ABSTRACT AND REFERENCES

CONTROL PROCESSES

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DEVELOPING A MULTILEVEL DISTRIBUITING CROWDSOURCING SYSTEM FOR AIDING AND RESCUING TO OVERCOME WIDESPREAD CRISES (p. 6–21)

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Today, the management of different crises in urban areas is among the main challenges of societies due to their scope and limited resources. Using the crowd to solve these problems would be a proper solution. Crowdsourcing, due to a large number of people, the diversity of expertise, superficial dispersion and low cost, has long been considered. However, managing such a volume of people to restore the crisis situation has many problems that modern IT-based techniques in recent years have Facilitates the issue.

In this paper, a distributed geospatial system consisting of segments and different users is designed that can be used to manage the crowd to solve the problems of the urban crisis. The system consists of several subsystems and several user groups that operate on the basis of spatial crowdsourcing service.

The proposed new service is an atomic, consisting of a guiding section, an operational content, and a control segment. Operational content involves performing a simple activity. Solving complex issues involves the proper combination of simple services. After identifying the crisis environment with system elements, the system design a suitable combination of services for addressing regional issues and then allocate services to appropriate rescuers at the region level. The designed mechanism to allocate and combine services is based on a multidisciplinary agent environment.

In order to evaluate, in addition to designing software test scenarios, the system was tested during the Aqala flood of 2019 in Golestan province of Iran. The system accuracy in allocation was as well as its performance when the number of users increased. The system also considerably raised various quality indicators such as rescuer fatigue or mission latency. Furthermore, an innovated crowdsourcing evaluation method also announced the overall system success rate of 44.5 %.

Keywords: spatial crowdsourcing, urban disaster management, spatial allocation, Multi-agent environment, Enterprise GIS.

References

1. Wolensky, R. P., Wolensky, K. C. (1990). Local government's problem with disaster management: a literature review and structural analysis. Review of Policy Research, 9 (4), 703–725. doi: https://doi.org/10.1111/j.1541-1338.1990.tb01074.x
2. Kazemi, L., Shahabi, C. (2012). GeoCrowd: enabling query answering with spatial crowdsourcing. Proceedings of the 20th International Conference on Advances in Geographic Information Systems - SIGSPATIAL'12. doi: https://doi.org/10.1145/2424321.2424346
3. Zhao, Y., Han, Q. (2016). Spatial crowdsourcing: current state and future directions. IEEE Communications Magazine, 54 (7), 102–107. doi: https://doi.org/10.1109/mcom.2016.7509386
4. Liao, P., Wan, Y., Tang, P., Wu, C., Hu, Y., Zhang, S. (2019). Applying crowdsourcing techniques in urban planning: A bibliometric analysis of research and practice prospects. Cities, 94, 33–43. doi: https://doi.org/10.1016/j.cities.2019.05.024
5. Chatfield, A. T., Reddick, C. G. (2018). All hands on deck to tweet #sandy: Networked governance of citizen coproduction in turbulent times. Government Information Quarterly, 35 (2), 259–272. doi: https://doi.org/10.1016/j.giq.2017.09.004
6. William, S. (2013). On Language. New York Times Magazine.
7. L French, E. L., Birchall, S. J., Landman, K., Brown, R. D. (2019). Designing public open space to support seismic resilience: A systematic review. International Journal of Disaster Risk Reduction, 34, 1–10. doi: https://doi.org/10.1016/j.ijdrr.2018.11.001
8. Cai, L., Xu, J., Liu, J., Ma, T., Pei, T., Zhou, C. (2019). Sensing multiple semantics of urban space from crowdsourcing positioning data. Cities, 93, 31–42. doi: https://doi.org/10.1016/j.cities.2019.04.011
9. Gizzi, F. T., Potenza, M. R., Zotta, C. (2016). The Insurance Market of Natural Hazards for Residential Properties in Italy. Open Journal of Earthquake Research, 05 (01), 35–61. doi: https://doi.org/10.4236/ojer.2016.51004
10. Principles of Emergency Management Supplement (2007). doi: http://doi.org/10.13140/RG.2.2.32021.93925
11. Alieinykov, I., Thamer, K. A., Zhuravskyi, Y., Sova, O., Smirnova, N., Zhyvotovskyi, R. et. al. (2019). Development of a method of fuzzy evaluation of information and analytical support of strategic management. Eastern-European Journal of Enterprise Technologies, 6 (2 (102)), 16–27. doi: https://doi.org/10.15587/1729-4061.2019.184394
12. Camero, A., Alba, E. (2019). Smart City and information technology: A review. Cities, 93, 84–94. doi: https://doi.org/10.1016/j.cities.2019.04.014
13. Zander, J. (2014). Smart Emergency Response System (SERS).
14. The Smart Emergency Response System Using MATLAB and Simulink (2015).
15. World volunteer (2016). World Volunteer Web/Index. Available at: http://www.worldvolunteerweb.org/

16. Masli, M., Bouma, L., Owen, A., Terveen, L. (2013). Geowiki + route analysis = improved transportation planning. Proceedings of the 2013 Conference on Computer Supported Cooperative Work Companion - CSCW ’13. doi: https://doi.org/10.1145/2441955.2442008
17. Volunteer of World (2016). United Nations. Available at: https://www.unv.org/
18. Ahmed, S., Darsiti, M., Agustiawan, H. (2007). A development framewor for collaborative robots using feedback control.
19. Samany, N. N. (2019). Automatic landmark extraction from geo-tagged social media photos using deep neural network. Cities, 93, 1–12. doi: https://doi.org/10.1016/j.cities.2019.04.012.
20. Lim, C., Kim, K.-J., Maglio, P. P. (2018). Smart cities with big data: Reference models, challenges, and considerations. Cities, 82, 86–99. doi: https://doi.org/10.1016/j.cities.2018.04.011
21. Wei, L.-Y., Zheng, Y., Peng, W.-C. (2012). Constructing popular routes from uncertain trajectories. Proceedings of the 18th ACM SIGKDD International Conference on Knowledge Discovery and Data Mining - KDD ’12. doi: https://doi.org/10.1145/2339530.2339562
22. Bao, J., Zheng, Y., Mokbel, M. F. (2012). Location-based and preference-aware recommendation using sparse geo-social networking data. Proceedings of the 20th International Conference on Advances in Geographic Information Systems - SIGSPATIAL ’12. doi: https://doi.org/10.1145/2424321.2424348
23. Goodchild, M. F., Glennon, J. A. (2010). Crowdsourcing geographic information for disaster response: a research frontier. International Journal of Digital Earth, 3 (3), 231–241. doi: https://doi.org/10.1080/17538941003759255
24. Mohammadi, N., Malek, M. (2014). Artificial intelligence-based solution to estimate the spatial accuracy of volunteered geographic data. Journal of Spatial Science, 60 (1), 119–135. doi: https://doi.org/10.1080/14498596.2014.927337
25. Mohammadi, N., Malek, M. (2014). VGI and Reference Data Correspondence Based on Location-Orientation Rotary Descriptor and Segment Matching. Transactions in GIS, 19 (4), 619–639. doi: https://doi.org/10.1111/tgis.12116
26. Vieweg, S., Hughes, A. L., Starbird, K., Palen, L. (2010). Microblogging during two natural hazards events. Proceedings of the 28th International Conference on Human Factors in Computing Systems - CHI ’10. doi: https://doi.org/10.1145/1753326.1753486
27. Cutter, S. L. (2003). GI Science, Disasters, and Emergency Management. Transactions in GIS, 7 (4), 439–446. doi: https://doi.org/10.1111/1467-9671.00157
28. Lee, R., Sumiya, K. (2010). Measuring geographical regularities of crowd behaviors for Twitter-based geo-social event detection. Proceedings of the 2nd ACM SIGSPATIAL International Workshop on Location Based Social Networks - LBSN ’10. doi: https://doi.org/10.1145/1867699.1867701
29. Li, L., Goodchild, M. F. (2010). The Role of Social Networks in Emergency Management. International Journal of Information Systems for Crisis Response and Management, 2 (4), 48–58. doi: https://doi.org/10.4018/jiscrm.2010100104
30. Estellés-Arolas, E., González-Ladrón-de-Guevara, F. (2012). Towards an integrated crowdsourcing definition. Journal of Information Science, 38 (2), 189–200. doi: https://doi.org/10.1177/0165551512437638
31. Hirth, M., Hoßfeld, T., Tran-Gia, P. (2011). Anatomy of a Crowdsourcing Platform - Using the Example of Microworkers.com. 2011 Fifth International Conference on Innovative Mobile and Internet Services in Ubiquitous Computing. doi: https://doi.org/10.1109/imis.2011.89
32. Johnson, B. A., Scheyvens, H., Baqui Khalily, M. A., Onishi, A. (2019). Investigating the relationships between climate hazards and spatial accessibility to microfinance using geographically-weighted regression. International Journal of Disaster Risk Reduction, 33, 122–130. doi: https://doi.org/10.1016/j.ijdrr.2018.10.001
33. Mohanty, A., Hussain, M., Mishra, M., Kattel, D. B., Pal, I. (2019). Exploring community resilience and early warning solution for flash floods, debris flow and landslides in conflict prone villages of Badakhshan, Afghanistan. International Journal of Disaster Risk Reduction, 33, 5–15. doi: https://doi.org/10.1016/j.ijdrr.2018.07.012
34. Howe, J. (2006). The Rise of Crowdsourcing. Wired.
35. Harvey, F. (2012). To Volunteer or to Contribute Locational Information? Towards Truth in Labeling for Crowdsourced Geographic Information. Crowdsourcing Geographic Knowledge, 31–42. doi: https://doi.org/10.1007/978-94-007-4587-2_3
36. Stefanidis, A., Crooks, A., Radzikowski, J. (2011). Harvesting ambient geospatial information from social media feeds. GeoJournal, 78 (2), 319–338. doi: https://doi.org/10.1007/s10708-011-9438-2
37. Caillou, P., Gaudou, B., Grignard, A., Truong, C. Q., Taillandier, P. (2017). A Simple-to-Use BDI Architecture for Agent-Based Modeling and Simulation. Advances in Social Simulation 2015, 15–28. doi: https://doi.org/10.1007/978-3-319-47253-9_2
38. AnyLogic. Wikipedia. Available at: https://en.wikipedia.org/wiki/AnyLogic
39. Simio SYNC. SIMIO. Available at: https://www.simio.com/index.php
40. Afuah, A., Tucci, C. L. (2012). Crowdsourcing As a Solution to Distant Search. Academy of Management Review, 37 (3), 355–375. doi: https://doi.org/10.5465/amr.2010.0146
41. De Vreede, T., Nguyen, C., de Vreede, G.-J., Boughzala, I., Oh, O., Reiter-Palmon, R. (2013). A Theoretical Model of User Engagement in Crowdsourcing. Collaboration and Technology, 94–109. doi: https://doi.org/10.1007/978-3-642-41347-6_8

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DEVELOPMENT OF THE TECHNOLOGY FOR CHANGING THE SEQUENCE OF ACCESS TO SHARED RESOURCES OF BUSINESS PROCESSES FOR PROCESS MANAGEMENT SUPPORT (p. 22–29)

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The model of the event log of the information system has been improved. The model contains the sequences of events consistent with implemented sequences of management actions within both the process approach and functional management approach. A strict linear order in time was assigned for each pair of events belonging to the same process. The model is designed to describe the prototype of the as-is business process.

A case-based model of a business process, describing the features of its known implementations, reflected in the event log, has been proposed. The model combines a set of implemented sequences of operations of each process and takes into consideration the time to implement these operations, as well as the resources they need. When describing the time to implement the operations of a process, delays in accessing the company's shared resources are taken into consideration. The model makes it possible to predict the terms of completing the set of business processes competing for the resources when removing or adding new processes to this set.

The technology for changing the sequence of access to resources for a set of business processes competing for these resources within the process management was developed. The proposed technology uses the case-based model of a business process to calculate the order of access to resources. The technology provides an opportunity to calculate the total reduction in delays over the implementation time in relation to the implementation terms when processes are competing for resources. The technology makes it possible to choose how to access resources with the least delay in relation to operations completion deadlines for the known variants of a business process implementation. This enables a DM to assess the possibility of launching new processes that use shared resources by reducing the waiting time when accessing these resources.

Keywords: business process, process management, resource, event, event log, case, delay in access to resources.

References

1. Van der Aalst, W. M. P. (2013). Business Process Management: A Comprehensive Survey. ISRN Software Engineering, 2013, 1–37. doi: https://doi.org/10.1155/2013/507984
2. Vom Brocke, J., Rosemann, M. (Eds.) (2015). Handbook on Business Process Management 1. Introduction, Methods, and Information Systems. Springer. doi: https://doi.org/10.1007/978-3-642-45100-3
3. Smirnov, S., Weidlich, M., Mendling, J. (2010). Business Process Model Abstraction Based on Behavioral Profiles. Lecture Notes in Computer Science, 1–16. doi: https://doi.org/10.1007/978-3-642-17358-5_1
4. Maddern, H., Smart, P. A., Maull, R. S., Childe, S. (2013). End-to-end process management: implications for theory and practice. Production Planning & Control, 25 (16), 1303–1321. doi: https://doi.org/10.1080/09537287.2013.832821
5. Frye, D. W., Gulledge, T. R. (2007). End-to-end business process scenarios. Industrial Management & Data Systems, 107 (6), 749–761. doi: https://doi.org/10.1108/02635570710758707
6. Davis, R. (2011). Processes in Practice: It's the Customer Journey that Counts. BPTrends.
7. Van der Aalst, W. M. P. (2011). Mining: Discovery, Conformance and Enhancement of Business Processes. Springer. doi: https://doi.org/10.1007/978-3-642-19345-3
8. Müller, D., Reichert, M., Herbst, J. (2007). Data-Driven Modeling and Coordination of Large Process Structures. Lecture Notes in Computer Science, 131–149. doi: https://doi.org/10.1007/978-3-540-76848-7_10
9. Van der Aalst, W. M. P. (2019). 20 Years of Process Mining Research – Accomplishments, Challenges, and Open Problems. 1st International Conference on Process Mining.
10. Van der Aalst, W. M. P. (2014). Process Mining in the Large: A Tutorial. Lecture Notes in Business Information Processing, 33–76. doi: https://doi.org/10.1007/978-3-319-05461-2_2
11. Gunther, C. W., Ma, S. R., Reichert, M., Aalst, W. M. P. V. D., Recker, J. (2008). Using process mining to learn from process changes in evolutionary systems. International Journal of Business Process Integration and Management, 3 (1), 61. doi: https://doi.org/10.1504/ijbpim.2008.019348
12. Sergii, C., Ihor, L., Aleksandr, P., Ievgen, B. (2018). Causality-based model checking in business process management tasks. 2018 IEEE 9th International Conference on Dependable Systems, Services and Technologies (DESSERT). doi: https://doi.org/10.1109/dessert.2018.8409176
13. Kalenkova, A. A., van der Aalst, W. M. P., Lomazova, I. A., Rubin, V. A. (2015). Process mining using BPMN: relating event logs and process models. Software & Systems Modeling, 16 (4), 1019–1048. doi: https://doi.org/10.1007/s10270-015-0502-0
14. Levykin, V., Chala, O. (2018). Development of a method for the probabilistic inference of sequences of a business process activities to support the business process management. Eastern-European Journal of Enterprise Technologies, 5 (3 (95)), 16–24. doi: https://doi.org/10.15587/1729-4061.2018.142664
15. Kalynychenko, O., Chalyi, S., Bodyanskiy, Y., Golian, V., Golian, N. (2013). Implementation of search mechanism for implicit dependences in process mining. 2013 IEEE 7th International Conference on Intelligent Data Acquisition

and Advanced Computing Systems (IDAACS). doi: https://doi.org/10.1109/idaacs.2013.6662657
16. Bodyanskiy, Y., Kulishova, N., Chala, O. (2018). The Extended Multidimensional Neo-Fuzzy System and Its Fast Learning in Pattern Recognition Tasks. Data, 3 (4), 63. doi: https://doi.org/10.3390/data3040063
17. Kuchuk, N., Mozhaiev, O., Mozhaiev, M., Kuchuk, H. (2017). Method for calculating of R-learning traffic peakedness. 2017 4th International Scientific-Practical Conference Problems of Infocommunications. Science and Technology (PIC S&T). doi: https://doi.org/10.1109/infocommst.2017.8246416
18. Chalyi, S., Pribylnova, I. (2019). The method of constructing recommendations online on the temporal dynamics of user interests using multilayer graph. EUREKA: Physics and Engineering, 3, 13–19. doi: https://doi.org/10.21303/2461-4262.2019.00894
19. Chalyi, S., Leshchynskyi, V., Leshchynska, I. (2019). Method of forming recommendations using temporal constraints in a situation of cyclic cold start of the recommender system. EUREKA: Physics and Engineering, 4, 34–40. doi: https://doi.org/10.21303/2461-4262.2019.00952
20. Chala, O., Novikova, L., Chernyshova, L. (2019). Method for detecting shilling attacks in e-commerce systems using weighted temporal rules. EUREKA: Physics and Engineering, 5, 29–36. doi: https://doi.org/10.21303/2461-4262.2019.00983
21. Pavlenko, V., Shostak, I., Morozova, O., Danova, M. (2018). Information support for business processes at virtual enterprises with multi-agent technologies. 2018 IEEE 9th International Conference on Dependable Systems, Services and Technologies (DESSERT). doi: https://doi.org/10.1109/dessert.2018.8409189

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MODELING OF THE TRANSPORT AND PRODUCTION COMPLEX IN THE GROWING OF AGRICULTURAL CROPS, TAKING INTO ACCOUNT THE AVIATION COMPONENT (p. 30–39)

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Studies of the transport and technological process of growing crops revealed that it is a complex dynamic system. It is proved that the complexity of this system consists in the presence of a large number of heterogeneous subsystems, including transport, which is an important component for growing crops. Due to the system approach to the study of transport support of the crop growing process, it became possible to identify functional features of using ground and aviation vehicles. The properties of each stage of the growing process and involvement of certain types of vehicles are determined.

The scheme of transport support of the crop growing process is developed and the influence of the aviation component at certain stages in the introduction of resource-saving No-till technology is determined.

Experimental studies showed that the use of aviation transport contributes to the introduction of resource-saving No-till technology by minimizing the mechanical processing of sown areas, which reduces *the* anthropogenic load on the soil.

The developed mathematical model for analyzing the use of the transport and production complex in growing crops allows making a rational choice of ground and aviation vehicles, depending on the parameters of technologies, types of crops.

Thus, there is reason to argue that it is possible to make timely and reasonable management decisions in the organization and management of agricultural production in order to maximize profits.

Keywords: technological process, No-till technology, subsystem, set of operations, types of resources, process chart, aviation equipment, ground equipment.

References

1. Pron, S. V. (2016). Osnovy formuvannia intehrovanoi transportnoi systemy vyroshchuvannia zernovykh kultur. Avtomobilni dorohy i dorozhnie budivnytstvo, 96, 192–199.
2. Vasylkovska, K. V., Leshchenko, S. M., Vasylkovskyi, O. M., Petrenko, D. I. (2016). Improvement of equipment for basic tillage and sowing as initial stage of harvest forecasting. INMATEH, 50 (3), 13–20.
3. Popovych, P. V., Lyashuk, O. L., Murovanyi, I. S., Dzyura, V. O., Shevchuk, O. S., Myndyuk, V. D. (2016). The service life evaluation of fertilizer spreaders undercarriages. INMATEH, 50 (3), 39–46.
4. Mostypan, M. I., Vasylkovska, K. V., Andriyenko, O. O., Reznichenko, V. P. (2017). Modern aspects of tilled crops productivity forecasting. INMATEH, 53 (3), 35–40.
5. Vasylkovska, K. V., Vasylkovskyi, O. M., Sviren, M. O., Petrenko, D. I. et. al. (2019). Determining the parameters of the device for inertial removal of excess seed. INMATEH, 57 (1), 135–140. doi: https://doi.org/10.35633/inmateh_57_14
6. Krivutsa, Z. F. (2010). Ispol'zovanie matematicheskih modeley dlya optimizatsii raboty avtomobil'nogo transporta. Mehanizatsiya i elektrifikatsiya tehnologicheskih protsessov v sel'skohozyaystvennom proizvodstve, 17, 136.
7. Sharifov, F. A., Yun, H. M., Kandyba, H. Yu. (2014). Optimal route of aircraft for agroaviation works. Science-based technologies, 23 (3), 319–325. doi: https://doi.org/10.18372/2310-5461.23.7415
8. Marintseva, K., Yun, G., Kachur, S. (2015). Resource allocation improvement in the tasks of airport ground handling operations. Aviation, 19 (1), 7–13. doi: https://doi.org/10.3846/16487788.2015.1015291

9. Soloviova, O. O., Herasymenko, I. M., Rovnenko, M. M. (2011). Ekonomichna efektyvnist vykorystannia aviatsiyi v silskomu hospodarstvi v porivnianni z nazemnoiu tekhnikoiu. Visnyk Khmelnytskoho natsionalnoho universytetu. Ekonomichni nauky, 1 (171), 194–198.
10. Enaleeva-Bandura, I. M., Danilov, A. G., Nikonchuk, A. V., Davydova, A. L. (2017). A dynamic model of transport-technological process of transporting wood raw material in a multiproduct setting. Hvoynye boreal'noy zony, 1-2, 84–87.
11. Pron, S. V., Vysotska, I. I. (2016). Theoretical aspects of the concept transport system of agricultural works. Molodyi vchenyi, 4, 252–256.
12. Makhmud el Asskar, Bykova, O. Ye. (2009). Vplyv tekhnolohiyi No-till u zonakh nedostatnoho zvolozhennia na vlastyvosti gruntiv i produktyvnist kultur. Visnyk ahrarnoi nauky, 2, 25–28.
13. Huzhvenko, S. M. (2016). Osoblyvosti planuvannia pid chas vykorystannia innovatsiynykh system tekhnolohiy u vyrobnychiy diyalnosti ahrarnoho pidpryiemstva. Ekonomika i suspilstvo, 7, 260–265. Available at: http://economyandsociety.in.ua/journal/7_ukr/44.pdf
14. Pidsumky diyalnosti aviatsiynoi haluzi Ukrainy. Available at: http://avia.gov.ua/
15. Statystychni dani v haluzi aviatransportu. Available at: https://mtu.gov.ua/content/statistichni-dani-v-galuzi-aviatransportu.html
16. Hess, L. J. T., Hinckley, E.-L. S., Robertson, G. P., Matson, P. A. (2020). Rainfall intensification increases nitrate leaching from tilled but not no-till cropping systems in the U.S. Midwest. Agriculture, Ecosystems & Environment, 290, 106747. doi: https://doi.org/10.1016/j.agee.2019.106747
17. Wang, J., Zou, J. (2020). No-till increases soil denitrification via its positive effects on the activity and abundance of the denitrifying community. Soil Biology and Biochemistry, 142, 107706. doi: https://doi.org/10.1016/j.soilbio.2020.107706
18. Ferreira, C. dos R., Silva Neto, E. C. da, Pereira, M. G., Guedes, J. do N., Rosset, J. S., Anjos, L. H. C. dos. (2020). Dynamics of soil aggregation and organic carbon fractions over 23 years of no-till management. Soil and Tillage Research, 198, 104533. doi: https://doi.org/10.1016/j.still.2019.104533
19. Pron, S. V., Vysotska, I. I., Soloviova, O. O. (2017). Modeliuvannia vykonannia ahrarnykh robit z urakhuvanniam transportnoi skladovoi. Avtomobilni dorohy i dorozhnie budivnytstvo, 100, 331–340.
20. Sait korporatsiyi «Ahro-Soiuz». Available at: http://www.agrosoyuz.ua/products/tech-conf-educ/plant-growing
21. American Optimal Decisions. Available at: http://www.aorda.com

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MANAGEMENT OF AN ADVERTISING CAMPAIGN BASED ON THE MODEL OF THE ENTERPRISE'S LOGISTIC SYSTEM (p. 40–49)

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The study is devoted to solving the scientific problem of optimal expansion of the enterprise's market niche, taking into account potential demand and the formation of an effective advertising campaign. An economic-mathematical model of the enterprise's production activity has been developed taking into account logistics and market demand.

The problem of determining the optimal advertising costs is solved in two formulations:

a) the enterprise produces homogeneous goods and the wholesale warehouse can fulfill the retail order for any quantity of goods in the wholesale warehouse;

b) the enterprise produces some products in assortment. In this case, a certain minimum stock of products should be available at the wholesale warehouse.

The study found that the optimal advertising costs are determined by the value of all the main parameters of the enterprise's logistics system.

This conclusion was obtained as a result of careful model accounting of the structure of the enterprise's logistics system. All the main links (flows) between the elements of the logistics system were also taken into account. The simulation was performed in such a way that non-physical phenomena (for example, storage overflow, etc.) did not appear at the intermediate stages of modeling. The calculations found that with the planned capacity of 4.1 (units per day), the annual profit will be 3975.5 (units) with an optimal advertising cost of 44.8 (units). The practical significance of the study is that scientific ideas about the relationship of the advertising campaign with the production potential of the enterprise can serve as the basis for more efficient management of the budget process at the enterprise, namely: more informed planning of production volumes and expenses for its advertising campaign.

Keywords: model approach, optimal advertising costs, logistics, management of logistics processes, market demand, planning horizon, supply chain from manufacturer to final consumer.

References

1. Forrester, J. W. (1958). Industrial Dynamics – A Major Breakthrough for Decision Makers. Harvard Business Review, 36 (4), 37–66. Available at: https://ru.scribd.com/doc/158721742/Industrial-Dynamics-A-Major-Breakthrough-for-Decision-Makers

2. Brajnik, G., Gabrielli, S. (2010). A Review of Online Advertising Effects on the User Experience. International Journal of Human-Computer Interaction, 26 (10), 971–997. doi: https://doi.org/10.1080/10447318.2010.502100
3. Lambrecht, A., Tucker, C. (2013). When Does Retargeting Work? Information Specificity in Online Advertising. Journal of Marketing Research, 50 (5), 561–576. doi: https://doi.org/10.1177/002224371305000508
4. Wang, T.-C., Chen, L. Y., Chen, Y.-H. (2008). Applying Fuzzy PROMETHEE Method for Evaluating IS Outsourcing Suppliers. 2008 Fifth International Conference on Fuzzy Systems and Knowledge Discovery. doi: https://doi.org/10.1109/fskd.2008.506
5. Yuan, S., Wang, J., Zhao, X. (2013). Real-time bidding for online advertising: measurement and analysis. arXiv. Available at: https://arxiv.org/pdf/1306.6542.pdf
6. He, X., Prasad, A., Sethi, S. P. (2009). Cooperative Advertising and Pricing in a Dynamic Stochastic Supply Chain: Feedback Stackelberg Strategies. Production and Operations Management. 18 (1), 78–94. doi: https://doi.org/10.1111/j.1937-5956.2009.01006.x
7. Du, H., Xu, Y. (2012). Research on Multi-Objective Optimization Decision Model of Web Advertising – Takes Recruitment Advertisement as an Example. International Journal of Advancements in Computing Technology, 4 (10), 329–336. doi: https://doi.org/10.4156/ijact.vol4.issue10.39
8. Guha, S., Cheng, B., Francis, P. (2010). Challenges in measuring online advertising systems. Proceedings of the 10th Annual Conference on Internet Measurement - IMC '10. doi: https://doi.org/10.1145/1879141.1879152
9. Marques, C. P., Almeida, D. (2013). A Path Model of Attitudinal Antecedents of Green Purchase Behaviour. ECONOMICS & SOCIOLOGY, 6 (2), 135–144. doi: https://doi.org/10.14254/2071-789x.2013/6-2/12
10. Xie, J., Neyret, A. (2009). Co-op advertising and pricing models in manufacturer–retailer supply chains. Computers & Industrial Engineering, 56 (4), 1375–1385. doi: https://doi.org/10.1016/j.cie.2008.08.017
11. Tsou, C.-S., Fang, H.-H., Lo, H.-C., Huang, C.-H. (2009). A study of cooperative advertising in a manufacturer-retailer supply chain. International Journal of Information and Management Sciences, 20, 15–26.
12. Wei, Y., Choi, T.-M. (2010). Mean–variance analysis of supply chains under wholesale pricing and profit sharing schemes. European Journal of Operational Research, 204 (2), 255–262. doi: https://doi.org/10.1016/j.ejor.2009.10.016
13. Kogler, C., Rauch, P. (2018). Discrete event simulation of multimodal and unimodal transportation in the wood supply chain: a literature review. Silva Fennica, 52 (4). doi: https://doi.org/10.14214/sf.9984
14. Siderska, J. (2016). Application of tecnomatix plant simulation for modeling production and logistics processes. Business, Management and Education, 14 (1), 64–73. doi: https://doi.org/10.3846/bme.2016.316
15. Bremer, P. (2018). Towards a reference model for the cold chain. The International Journal of Logistics Management, 29 (3), 822–838. doi: https://doi.org/10.1108/ijlm-02-2017-0052
16. Farahani, R. Z., Rezapour, S., Kardar, L. (2011). Logistics Operations and Management: Concepts and Models. Elsevier, 486. doi: https://doi.org/10.1016/c2010-0-67008-8
17. Voronin, A. V., Gunko, O. V. (2013). Discrete Model of Market Adaptation. Business Inform, 4, 158–162. Available at: http://nbuv.gov.ua/UJRN/binf_2013_4_30
18. Titarenko, D. V. (2011). Model of conduct of users of the same type products. Business Inform, 10, 99–100. Available at: https://www.business-inform.net/annotated-catalogue/?year=2011&abstract=2011_10_0&lang=ru&stqa=23
19. Gvozdetskaya, I. V., Ostapchuk, O. V. (2011). Analysis of Approaches to Modeling Industrial Enterprise Management Processes. Business Inform, 5, 79–80. Available at: https://www.business-inform.net/annotated-catalogue/?year=2011&abstract=2011_05_1&lang=ua&stqa=23
20. Gorskii, A. A., Kolpakova, I. G., Lokshin, B. Ya. (1998). Dynamical model of the process of production, storage, and sale of daily demand goods. Izvestiya Rossiyskoy Akademii Nauk. Teoriya i sistemy upravleniya, 1, 144–148. Available at: https://www.elibrary.ru/item.asp?id=14945102
21. Sherstennykov, Yu. V., Rudianova, T. M. (2014). Modeliuvannia mekhanizmiv vplyvu na tempy prodazhu produktsiyi pidpryiemstva. Aktualni problemy ekonomiky, 1, 551–559.
22. Sherstennykov, Y. V., Rudyanova, T. M. (2013). Model for planning of small or medium enterprise project. Actual Problems of Economics, 7, 205–216. Available at: http://nbuv.gov.ua/UJRN/ape_2013_7_25
23. Sherstennykov, Yu. V. (2011). Model zhyttievoho tsyklu proektu i sezonnosti v roboti maloho pidpryiemstva. Aktualni problemy ekonomiky, 8, 334–347.
24. Sherstennikov, Yu. V., Rudianova, T. M., Brytska, V. Yu. (2018). The Model Optimization of Production Capacity of Enterprise. Business Inform, 6, 186–192. Available at: http://nbuv.gov.ua/UJRN/binf_2018_6_27

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CONTENT OPTIMIZATION OF THE DEVELOPMENT OF MULTIPROJECT OF A SHIPPING COMPANY (p. 50–57)

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An economic-mathematical model of content optimization of the development multi-project of the project-oriented enterprise in a general form is proposed. The developed economic-mathematical model of multi-project content optimization allows creating a development multi-project taking into account the specifics of the activity, resources and capabilities of the company.

It is shown that the current situation requires new methods in managing problem areas of the economy. The issue of attracting and distributing resources is particularly relevant for shipping companies.

The economic-mathematical model of content optimization of the development multi-project of a shipping company is experimentally investigated. It is shown that the connection between projects in the development multi-project of the shipping enterprise is implemented through resources and strategic goals.

The connections between development projects are investigated. The relationship between projects within the framework of the development multi-project of the shipping company in such areas as: resource restrictions, restrictions at the level of goals, restrictions at the organization level is considered. The presented economic-mathematical model of content optimization of the development multi-project of the shipping company allows determining strategic goals in the long period, evaluating the resources needed to achieve them, and determining the sources of their replenishment. The economic-mathematical model makes it possible to take into account not only resource limitations, but also the compliance of the results of the multi-project with the strategic goals of the company.

The optimal content of the development multi-project of the shipping company is obtained for a given level of the company's ability to finance projects in the current period; and the company's ability to finance projects as part of the multi-project throughout the entire life cycle.

The presented approach to the formation of the development multi-project of the shipping company allows achieving the strategic goals of the company in the unity of the project, multi-project and portfolio of the enterprise.

Keywords: economic-mathematical model of multi-project content optimization, development of shipping company, strategic planning.

References

1. Sandru, M., Pirnea, I. C., Purcarea, A., Surugiu, I., Schmid, J. (2015). Study on the Multi-Project Management Practices for Complex Investments. Amfiteatru Economic, 17 (9), 1314–1330
2. Li, X. B., Nie, M., Yang, G. H., Wang, X. (2017). The Study of Multi-Project Resource Management Method Suitable for Research Institutes from Application Perspective. Procedia Engineering, 174, 155–160. doi: https://doi.org/10.1016/j.proeng.2017.01.191
3. Burkova, V. N., Korginab, N. A., Novikov, D. A. (2016). Problems of integration and decomposition of organizational-technical systems' control mechanisms. Problemy upravleniya, 5, 14–23.
4. Bushuev, S. D., Bushueva, N. S. (2006). Development project management maturity for the fast growing innovative company in turbulence environment – Ukrainian case. The preceding of 20 IPMA World Congress on Project Management, Vol. 2. Shanghai, China, 559–563.
5. Hiroshi Tanaka. (2011). Multi Project Management (MPM) at Project-based Companies: Theoretical Models and the Case of the Maritime. Annual International Conference, 29.
6. Tosselli, L., Bogado, V., Martínez, E. (2017). An agent-based simulation model using decoupled learning rules to (re) schedule multiple projects. XXIII Congreso Argentino de Ciencias de la Computación, 33–42.
7. Jedrzejowicz, P., Ratajczak-Ropel, E. (2018). A-Team Solving Distributed Resource-Constrained Multi-project Scheduling Problem. Lecture Notes in Computer Science, 243–253. doi: https://doi.org/10.1007/978-3-319-98446-9_23
8. Onyshchenko, S., Bondar, A., Andrievska, V., Sudnyk, N., Lohinov, O. (2019). Constructing and exploring the model to form the road map of enterprise development. Eastern-European Journal of Enterprise Technologies, 5 (3 (101)), 33–42. doi: https://doi.org/10.15587/1729-4061.2019.179185
9. Madar, A., Neacşu, N. A. (2016). Quality management in shipping. Case study: Maersk Line Denmark. Bulletin of the Transilvania University of Brasov. Series V: Economic Sciences, 9 (1), 139–148.
10. Park, K.-S., Seo, Y.-J., Kim, A.-R., Ha, M.-H. (2018). Ship Acquisition of Shipping Companies by Sale & Purchase Activities for Sustainable Growth: Exploratory Fuzzy-AHP Application. Sustainability, 10 (6), 1763. doi: https://doi.org/10.3390/su10061763
11. The standard for portfolio management (2017). Newtown Square: Project Management Institute, 127.
12. A Guide to the Project Management Body of Knowledge PMBOK (2017). Project Management Institute, 726.
13. Lapkina, I. O., Prykhno, Y. E. (2015). Multiproject management in companies' development (on example of shipping companies). Project Management World Journal.

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ASSESSING THE QUALITY LEVEL OF TECHNOLOGICAL PROCESSES AT CAR SERVICE ENTERPRISES (p. 58–75)

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This paper addresses the problem of the level of maintenance and repair of motor vehicles depending on the parameters that take into consideration the internal state of a car service enterprise and the external factors that characterize the environment of its functioning, as well as the cars serviced by the enterprise. The course of the study involved a morphological analysis of the auto service system, based on which the functional elements of the system were determined, as well as the essential morphological attributes of these elements and the variants for their implementation. In order to identify the degree of influence exerted by these morphological attributes on the quality of technological processes performance, a survey of the typical Ukrainian car service enterprises has been carried out and a mathematical model of the system has been built in the form of a linear multiple regression equation. The preliminary verification of the input parameters of the system model for multicollinearity based on the Farrar-Glober algorithm has made it possible to separate the independent ones among them and to reduce the complexity of further calculations. The regression equation coefficients characterize the degree of importance of considering the appropriate parameters when designing an automated quality management system. To improve the adequacy of the model and to reduce the complexity of the simulation process, the source data array has been divided into the training and control samples using an algorithm based on computing the values for the sampling variance. In order to obtain the most adequate model, the nonlinear models of the examined system of the Mamdani and Sugeno type have been constructed. To this end, the MATLAB software suite was employed with its Fuzzy Logic Toolbox. The input and output parameters' membership functions were set in a trapezoidal form. The nonlinear models have been implemented for various defuzzification methods of the output parameter. The smallest root mean square error of the resultant characteristic was obtained when implementing the Sugeno-type model; it was 1.07 %. This indicates the expediency of integrating the specified model into a quality management system in order to determine the optimal operating modes. The study results could be applied to assess the quality of the services rendered by car service systems at the micro- and macro levels.

Keywords: auto-service enterprise, quality level, morphological analysis, linear multiple regression, fuzzy logical derivation.

References

1. Mateichyk, V. P., Tarandushka, L. A., Kostian, N. L. (2018). Optimization of autoservice enterprises activity based on the current state indicators. Systems and means of car transport. Problems of explotation and diagnostics, 14, 91–99.
2. Tarandushka, L., Kostian, N. (2018). Functional model of selection the strategy form organization of production for the qualitative performance of services at auto service enterprises. Suchasni tekhnolohiyi v mashynobuduvanni ta transporti, 1 (10), 131–136. Available at: http://nbuv.gov.ua/UJRN/ctmbt_2018_1_23
3. Tarandushka, L. A., Kostian, N. L. (2019). Software support of production restructuring in quality management system of car service enterprise. Scientific Bulletin of Ivano-Frankivsk National Technical University of Oil and Gas, 2 (47), 48–56. doi:https://doi.org/10.31471/1993-9965-2019-2(47)-48-56
4. Khaksar, S. M., Nawaser, K., Jahanshahi, A. F., Kamalian, A. R. (2011). The relation between after-sales services andentrepreneurial opportunities: Case study of Iran-Khodro Company. African Journal of Business Management, 5 (13), 5152–5161. Available at: https://www.academia.edu/1470063/The_relation_between_after-sales_services_and_entrepreneurial_opportunities_Case_study_of_Iran-_Khodro_Company
5. McMurrian, R. C., Matulich, E. (2011). Building Customer Value And Profitability With Business Ethics. Journal of Business & Economics Research (JBER), 4 (11), 11–18. doi: https://doi.org/10.19030/jber.v4i11.2710
6. Baffour-Awuah, E. (2018). Service Quality in the Motor Vehicle Maintenance and Repair Industry: A Documentary Review. International Journal of Engineering and Modern Technology, 4 (1), 14–34. Available at: http://www.iiard.com/index.php/IJEMT/article/view/1130
7. Velimirović, D., Duboka, Č., Damnjanović, P. (2016). Automotive maintenance quality of service influencing factors. Tehnicki Vjesnik, 23 (5), 1431–1438. doi: https://doi.org/10.17559/tv-20140402074657
8. Oliva, R., Kallenberg, R. (2003). Managing the transition from products to services. International Journal of Service Industry Management, 14 (2), 160–172. doi: https://doi.org/10.1108/09564230310474138
9. Stevanović, I., Stanojević, D., Nedić, A. (2013). Setting the after sale process and quality control at car dealerships to the purpose of increasing clients satisfaction. Journal of Applied Engineering Science, 11 (2), 81–88. doi: https://doi.org/10.5937/jaes11-3821
10. Tse, D. K., Wilton, P. C. (1988). Models of Consumer Satisfaction Formation: An Extension. Journal of Marketing Research, 25 (2), 204. doi: https://doi.org/10.2307/3172652
11. Bai, Y., Wang, D. (2006). Fundamentals of Fuzzy Logic Control – Fuzzy Sets, Fuzzy Rules and Defuzzifications. Advanced Fuzzy Logic Technologies in Industrial Applications, 17–36. doi: https://doi.org/10.1007/978-1-84628-469-4_2
12. widerski, A., Jóżwiak, A., Jachimowski, R. (2018). Operational quality measures of vehicles applied for the transport services evaluation using artificial neural networks. Eksploatacja i Niezawodnosc - Maintenance and Reliability, 20 (2), 292–299. doi: https://doi.org/10.17531/ein.2018.2.16
13. Martínez, J. A., Ko, Y. J., Martínez, L. (2010). An Application of Fuzzy Logic to Service Quality Research: A Case of Fitness Service. Journal of Sport Management, 24 (5), 502–523. doi: https://doi.org/10.1123/jsm.24.5.502
14. Savino, M. M., Sekhari, A. S. (2009). A quality management system based on fuzzy quality pointers in ISO 9000. International Journal of Product Development, 8 (4), 419. doi: https://doi.org/10.1504/ijpd.2009.025255
15. Shia, C. S., Khaohun, S. (2019). Fuzzy to Quality: A practical application of ISO 25000 (SQuaRE), ISO 9000 and Fuzzy Logic. Available at: https://www.researchgate.net/publication/331984770_Fuzzy_to_Quality_A_practical_application_of_ISO_25000_SQuaRE_ISO_9000_and_Fuzzy_Logic
16. Feili, H. R., Hassanzadeh Khoshdooni, M. (2011). A Fuzzy Optimization Model For Supply Chain Production Planning With Total Aspect Of Decision Making. Journal of Mathematics and Computer Science, 02 (01), 65–80. doi: https://doi.org/10.22436/jmcs.002.01.08

17. Cioca, L.-I., Breaz, R., Racz, S.-G. (2006). Fuzzy Logic Techniques used in Manufacturing Processes Reengineering. Proceedings of the 6th WSEAS International Conference on Simulation, Modelling and Optimization, (SMO 2006), 530–533. Available at: https://www.researchgate.net/publication/262399693_Fuzzy_logic_techniques_used_in_manufacturing_processes_reengineering
18. Francalanza, E., Borg, J. C., Constantinescu, C. (2016). A Fuzzy Logic Based Approach to Explore Manufacturing System Changeability Level Decisions. Procedia CIRP, 41, 3–8. doi: https://doi.org/10.1016/j.procir.2015.12.011
19. Dmytrychenko, M. F., Mateichyk, V. P., Hryshchuk, O. K., Tsiuman, M. P. (2014). Metody systemnoho analizu vlastyvostei avtomobilnoi tekhniky. Kyiv: NTU, 168.
20. Tarandushka, L. A. Kostian, N. L. (2018). Tryrivneva model systemy menedzhmentu yakosti avtoservisnykh pidpryiemstv. Materialy IV Vseukrainskoi naukovo-praktychnoi konferentsiyi «Novitni shliakhy stvorennia, ekspluatatsiyi, remontu i servisu avtomobiliv. Mykolaiv: MTU, Mykolaivska politekhnika, 65–67.
21. Napol'skiy, G. M. (1993). Tehnologicheskoe proektirovanie avtotransportnyh predpriyatiy i stantsiy tehnicheskogo obsluzhivaniya. Moscow: Transport, 271.
22. Mateichyk, V. P., Smieszek, M., Polovko, M. V., Kolomiiec, S. V. (2013). Assessment of emissions of pollutants into the process of technological cycle maintenance vehicles. Visnyk Sevastopolskoho natsionalnoho tekhnichnoho universytetu. Mashyno-pryladobuduvannia ta transport, 142, 166–169.
23. Hurzhii, N. M., Ovcharenko, A. I. (2016). The logistic potential of the enterprise estimation as a basis of its logistic strategy choice. Hlobalni ta natsionalni problemy ekonomiky, 13, 244–248. Available at: http://global-national.in.ua/archive/13-2016/50.pdf
24. Ludchenko, O. A. (2004). Tekhnichne obsluhovuvannia i remont avtomobiliv: orhanizatsiya i upravlinnia. Kyiv: Znannia, 479.
25. Snytiuk, V. Ye. (2008). Prohnozuvannia. Modeli. Metody. Alhorytmy. Kyiv: Maklaut, 364.
26. Nakonechnyi, S. I., Tereshchenko, T. O., Romaniuk, T. P. (2004). Ekonometriya. Kyiv: KNEU, 520.
27. Rutkovskaya, D., Pilin'skiy, M., Rutkovskiy, L. (2008). Neyronnye seti, geneticheskie algoritmy i nechetkie sistemy. Moscow: Goryachaya liniya – Telekom, 452.
28. Shtovba, S. D. (2007). Proektirovanie nechetkih sistem sredstvami MATLAB. Moscow: Goryachaya liniya – Telekom, 288.