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IMPLEMENTATION OF THE MATHEMATICAL MODELING METHODS DURING THE STARTUP MARKETING STRATEGY DEVELOPMENT

ВНЕДРЕНИЕ МЕТОДОВ МАТЕМАТИЧЕСКОГО МОДЕЛИРОВАНИЯ ПРИ РАЗРАБОТКЕ МАРКЕТИНГОВОЙ СТРАТЕГИИ СТАРТАП-ПРОЕКТА

Kofanov O.

National Technical University of Ukraine «Igor Sikorsky Kyiv Polytechnic Institute», Ukraine,

e-mail: aleckof@protonmail.com

Кофанов А. Е.

Национальный технический университет Украины «Киевский политехнический институт имени Игоря Сикорского», Украина

ABSTRACT

STARTUP SUCCESS; STARTUP MARKETING STRATEGY; BAYESIAN NETWORKS; MANAGEMENT SOLUTIONS; INNOVATION

Startups are an important tool for the development of the world economy. But risks in the startup industry are high. So, determination of the success factors and prediction of the startup success is an important task which can be solved by the implementation of the mathematical modeling methods. The model for startup success prediction depending on the combinations of conditions was developed in the form of the Bayesian network. It was determined that the modeled startup success probability is most likely to be of a low or an average level.

АННОТАЦИЯ

УСПЕШНОСТЬ СТАРТАПА; МАРКЕТИНГОВАЯ СТРАТЕГИЯ СТАРТАПА; БАЙЕСОВСКИЕ СЕТИ; УПРАВЛЕНЧЕСКИЕ РЕШЕНИЯ; ИННОВАЦИИ

Стартапы являются важным инструментом для развития мировой экономики. Однако риски в стартап-индустрии высоки. Поэтому определение факторов успеха и прогнозирование успешности стартап-проектов является важной задачей, которая может быть решена путем внедрения методов математического моделирования. Разработана модель прогнозирования успешности стартапов в виде байесовской сети. Определено, что модельная вероятность успешной реализации стартап-проектов будет иметь низкий или средний уровень.

Startups are an important tool for the development of the world economy and scientific & technical progress, while the developed startup industry and infrastructure help to

implement innovations much faster and at the same time using fewer resources. Recently, the number of innovative startup-projects both on the B2C and B2B markets has started to increase, in particular, in such areas as smart cities, green economy, sustainable and environmentally friendly industry development, light and textile industry, electronics, nanotechnology, etc. However, the risks in the startup industry are quite high, so only some projects reach the level of a successful and scalable business. Therefore, determination of the success factors and prediction of the startup success levels is an important task and mathematical modeling methods are among the most suitable instruments for this purpose. In particular, such models can be created on the bases of the Bayesian networks.

So, the aim of the conducted research was to identify the key startup success factors and to create an instrument for startup success evaluation. Currently, a lot of scientific investigations are devoted to the study of the features of innovative startups. For example, the important results can be found in the following papers [1–6].

It was found that there are three key constituents, which influence startup success – an external environment, startup activity and an internal environment of the startup. For the modeling, the discovered factors were divided into three groups according to their influence on these constituents. In the developed Bayesian network model the external environment was considered as favorable, neutral or unfavorable; startup activity was considered as effective or inefficient; while the internal startup environment was considered as a reliable, which facilitates startup development and strengthens its positions on the market, or as an unreliable, if the current environment is harmful to the startup development [7]. These constituents affect the startup success which is evaluated in the Bayesian network model as high, average and low level.

The mathematical model for prediction of the startup-projects success depending on the combinations of the conditions on various markets, regions, etc. was developed in the R and R Studio software by the implementation of the components of the methods described in [8–10]. The specialized packages Bnlearn, Rgraphviz, gRain, Lattice, etc. were used for the modeling purposes. The Bayesian network structure was composed on the bases of the determined success factors. The obtained network consisted of 25 nodes and 24 arcs.

On the bases of the analyzed dataset, it was determined that the modeled startup success probability is most likely to be of a low or an average level with probabilities of 43.9 % and 41.4 % respectively, while the probability of a high success level is only 14.7 % [7]. The developed model can be also used to analyze various combinations of conditional probabilities in order to analyze interactions between components influencing startup success. It was found that high success levels can be observed only when all three constituents, described above, are favorable, effective and reliable. At the same time, in combinations, in which only one option was negative, the average success levels were

dominating; in the cases of combinations in which two of the three components were negative, low success levels prevailed [7].

The developed Bayesian network model of startup success can be used for the analysis of innovative projects samples in order to predict success levels in a particular country, region, in a specific market, etc. This model can be used during startup marketing strategy development and can contribute to the more efficient and sustainable management solutions.

REFERENCES

1. Čirjevskis, A., & Dvotsova, A. (2012). How to Define the Probability of Success of Innovative Startups? In The 7th International Scientific Conference "Business and Management 2012". Selected papers (pp. 815–821). Vilnius, Lithuania: Vilnius Gediminas Technical University Publishing House Technika. doi: 10.3846/bm.2012.105

2. Davila, A., Foster, G., He, X., & Shimizu, C. (2015). The rise and fall of startups: Creation and destruction of revenue and jobs by young companies. Australian Journal of Management, 40(1), 6–35. doi: 10.1177/0312896214525793

3. Gundolf, K., Gast, J., & Géraudel, M. (2017). Startups' Innovation Behaviour: an Investigation into the Role of Entrepreneurial Motivations. International Journal of Innovation Management, 21(7), 1750054. doi: 10.1142/S1363919617500542

4. Kohler, T. (2016). Corporate accelerators: Building bridges between corporations and startups. Business Horizons, 59(3), 347–357. doi: 10.1016/j.bushor.2016.01.008

5. Lacerda, R. T. de O., Klein, B. L., Fulco, J. F., Santos, G., & Bittarello, K. (2017). Integração inovadora entre empresas incubadas e universidades para geração contínua de vantagens competitivas em ambientes dinâmicos. Navus - Revista de Gestão E Tecnologia, 78–96. doi: 10.22279/navus.2017.v7n2.p78-96.497

6. Ouimet, P., & Zarutskie, R. (2014). Who works for startups? The relation between firm age, employee age, and growth. Journal of Financial Economics, 112(3), 386–407. doi: 10.1016/j.jfineco.2014.03.003

7. Kofanov, O., & Zozul'ov, O. (2018). Successful Development of Startups as a Global Trend of Innovative Socio-Economic Transformations. International and Multidisciplinary Journal of Social Sciences, 7(2), 191–217. doi: 10.17583/rimcis.2018.3576

8. Nagarajan, R., Scutari, M., & Lèbre, S. (2013). Bayesian Networks in R. New York, NY: Springer New York. doi: 10.1007/978-1-4614-6446-4

9. Sarkar, D. (2008). Lattice. New York, NY: Springer New York. doi: 10.1007/978-0-387-75969-2

10. Scutari, M., & Denis, J.-B. (2015). Bayesian networks with examples in R. Boca Raton: CRC Press Taylor & Francis Group.