), 1115-1152. <https://doi.org/10.1111/jeea.12033>
15. Griffith, R., Huergo, E., Mairesse, J., & Peters, B. (2006). Innovation and Productivity Across four European Countries. *Oxford Review of Economic Policy*, 22(4), 483-498. <https://doi.org/10.1093/OXREP%2FGRJ028>
 16. Griliches, Z. (1985). *Productivity, R&d, and Basic Research at the Firm Level in the 1970s*. NBER Working Papers 1547, National Bureau of Economic Research, Inc.
 17. Grossman, G., & Helpman E. (1993). Endogenous innovation in the theory of growth. *Journal of Economics Perspective*, 8(1), 23-44. <https://doi.org/10.1257/JEP.8.1.23>
 18. Hajduova, Z., Peráček, T., Hurajová, C., & Bruothová, M. (2021). Determinants of innovativeness of Slovak SMEs. *Problems and Perspectives in Management*, 19(1), 198-208. [http://dx.doi.org/10.21511/ppm.19\(1\).2021.17](http://dx.doi.org/10.21511/ppm.19(1).2021.17)
 19. Kireyeva, A.A., Turdalina, Sh., Mussabalina, D., Turlybekova, N.M., & Akhmetova, Z. (2020). Analysis of the Efficiency Technology Transfer Offices in Management: the Case of Spain and Kazakhstan. *Journal of Asian Finance, Economics and Business*, 7(8), 735-746. <https://doi.org/10.13106/jafeb.2020.vol7.no8.735>
 20. Khan, S. (2021). Exploring the firm's influential determinants pertinent to workplace innovation. *Problems and Perspectives in Management*, 19(1), 272-280. [https://doi.org/10.21511/ppm.19\(1\).2021.23](https://doi.org/10.21511/ppm.19(1).2021.23)
 21. Kotabe, M., & Murray, J. Y. (1990). Linking Product and Process Innovations and Modes of International Sourcing in Global Competition: A Case of Foreign Multinational Firms. *Journal of International Business Studies*, 21(3), 383-408. <https://doi.org/10.1057/PALGRAVE.JIBS.8490339>
 22. Krugman, P. R. (1991). *Geography and Trade*. London: MIT Press.
 23. Knight, K. E. (1967). A descriptive model of the intra-firm innovation process. *Journal of Business*, 40(4), 478-496. Retrieved from <http://www.jstor.org/stable/2351630>
 24. Lundvall, B. A. (2002). *Growth, Innovation and Social Cohesion: The Danish model*. Cheltenham: Elgar Publisher.
 25. Mahendra, E., Zuhdi, U., & Muyanto, R. (2015). Determinants of firm innovation in Indonesia: the Role of institutions and access to finance. *Economic and Finance in Indonesia*, 61(3), 149-160. <https://doi.org/10.7454/EFI.V61I3.512>
 26. Merono-Cerdan, A. L., & Lopez-Nicolas, C. (2017). Innovation objectives as determinants of organizational innovations. *Innovation*, 9(2), 208-226. <https://doi.org/10.1080/14479338.2016.1276407>
 27. Ortiz-Villajos, J. M., & Sotoca, S. (2018). Innovation and business survival: A long-term approach. *Research Policy*, 47(8), 1418-1436. <https://doi.org/10.1016/j.respol.2018.04.019>
 28. Rogers, E. M. (1971). *Communication of innovation*. New York: Free Press.
 29. Romer, P. M. (1989). *Endogenous technological change* (Working Paper 3210). NBER Working Paper Series. <https://doi.org/10.3386/w3210>
 30. Shashi, Centobelli, P., Cerchione, R., & Singh, R. (2019). The impact of leanness and innovativeness on environmental and financial performance: Insights from Indian SMEs. *International Journal of Production and Economics*, 212, 111-224. <https://doi.org/10.1016/j.ijpe.2019.02.011>
 31. Schuch, K., Bonas, G., & Sonnenburg, J., (2012). Enhancing science and technology cooperation between the EU and Eastern Europe as well as Central Asia: a critical reflection on the White Paper from a S&T policy perspective. *Journal of Innovation and Entrepreneurship*, 1(3), 1-14. <https://doi.org/10.1186/2192-5372-1-3>
 32. Utterback, J. M. (1971). The process of technological innovation within the firm. *Academy of Management Journal*, 14(1), 75-88. <https://doi.org/10.5465/254712>
 33. Varshavsky, A. E. (2011). Problems of science and its effectiveness. *Voprosy Ekonomiki – Economic issues*, 1, 151-157. (In Russian). <https://doi.org/10.32609/0042-8736-2011-1-151-157>
 34. Wan, D., Ong, C. H., & Lee, F. (2005). Determinants of firm innovation in Singapore. *Technovation*, 25(3), 261-268. <https://doi.org/10.1016/S0166-4972%2803%2900096-8>
 35. World Bank. (2020). Enterprise Surveys Portal Datasets – World Bank Group. Retrieved from <https://www.enterprisesurveys.org/en/survey-datasets>
 36. Yunshi, M., & Jiancheng, W. (2007). The strategic decisions and success factors of the global integration-local responsiveness of Japanese MNCs in China. *Frontier of Business Research in China*, 1(1), 67-90. <https://doi.org/10.1007/S11782-007-0005-0>
 37. Zemplerova, A., & Hromadkova, E. (2012). Determinants of firm's innovation. *Prague Economic Papers*, 21(4), 487-503. <https://doi.org/10.18267/j.pep.436>
 38. Zhang, X. (2018). Frugal innovation and the digital divide developing an extended model of the diffusion of innovations. *International Journal of Innovation Studies*, 2(2), 53-64. <https://doi.org/10.1016/I.IJIS.2018.06.001>