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SEVERAL METHODS FOR EVALUATING THE INVESTMENT ATTRACTIVENESS OF SMALL INNOVATION ENTERPRISES

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Ignatova Iu. V., Datsenko N. V., Rudyk N. V. Several Methods for Evaluating the Investment Attractiveness of Small Innovation Enterprises

An important factor of impact on the development and living abilities of small and medium-sized innovation enterprises, including startups, is the opportunity to evaluate their investment attractiveness. The main reason for the «failure» of such enterprises is the lack of instrumentarium to forecast the potential number of their customers, and therefore their financial results. The article suggests the number of projected customers as an indicator for evaluation of the investment attractiveness of small innovation enterprises. The authors propose to use a number of mathematical models on the basis of the instrumentarium of descriptive statistics and simulation modeling. The proposed models are built on the basis of the hypothesis of normality of the distribution law of random amounts of income clients and allow forecasting with high accuracy in relation to the day of week, and therefore evaluating the investment risks for potential investors.

Keywords: *small innovation enterprise, startup, descriptive statistics, density function.*

Fig.: *5.* ***Tbl.:*** *5.* ***Formulae:*** *11.* ***Bibl.:*** *14.*

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Ігнатова Ю. В., Даценко Н. В., Рудик Н. В. Деякі методи оцінювання інвестиційної привабливості малих інноваційних підприємств

Важливим фактором, що впливає на розвиток та життєдіяльність малих і середніх інноваційних підприємств, зокрема стартапів, є можливість оцінити їх інвестиційну привабливість. Основною причиною «провалу» таких підприємств є відсутність інструментарію для прогнозування потенційної кількості своїх клієнтів, а отже, і фінансових результатів. Як показник оцінювання інвестиційної привабливості малого інноваційного підприємства у статті пропонується розглядати кількість прогнозованих клієнтів. З цією метою запропоновано використовувати ряд математичних моделей на основі інструментарію дескриптивної статистики та імітаційного моделювання. Запропоновані моделі побудовано на основі гіпотези про нормальність закону розподілу випадкової кількості надходження клієнтів. Вони дозволяють здійснити прогноз високої точності залежно від дня тижня, а отже, і оцінити інвестиційні ризики для потенційних інвесторів.

Ключові слова: *мале інноваційне підприємство, стартап, дескриптивна статистика, функція щільності розподілу.*

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Игнатова Ю. В., Даценко Н. В., Рудик Н. В. Некоторые методы оценивания инвестиционной привлекательности малых инновационных предприятий

Важным фактором, влияющим на развитие и жизнедеятельность малых и средних инновационных предприятий, в том числе стартапов, является возможность оценить их инвестиционную привлекательность. Основной причиной «провала» таких предприятий является отсутствие инструментария для прогнозирования потенциального количества своих клиентов, а значит, и финансовых результатов. В качестве показателя оценивания инвестиционной привлекательности малого инновационного предприятия в статье предлагается рассматривать количество прогнозируемых клиентов. С этой целью предложено использовать ряд математических моделей на основе инструментария дескриптивной статистики и имитационного моделирования. Предложенные модели построены на основании гипотезы о нормальности закона распределения случайного количества поступления клиентов и позволяют осуществить прогноз высокой точности в зависимости от дня недели, а значит, и оценить инвестиционные риски для потенциальных инвесторов.

Ключевые слова: *малое инновационное предприятие, стартап, дескриптивная статистика, функция плотности распределения.*

Рис.: *5.* ***Табл.:*** *5.* ***Формул:*** *11.* ***Библ.:*** *14.*

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Nowadays the issue of the actual state and prospects of start-up technologies occupies a prominent place in economic research in the world and in Ukraine, in particular. Recently the economic situation in Ukraine has imposed some corrections to the prospects of introducing start-up technologies, which leads to the reduction of investment assets and some other problems. However, the realities of 2015–2016 showed that the potential of Ukrainian and international start-ups is sufficient to resist the crisis.

After analyzing a number of literary sources [1; 3; 5; 7; 9; 11–14], we have formulated a simple and clear definition of a start-up. Thus, in our opinion, the start-up can be defined both as an individual innovative project and a company (small or medium) founded for its implementation. The development of the practice of start-ups in Ukraine is at the initial stage and the key performance indicators of such activities are low. In today's world the innovative activity and, as its consequence, innovative projects are not massive. Every new business needs a unique idea and technology to produce a product or service that would not have analogs in the competitive market. Moreover, this project does not have to be expensive and, most importantly, should be popular among consumers. Thus, the current market creates a request for the emergence and development of start-ups in the original, correct sense of understanding, that is, such projects, the idea of which would be unique and have no analogs, and at the same time it would not be as expensive as innovative developments and would not require huge human, energy and financial resources. Therefore, great hopes for improving the economic situation are laid on the development of innovative small businesses.

The main directions of start-ups development in recent years are:

- *hardware* – start-up projects in the field of technologies: 3D-printing, development of drones and various devices, etc.;
- *financial services* – start-ups, which enable clients to save time and money when carrying out financial transactions;
- *medicine* – design of devices to monitor the state of health, efficiency of disease treatment methods, etc. For example, applications, which monitor biological parameters of the human body functioning, or a platform for choosing a doctor and receiving advice and treatment in any country of the world.
- *education* – one of the fast developing areas of start-ups. Today platforms, which help remotely or internally examine any scientific field, from IT to foreign languages, are actively created.
- *Internet of Things (IoT).* Over the last year, the most promising in this regard was the home security, for example, Ajax Systems – "cozy house" or SolarGaps — smart blinds, which can accumulate solar energy;
- *Big Data* – data management and analysis in order to use this information for business development and enterprises growth.

Problem statement. Regardless of the chosen direction, any start-up faces the problem of finding initial financing. This problem is related to the start-up's potential measurement and forecasting of the financial results.

At the planning stage of a new project the founder is interested in how much labor the project will require, how long it will take to implement it and, which is more important, how much money is needed for this. Incorrect calculation of the project budget can not only lose some revenue but incur significant losses. A preliminary assessment of the project can help to avoid such failures and make a decision on whether to accept or reject the project.

It is also important to identify the risks because a potential investor needs to know what to invest and what it may cost him. There are different methods that help to determine the project risks. They all have their strengths and weaknesses. To select a particular method of assessment of the financial potential and risks of an IT start-up, the founder should be fully aware of all the existing methods.

The availability of some statistical information about some enterprise makes it possible to use this information to predict its profitability of and potential for growth in the market. However, the essential feature of assessing start-ups, first of all, is the lack of financial history, i.e., the absence of any statistics at all. In the latter case, according to [9], it is appropriate to use the method of analogies, which implies the application of "the base of data and knowledge on similar projects that were implemented before" [9, p. 32].

The *aim* of the research is to develop methods for assessment of the investment attractiveness of small innovative enterprises based on the available statistical information.

According to [4; 11; 12], statistics and mathematics should be instruments helping the investor to ensure a financial payback and return on the projects. For a long time, to analyze investments, in particular in terms of where, when and how to invest, specialists have been using Markowitz portfolio theory [9, p. 150]. However, in our opinion, this theory is ineffective when investing in start-ups because the return on the venture capital is not distributed evenly as it is provided under Markowitz theory.

It is a difficult task to perform a numerical analysis of small and medium innovative enterprises at the initial stage. The assessment of return on capital for start-up differs from traditional methods of liquid assets evaluation.

The careful study of changes in return on investment, as noted by some analysts, including [12], indicates that income of start-ups is likely subject to normal or lognormal distribution law, i.e., the logarithm of random income variable has a normal distribution. The list of typical values considered as lognormal ones could include the following: duration of illness, duration of marriage, income distribution of companies (branches, countries), amount of capital invested in the start-up, amount of reserve funds that will be required for future investments, etc.

The economists Elton and Gruber have proved that Markowitz portfolio theory is also associated with lognormal distribution. If we assume that the return on capital falls under the normal distribution, but in practice it is on the contrary, all previous calculations will have no sense, and the evaluation of return on investment will be irrelevant.

In its turn, article [10] proposes to use the normal distribution to simulate the number of the start-up clients. However, this approach has its drawbacks, namely, how many clients the start-up attracts also depends on certain factors, which were not taken into account in the model.

Thus, there is the unsolved issue of building a model for assessment of the investment attractiveness of small innovative enterprise that would take into account all previous shortcomings being easy enough to use.

Since the absence of statistics data is the main feature of a vast majority of small innovative enterprises, in order to develop the method of assessing the level of start-up investment attractiveness we propose to use the database of an enterprise working in the same sphere (the method of analogies). For instance, let's consider the potential growth of start-ups promoting content on social networks. As an analog of such enterprise let's take a closer look at the well-known start-up Buffer [2].

Among the famous start-ups, Buffer takes a special place as one of the first start-ups providing full statistical information on its activities. Therefore, the development of the method of assessing the potential of this start-up will allow using it for measuring the potential of enterprises working in a similar field but without any statistical records or databases.

In particular, similarly to [10; 12–14], we will consider the number of new clients attracted to using the Buffer service as an indicator of the start-up investment attractiveness. In order to forecast the number of new service clients, we have analyzed in detail the historical data constituting the general totality in a time series for the whole period of business activity (January 2012 – October 2016). The last six months (04.04.2016 – 10.30.2016) reflect the latest trend in the number of clients of the start-up. According to this, we can construct a mathematical model of the potential number of clients. Let's analyze the statistical data using the descriptive statistics instruments. The proposed *Fig. 1* shows the visualization of time series selected from the representative sample.

As only the number of clients as of the specific date is known, we have an opportunity to visualize the number of clients depending on the day of the week (*Fig. 2*).

Based on Fig. 2 we can conclude that the number of clients attracted to Buffer at weekends rather differs from that on weekdays. Thus, it is necessary to investigate whether the difference between these two categories is significant before constructing the mathematical model of forecasting the potential number of Buffer's clients.

We divided the selected data into two stratums as follows:

- *weekday stratum* – the number of new clients attracted to the start-up on weekdays (from Monday till Friday inclusive);
- *weekend stratum* – the number of new clients attracted to the start-up at weekends.

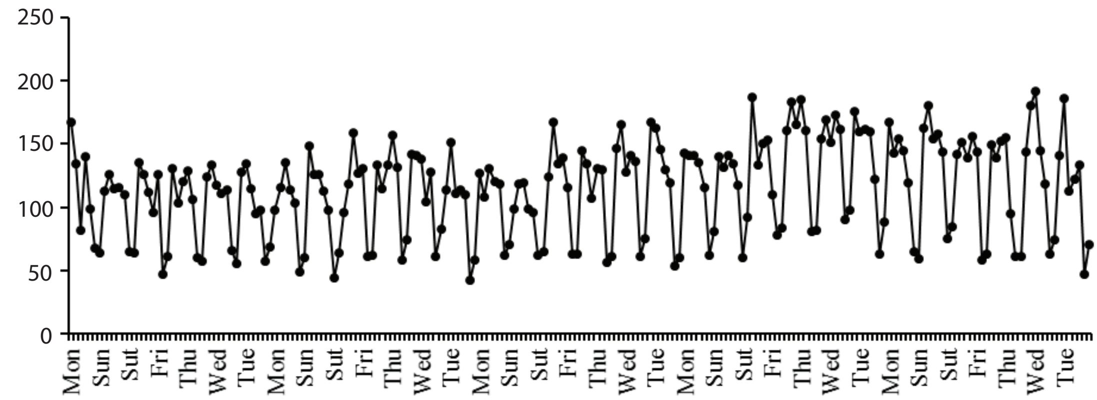

Fig. 1. The total number of clients attracted to Buffer for the period of January 2012 – October 2016

Source: developed by the authors based on [2].

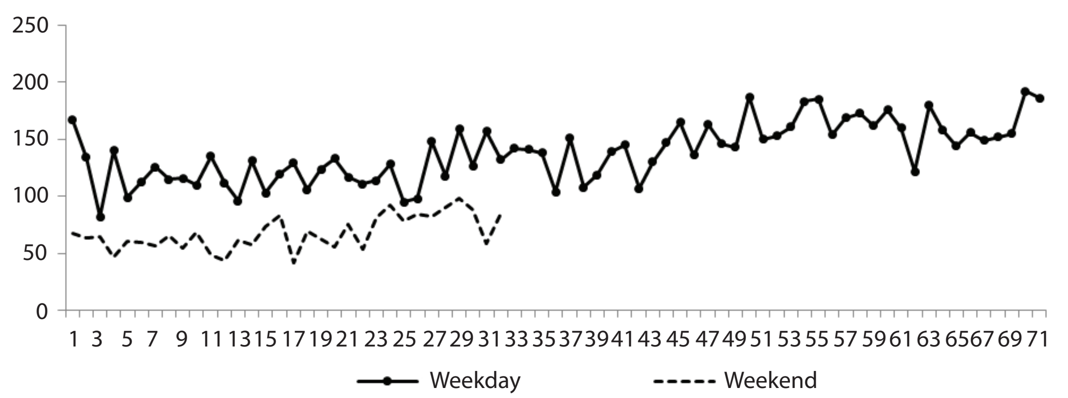

Fig. 2. The number of clients attracted to Buffer on weekdays and at weekends for the period of January 2012 – October 2016

Source: developed by the authors based on [2].

Let's analyze these stratums with regard to the selected sample based on the instruments of the descriptive statistics [6; 8]. In particular, as the main statistical indicators for the analysis carried out by means of stratified sampling we will choose the following ones:

a) *Mean* – the average of all values:

$$\overline{x} = \frac{\sum_{i=1}^{n} x_i}{n}, \qquad (1)$$

where n – is the number of observations; x_i – income of the small innovative enterprise; $i = 1, 2, 3, \ldots, n$;

b) *Median* (*Me*) – the middle observation when values of the variable of income x i are sorted from the smallest to largest ones;

c) *The standard deviation* (*StDev, or* σ) – the square root of the average of the squared deviations from the mean

$$\sigma = \sqrt{\frac{\sum_{i=1}^{n}(x_i - \overline{x})^2}{n}}; \qquad (2)$$

d) *The sampling error* (*SE* ($\overline{x}$)) – the difference between the point estimate (mean) and the true value of the population parameter being estimated

$$SE\,(\overline{x}) = \frac{\sigma}{\sqrt{n}}. \qquad (3)$$

Tbl. 1 presents the analysis of the sample and each stratum on the above mentioned indicators.

Based on the results represented in Table 1, it is clear that statistical indicators for each stratum somewhat differ. It is necessary to determine whether this difference is significant. If the difference is significant we need to construct a mathematical model of forecasting the number of the start-up's clients for each stratum. Conversely, if the difference is not significant the model of the forecasting could be constructed for the whole sample.

The confidence intervals for the mean values for each stratum should be constructed in order to analyze these differences. The tests of statistical hypotheses should be also conducted.

We construct confidence intervals for the mean values for each stratum using the following parameters:

a) degrees of freedom, $df = n - 1$;

b) confidence level;

c) *t*-value – theoretical value of the Student's test for the selected values of confidence and number of degrees' freedom, which can be found in standard normal distribution tables;

d) Lower limit – lower limit of confidence interval

$$\overline{x} - SE(\overline{x}) \cdot t - value; \qquad (4)$$

e) Upper limit – upper limit of confidence interval

$$\overline{x} + SE(\overline{x}) \cdot t - value. \qquad (5)$$

Based on the aforementioned parameters we obtain the following results presented in *Tbl. 2*.

Table 2 demonstrates that the average number of clients on weekdays does not get in the confidence interval for the number of clients at weekends and vice versa. So, the question is whether there is a significant difference between the mean values of stratums.

Let's define the difference between the mean values of stratums and range of the confidence interval of the difference. The following parameters of descriptive statistics will be used:

Table 1

Numerical characteristics for new clients attracted to Buffer in general and by stratum

Stratums	Mean	Median	StDev	n	SE ($\overline{x}$)
Sample	114.624	119	37.068	103	3.652
Weekday stratum	138.394	139	25.773	71	3.059
Weekend stratum	68.094	65.5	14.759	32	2.609

Source: calculated by the authors based on [2] using Formulae (1) – (3).

Table 2

Confidence intervals for the mean values for Weekday and Weekend stratums

Indicators	Values for Weekday stratum	Values for Weekend stratum
Mean	138.394	68.094
Median	139	65.5
StDev	25.773	14.759
n	71	32
SE ($\overline{x}$)	3.059	2.609
df	70	31
Confidence level	0.95	0.95
t-value	1.994	2.040
Lower limit	132.294	62.772
Upper limit	144.495	73.415

Source: calculated by the authors based on [2] using Formulae (1) – (5).

a) *Mean difference,* or $\overline{x}_{diff}$ – the difference between the mean values of the stratums

$$\overline{x}_{diff} = \overline{x}_1 - \overline{x}_2; \qquad (6)$$

b) *StDev*, or σ_{diff} – the standard deviation of difference of the mean values between the stratums

$$\sigma_{diff} = \sqrt{\frac{(n_1-1)\cdot\sigma_1+(n_2-1)\cdot\sigma_2}{n_1+n_2-2}}, \qquad (7)$$

where n_1 – is the number of observations in the first stratum; n_2 – is the number of observations in the second stratum; σ_1 – standard deviation of the first stratum; σ_2 – standard deviation of the second stratum;

c) *df* – the number of degrees of freedom for the difference of the mean values, $n_1 + n_2 - 2$;

d) *SE* ($\overline{x}$) – the standard error for the difference of the mean values

$$SE(\overline{x}) = \sigma_{diff}\cdot\sqrt{\frac{1}{n_1}+\frac{1}{n_2}}; \qquad (8)$$

e) *t*-value – the Student's test critical value for the selected level of confidence and the number of degrees of freedom;

f) t-test – the actual value of the Student's *t*-test

$$t_{\text{test}} = \frac{\overline{x_1}-\overline{x_2}}{SE(\overline{x})}; \qquad (9)$$

g) the number of stratums $i = 1, 2$.

Based on the aforementioned parameters we obtain the following numerical values presented in *Tbl. 3.*

Table 3

Estimated indicators of differences of the mean values of Weekday and Weekend stratums

Indicators	Value
Mean	70.301
StDev	22.962
SE ($\overline{x}$)	4.889
df	101
Confidence level	0.95
t-value	1.984
Lower limit	60.6024
Upper limit	79.999

Source: calculated by the authors based on [2] using Formulae (6) – (9).

Tbl. 3 shows that the confidence interval for the mean difference is rather broad. It is necessary to verify the statistical hypotheses on the significance of this difference. So, let us put forward the null and alternative hypotheses about significance of the mean difference.

The implementation of the null hypothesis (H_0) will indicate that $\overline{x_1}-\overline{x_2}=0.$ It means that this difference is not significant and the whole sample can be used for forecasting.

The implementation of the alternative hypothesis (H_a) will indicate that $\overline{x_1}-\overline{x_2}>0.$ In this case, the forecast should be built separately for weekdays and weekends.

The results of statistical hypotheses testing are presented in *Tbl. 4.*

Table 4

Results of the statistical hypotheses testing for the mean difference

Indicators	Value
H_0	$\overline{x_1}-\overline{x_2}=0$
H_a	$\overline{x_1}-\overline{x_2}>0$
Mean difference	70.301
SE ($\overline{x}$)	4.889
df	101
t-test	14.379
Ratio of sample var	3.050
p-value	0.002

Source: calculated by the authors based on [2] using Formulae (6) – (9).

Since *p-value* – the probability of accepting H_0, – is significantly less than 5%, the alternative hypothesis of the significance of mean differences is taken into account. It means that the forecast of the number of new clients should be made separately for each stratum.

Thus, based on the statistical data of the Buffer start-up, let's construct a mathematical model of the forecast number of new clients. For this purpose, we use the methodology [10] taking into account its drawbacks and make a forecast separately for the clients attracted on weekdays and at weekend.

In accordance with the law of large numbers, if we take a set of parameters from any sample and put them together, then the distribution of these amounts has the normal distribution. The more summands, the closer its distribution to normal. Based on the law of large numbers we can hypothesize that the number of clients attracted to the start-up is normal.

To adapt the random number of clients attracted to the normal distribution low with average value of $\overline{x}$ and standard deviation σ, we will use the Monte-Carlo imitation method. At that, we take into account pessimistic and optimistic scenarios:

- *pessimistic scenario* – the forecast number of clients attracted on the following day may be less than the number of clients on the previous day. In its turn, the standard error will vary for the average number of clients in the previous period to the average number of clients according to the statistical data. Also, the forecast number of clients may be less than the minimum number of the start-up's users in the representative sample;
- *optimistic scenario* – the forecast number of clients that will be attracted on the following day cannot be less than the number of clients on the previous day. As well as in the pessimistic scenario, the standard deviation, in turn, will vary by the share of the average number of clients in the previous period

with respect to the average number of clients in historical dataset. Also the forecast number of clients can't be less than the minimum number of users of the start-up in the representative sample.

Thus, let's make a forecast for the number of the service users for the following month. With this purpose we will use the simulation modeling tool based on the normal law of probability distribution

$$f(x) = \frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{(x-\overline{x})}{2\sigma^2}}, \qquad (10)$$

with the average value $\overline{x}$ and standard deviation σ for each stratum.

Let the probability of the number of clients per 1 day may be distributed randomly in the range from 0 to 1. For the modeling of the client attraction on weekdays we will make 150 experiments of occurrence of the probability as presented in *Tbl. 5.*

Table 5

Forecast flow of attraction of new clients on weekdays based on simulation modeling

Experiment #	Probability of attraction of new clients	Actual number of new attracted clients
1	0.962045	167
2	0.660521	134
3	0.551235	142.4
4	0.157268	75.33333
…	…	…
149	0.861734	158.7
150	0.301862	108.7

Source: calculated by the authors.

According to Tbl. 5, the number of new attracted clients meets the probability distribution function calculated by Formula (10) with the mean value and standard error of clients attracted on weekdays. Thus, for example, having substituted 0.962 probability in Formula (10) with $\overline{x}$ = 138.934, σ = 25.773, we get that the start-up can attract x = 167 users on a weekday with the probability 0.962. Other experiments were conducted similarly.

Base on the results of the simulation modeling of the number of new clients attracted on weekdays, the number of new clients on the first forecast day will be 167 or 134, or 142, etc. Thus, the average number of clients per day will be:

$$\overline{x} = \frac{\sum_{i=1}^{150} x_i}{150} = 124. \qquad (11)$$

In this case the standard deviation is σ = 37 clients.

The results of the simulation modeling of the number of new clients attracted under both scenarios and historical data for weekdays are shown in *Fig. 3.*

Similarly to the abovementioned approach, the simulation model of forecasting the number of Buffer's clients at weekends was build. The results of forecasting new users under both scenarios and historical data for the weekends are shown in *Fig. 4.*

The forecast of new clients for each day of the week based on the combined results of previous stages is presented in *Fig. 5.*

CONCLUSIONS

Nowadays the problems and tasks in the field of innovative entrepreneurship are particularly relevant. This development enables innovative businesses to achieve the strategic vector associated with overcoming the raw material dependence of the domestic economy and developing new technological order.

An important factor, which influences the business activity and development of small and medium innovative enterprises, including start-ups, is a possibility to determine the number of its potential clients. The main cause of "failure" of such enterprises is the lack of tools for forecasting the potential number of its clients and, thus, the financial results. For this purpose, it is suggested to use a series of mathematical models based on toolkits of descriptive statistics and simulation modeling. The proposed model is based on the hypothesis of normal distribution of a random number of clients and allows making a high accuracy forecast depending on the day of the week and, thus, estimating the investment risks for potential investors. As the prospects for further research, in our opinion, it is reasonable to conduct a study of time series of new clients and systemize factors, which can influence it, particularly tools of marketing strategy, quality of the website, number of visitors, etc. ■

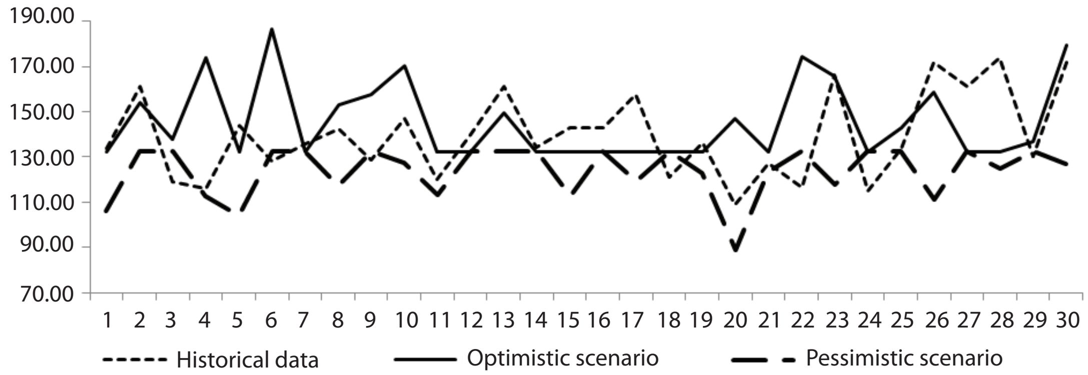

Fig. 3. The forecast number of the start-up's clients for 30 periods under the simulation model for the first stratum

Source: developed by the authors based on Formulae (10) – (11).

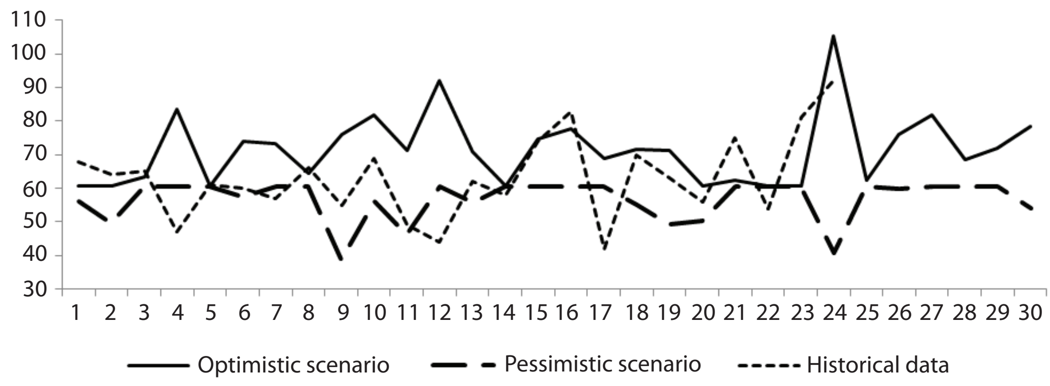

Fig. 4. The forecast number of the start-up's clients for 30 periods under the simulation model for the second stratum

Source: developed by the authors based on Formulae (10) – (11).

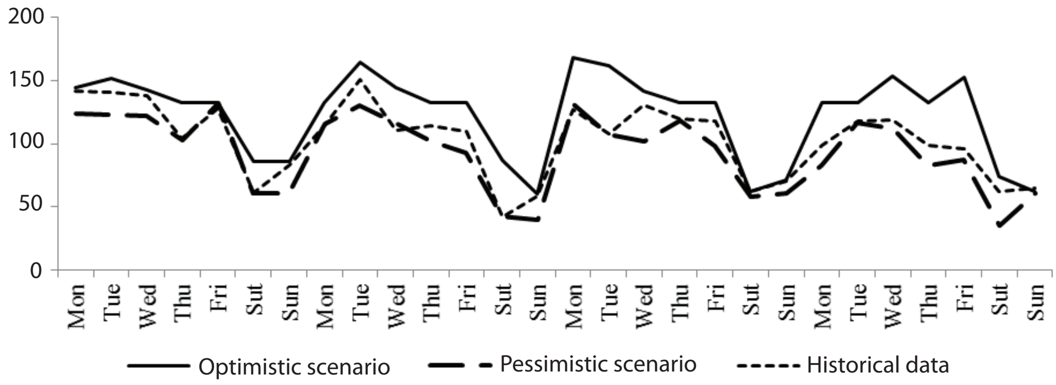

Fig. 5. The forecast number of the start-up's clients for 28 periods under the simulation model for the whole sample

Source: developed by the authors based on Formulae (10) – (11).

LITERATURE

1. Blank S. The Four Steps to the Epiphany: Successful Strategies for Products that Win. 2d ed. K&S Ranch, 2013. 281 p.

2. Buffer Team. Social media management for marketers and agencies URL: https://open.buffer.com/buffer-november-update-2347000-run-rate-1189000-users/

3. Guillebeau C. The $100 Start-up: Reinvent the Way You Make a Living, Do What You Love, and Create a New Future: Audiobook. New York: Crown Business, 2012.

4. Shaw K. Mathematical Modeling in Business and Economics: A Data-Driven Approach. Business Expert Press, 2014. 200 p.

5. Ries E. The Lean Start-up: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses. New York: Crown Business, 2011. 320 p.

6. Walkenbach J. Excel 2013. Power Programming with VBA. John Wiley & Sons, Inc., 2013. 1104 p.

7. Weiss A. Million Dollar Consulting: The Professional's Guide to Growing A Practice. 4th ed. McGraw-Hill Education, 2009. 358 p.

8. Вітлінський В. В., Верченко П. І. Аналіз, моделювання та управління економічним ризиком: навч.-метод. посіб. Київ: КНЕУ, 2000. 292 с.

9. Вітлінський В. В. Аналіз, оцінка і моделювання економічного ризику. Київ: Деміур, 1996. 212 с.

10. Ігнатова Ю. В., Даценко Н. В., Поліщук Є. А. Моделювання потенціалу малих інноваційних підприємств. *Інвестиції: практика та досвід*. 2017. № 1. С. 23–28.

11. Колемаев В. А. Математическая экономика: учебник. М.: Юнити-Дана, 2002. 399 с.

12. Мельник А. Специалист по инвестициям Мэтт Огаз: Вложения в стартапы нужно оценивать с помощью математики. URL: https://vc.ru/p/venture-capital

13. Северова И. Стартап-итоги 2015 года: Украина и мир. URL: http://ubr.ua/market/startup-time/startap-itogi-2015-goda-ukraina-i-mir-368926

14. Фелд Б., Мендельсон Дж. Привлечение инвестиций в стартап. М.: Издательство «Манн, Иванов и Фербер», 2012. 288 с.

REFERENCES

Blank, S. *The Four Steps to the Epiphany: Successful Strategies for Products that Win*. K&S Ranch, 2013.

"Buffer Team. Social media management for marketers and agencies". https://open.buffer.com/buffer-november-update-2347000-run-rate-1189000-users/

Guillebeau, C. *The $100 Start-up: Reinvent the Way You Make a Living, Do What You Love, and Create a New Future*: Audiobook. New York: Crown Business, 2012.

Shaw, K. *Mathematical Modeling in Business and Economics: A Data-Driven Approach*. Business Expert Press, 2014.

Ries, E. <*The Lean Start-up: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses*. New York: Crown Business, 2011.

Walkenbach, J. *Excel 2013. Power Programming with VBA*. John Wiley & Sons, Inc., 2013.

Weiss, A. *Million Dollar Consulting: The Professional's Guide to Growing A Practice*. McGraw-Hill Education, 2009.

Vitlinskyi, V. V., and Verchenko, P. I. *Analiz, modeliuvannia ta upravlinnia ekonomichnym ryzykom* [Analysis, modeling and management of economic risk]. Kyiv: KNEU, 2000.

Vitlinskyi, V. V. *Analiz, otsinka i modeliuvannia ekonomichnoho ryzyku* [Analysis, evaluation and modeling of economic risk]. Kyiv: Demiur, 1996.

Ihnatova, Yu. V., Datsenko, N. V., and Polishchuk, Ye. A. "Modeliuvannia potentsialu malykh innovatsiinykh pidpryiemstv" [Modeling of the potential of small innovative enterprises]. *Investytsii: praktyka ta dosvid*, no. 1 (2017): 23-28.

Kolemayev, V. A. *Matematicheskaya ekonomika*. [Mathematical Economics]. Moscow: Yuniti-Dana, 2002.

Melnik, A. "Spetsialist po investitsiiam Mett Ogaz: Vlozheniia v startapy nuzhno otsenivat s pomoshchiu matematiki" [Investment officer Matt Ogaz: investing in start-ups should be evaluated with the help of mathematics]. https://vc.ru/p/venture-capital

Severova, I. "Startap-itogi 2015 goda: Ukraina i mir" [Start-up 2015: Ukraine and the world]. http://ubr.ua/market/startup-time/startap-itogi-2015-goda-ukraina-i-mir-368926

Feld, B., and Mendelson, Dzh. *Privlecheniye investitsiy v startap* [Attracting investment in startup]. Moscow: Mann, 2012.

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СТРАТЕГІЧНІ ПРИНЦИПИ СТАНОВЛЕННЯ ТА РОЗВИТКУ БІОПАЛИВНОЇ ІНДУСТРІЇ В УКРАЇНІ

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Климчук О. В. Стратегічні принципи становлення та розвитку біопаливної індустрії в Україні

Мета статті полягає у висвітленні стратегічних принципів становлення та розвитку біопаливного виробництва в Україні на конкурентоспроможному рівні. Проведений всебічний аналіз наукових праць вказує на актуальність нарощування темпів розвитку біопаливної індустрії як у світі, так і в Україні. Проте низький рівень споживання та виробництва біопалива в нашій державі потребує проведення подальших досліджень стратегічного характеру. Встановлено, що формування конкурентоспроможного виробництва біопалива в Україні буде забезпечувати позитивні зрушення в економіко-енергетичному та агропромислово-екологічному напрямках. На основі проведеного SWOT-аналізу було оцінено внутрішні сили та систему внутрішніх недоліків, а також ресурсний потенціал агропромислового комплексу для реалізації наявних зовнішніх можливостей та протистояння різного роду загрозам, що виникають в ринкових умовах у процесі розвитку та становлення біопаливної індустрії.

Ключові слова: *економіка, регулювання, енергоспоживання, енергетична залежність, біопаливо, стратегія, SWOT-аналіз.*

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Климчук А. В. Стратегические принципы становления и развития биотопливной индустрии в Украине

Цель статьи заключается в освещении стратегических принципов становления и развития биотопливного производства в Украине на конкурентоспособном уровне. Проведенный всесторонний анализ научных работ указывает на актуальность наращивания темпов развития биотопливной индустрии как в мире, так и в Украине. Однако низкий уровень потребления и производства биотоплива в нашей стране требует проведения дальнейших исследований стратегического характера. Установлено, что формирование конкурентоспособного производства биотоплива в Украине будет обеспечивать положительные сдвиги в экономическом, энергетическом, агропромышленном и экологическом направлениях. На основе проведенного SWOT-анализа были оценены внутренние силы и система внутренних недостатков, а также ресурсный потенциал агропромышленного комплекса для реализации имеющихся внешних возможностей и противостояния различного рода угрозам, возникающим в рыночных условиях в процессе развития и становления биотопливной индустрии.

Ключевые слова: *экономика, регулирование, энергопотребление, энергетическая зависимость, биотопливо, стратегия, SWOT-анализ.*

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Klymchuk O. V. The Strategic Principles of Formation and Development of the Biofuel Industry in Ukraine

The article is aimed at highlighting the strategic principles of formation and development of the biofuel production in Ukraine at a competitive level. The carried out comprehensive analysis of scientific publications indicates the relevance of the pace of development in the biofuel industry as in the world, so in Ukraine. However, the low level of consumption and production of biofuels in our country requires further research of strategic nature. It has been found that formation of the competitive production of biofuels in Ukraine would ensure the positive developments in the economic, energy, agro-industrial, and environmental directions. On the basis of the carried out SWOT-analysis, the author has evaluated internal forces and the system of internal shortages, as well as the resource potential of the agro-industrial complex towards the implementation of existing external opportunities and confronting various threats, emerging in the market conditions during the process of development and rise of the biofuel industry.

Keywords: *economy, regulation, energy consumption, energy dependence, biofuel, strategy, SWOT-analysis.*

Fig.: *1.* ***Tbl.:*** *1.* ***Bibl.:*** *8.*

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Ефективне вирішення проблеми енергозабезпечення є ключовим, першочерговим завданням сталого, тобто гармонійного з природою та суспільством, розвитку кожної держави, здійснення нею незалежної зовнішньої політики, внутрішньої політичної та соціальної стабільності, піднесення економічного та культурного рівня життя населення. Як наслідок – роль енергетики в розв'язанні завдань сталого розвитку постійно зростає. Неухильне підвищення останнім часом світових цін на традиційні енергоносії та енергію призводить до посилення впливу проблеми енергозабезпечення на перелічені фактори, особливо в державах із нестабільним економічним становищем, до яких належить і Україна.