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QUALITATIVE STOCHASTIC MODELING OF THE PROCESS OF MAKING FLEXIBLE EMERGENCY DECISIONS IN CONDITIONS OF UNCERTAINTY

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The article presents an innovative methodological approach to making flexible emergency decisions in an uncertain business environment through the application of qualitative stochastic modeling. The study aims to transform quantitative approaches into a qualitative domain, enabling rapid and adaptive responses to dynamic changes in the business environment under conditions of limited initial data. An advanced adaptive model is proposed that enhances the effectiveness of strategic management decision-making under conditions of uncertainty. The research's novelty lies in implementing a comprehensive methodological approach that integrates tools of qualitative stochastic modeling, marketing analysis, and strategic management techniques. The practical significance of the work lies in the ability to assess general trends and complex interconnections in crisis conditions, and as a result, make flexible emergency decisions. The research methodology is grounded in a multi-dimensional approach, combining systematic and comparative analysis, adaptive stochastic and qualitative modeling techniques, and marketing research process. This methodological framework enables a more holistic understanding of complex business environments and provides a mechanism for decision-making under the lack of the information and uncertainty. The primary outcome of the study is the development of a qualitative approach for making flexible emergency decisions in an environment characterized by limited information and high uncertainty. The proposed model offers a novel perspective on handling complex business challenges, and the gap between quantitative data limitations and strategic decision-making.

Keywords: flexible decisions, qualitative modeling, stochastic analysis, business environment, marketing research, uncertainty.

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Introduction and formulation of the problem

The uncertain business environment creates new conditions for business that require novel reactions and entail a series of changes. Due to the absence of previous experience and instructions, economic entities seek new solutions for operating under uncertainty. In searching for new solutions, the business loses time, resources, and consequently, market competitiveness, which potentially can lead to the company's market exit [6]. Therefore, the article's objective is to provide a methodological and practical

model that defines the flexible emergency decision-making process for businesses and describes the steps to act under instability. The flexible emergency decision-making process is not deterministic. During the research, an analysis of flexible emergency decision-making stages [4] was conducted using utilitarian research methods, such as qualitative and stochastic modeling, and primitive defuzzification [6].

Analysis and research of publications

The analysis of research and publications on the topic of flexible decision-making under uncertainty

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Qualitative stochastic modeling of the process of making flexible emergency decisions in conditions of uncertainty

is based on the examination of the business environment, identification of new trends, and features of managerial decision-making. Artikis, C. T. [1] presents a stochastic approach to risk management. Meanwhile, the studies by Balan, V. G. [2; 3] focus on strategic management and the analysis of an enterprise's external environment using fuzzy data and stochastic modeling methods.

Deep, G. [4] explores the process of strategic decision-making, while the research by Korem, N., et al. [5] involves modeling the decision-making process under conditions of uncertainty with qualitative outcomes. The study by Oldroyd, A. and Teece, D. J. [6] emphasizes the role of dynamic capabilities in large organizations, which contributes to the development of entrepreneurial management. Starostina, A. O., and colleagues [7; 8] highlight modern approaches to marketing management and marketing research in general.

Purpose of the article

The main objectives are to improve the theoretical and methodological tools for the process of making flexible emergency decisions and to develop an applied algorithm for making such decisions in an uncertain business environment through the use of an adapted stochastic modeling methodology, specifically qualitative stochastic modeling.

Presentation of the main material

The study is based on the transformation of the traditional quantitative approach of stochastic modelling into a qualitative plane by introducing the concept of “qualitative stochastic modelling”. Qualitative stochastic modelling offers an innovative methodological tool for analyzing business processes in the face of high uncertainty and dynamic changes in the business environment, especially in the context of global economic transformations of the 20s of the 21st century.

Stochastic modeling itself involves a set of predefined actions that reveal interconnections and accumulate internal processes and organizational resources to implement necessary changes over a specific period. According to Balan [3], a stochastic network is a network model requiring the execution of a specific subset of arcs (operations). The calculation of each arc's implementation period depends on a specific probabilistic distribution. In stochastic analysis, calculating the mathematical expectation, variance of execution time, and probability of execution are crucial [1].

In contrast to traditional models, this article applies a simplified adaptive model based on qualitative modeling. Stochastic modeling traditionally relies on quantitative probability and numerical value analysis. However, in describing the method of making flexible emergency decisions, “qualitative stochastic modeling”

is used, which employs qualitative approaches to describing stochastic processes.

Qualitative stochastic modeling demonstrates relationships and general trends without detailed numerical substantiation. Verbal conditional descriptions replace numerical probability values. Within stochastic modeling, the application of qualitative descriptive assessments is anticipated. The primary goal of qualitative stochastic modeling is to create a general system without numerical calculations.

The appropriateness of this approach is particularly valued in preliminary situation assessment when precise data is unavailable (for example, impossibility of obtaining data due to military actions or economic collapse). It becomes crucial when rapid and decisive strategic decisions are necessary. Applying qualitative stochastic modeling is practical for determining general direction and trends, which is essential under uncertainty conditions [2].

While determining the flexible emergency decision-making process, qualitative stochastic modeling allows hypothetically thinking through step-by-step actions of an organization facing uncertainty. The need to investigate organizational decision-making processes [3] stems from irreversible business environment changes: a new reality demanding new solutions. Under the influence of global trends, decision-making has undergone substantial changes in nature. If a decade ago it was possible to predict an organization's future actions and respond to market challenges based on previous scenarios, uncertain conditions now require new flexible management decision-making strategies [4]. The phase-specific illustration (Fig. 1) demonstrates a direct correlation between the business environment characteristics of the 2020s and the management decision-making process, specifically adopting flexible emergency decisions as a method.

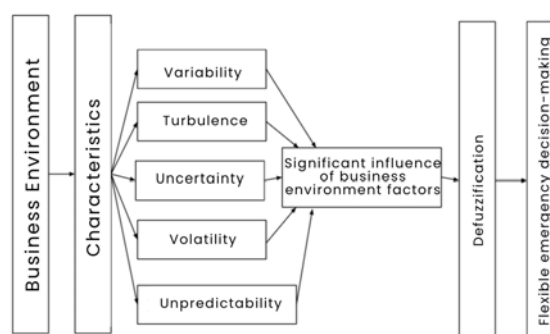


Fig. 1. The impact of the characteristics of the business environment of the 2020s on the choice of a managerial decision-making method

Source: authors' development

Flexible emergency decisions represent a contemporary tool for organizational response to an unstable business environment. This process can be interpreted through multiple perspectives: as a preventive method of market adaptation [1], or as a necessary process of adapting to business environmental changes under pressure from specific characteristics.

The process of making flexible emergency decisions can be divided into four primary stages, illustrated in Fig. 2 as an integrated stochastic model with qualitative modeling [2]. Drawing upon marketing research processes [8] adapted to uncertain business environments, each stage of this model is characterized by specific probability and execution time. These can be transformed into a single parameter – the W-function (where W represents the conditional generating moment function of a random variable, accounting for its probabilistic distribution type) [3]. The execution time of each stage will depend on various factors, including:

- a) enterprise scale;
- b) market coverage strategy;
- c) market specificity (national or international);
- d) sales volumes;
- e) other factors determining the stochastic nature and uncertainty in organizational activities.

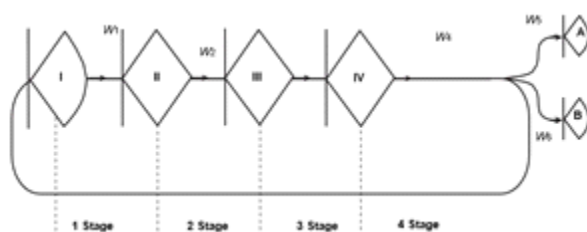


Fig. 2. Stochastic model for making flexible emergency decisions based on marketing research under conditions of instability

Source: authors' development

Structured explanation of network nodes:

Stage 1 – Defining marketing research objectives and setting tasks based on business environment analysis:

- 1: Unpredictable volatile business environment;
- 2: Analysis of marketing problems and opportunities;
- 3: Identifying alternative management issue solutions;
- 4: Establishing research frames.

Stage 2 – Information collection and processing:

- 5: Information gathering;
- 6: Information processing and compilation;

7: Report preparation and results presentation.
 Stage 3 – Evaluation and analysis of obtained results.

Stage 4 – Analysis of flexible emergency decision options:

- 8: Making a flexible emergency decision (A, B);
- 9: Implementing the chosen solution (A, B).

Options A and B represent the management's decision to accept or reject the marketing consultant's recommendations.

Applying stochastic models in making flexible emergency decisions allows for considering probabilistic considerations regarding the duration of individual marketing research stages and their actual execution. Through this approach, the marketing consultant increases the chances not only of successfully identifying a flexible emergency decision as a strategic activity tool for an economic entity under uncertainty but also enhances the effectiveness of its subsequent implementation.

In the first stage (I–II), described by a generalized function, the marketing research objective and tasks are determined based on the business environment analysis results [7] (Fig. 3).

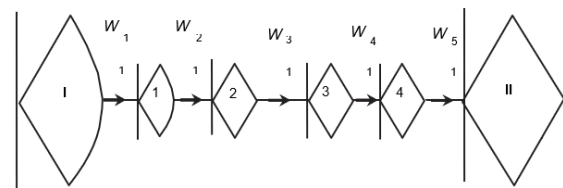


Fig. 3. Defining the goal of marketing research and setting tasks based on the analysis of the business environment
 Source: authors' development

For this purpose, the marketing consultant analyzes the unpredictable volatile business environment (W_1^1) by examining macro- and micro-marketing environmental factors. Subsequently, they diagnose marketing problems and opportunities (W_1^2), then formulate the management problem and research objective, identify alternative solutions for the management problem (W_1^3), and establish research boundaries (W_1^4). After this, the marketing consultant moves to the next stage of information collection and processing (W_1^5).

In the second stage (II–III function), information is collected (Fig. 4) according to the defined objectives.

Initially, the marketing consultant gathers primary and secondary information (W_2^1) using various information collection tools and techniques such as questionnaire development, surveys, experiments, etc.,

and then processes the obtained data in accordance with research objectives (W_2^2) [3]. Having established a reporting base, the marketing consultant prepares a report and presents the results to the enterprise’s management apparatus (W_2^3). Subsequently, they proceed to the next stage of evaluating and analyzing the obtained results (W_2^4).

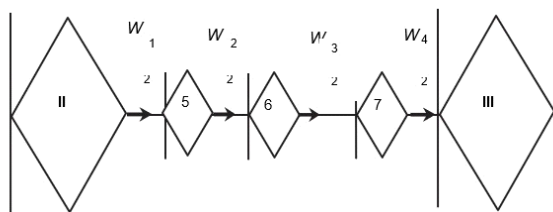


Fig. 4. The process of collecting and processing information within marketing research

Source: authors’ development

The evaluation and analysis of obtained results are conducted internally, analyzing performance indicators, relevance of proposed management decisions, and the firm’s resource capabilities (W_3) [4]. Following this, based on the experience and considerations of the management apparatus and other participants in the management decision-making group, an analysis of management decision options is performed (Fig. 5) [5].

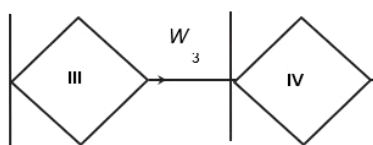


Fig. 5. Evaluation and analysis of obtained results

Source: authors’ development

The final stage (Fig. 6) involves analyzing a specific flexible emergency decision (W_4^1) by the management, resulting in its adoption (W_4^2) and implementation of the chosen decision (W_4^3).

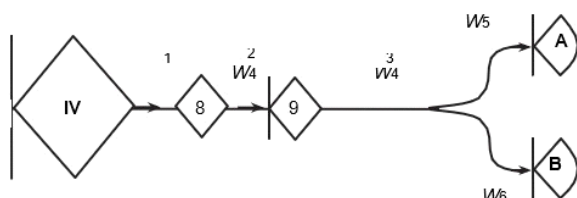


Fig. 6. Analysis of flexible emergency decision options

Source: authors’ development

Options A and B demonstrate the duality of management’s acceptance of the marketing consultant’s recommendations. During the final 4th stage, the flexible emergency decision is implemented and adapted (W_5), or rejected (W_6). Options A and B of management’s decision-making are based on the marketing consultant’s recommendations.

Conclusions

The article presents an innovative methodological approach to making flexible emergency decisions in an uncertain business environment through the application of qualitative stochastic modeling. The study demonstrates an adaptive model that allows organizations to quickly respond to changing market conditions, especially in the absence of precise quantitative data.

Qualitative stochastic modeling is proposed as an effective strategic management tool that enables evaluating general trends and interconnections without detailed numerical calculations. This approach is particularly useful during crisis phenomena when traditional analysis methods are ineffective, inaccessible, or irrelevant.

Potential directions for further scientific research include:

- in-depth study of practical applications of qualitative stochastic modeling in flexible emergency decision-making across various economic and business sectors;
- testing the proposed model on real-world cases of economic entities operating under high uncertainty;
- exploring integration possibilities of the proposed approach with artificial intelligence and machine learning systems to enhance the responsiveness and flexibility of management decision-making.

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КВАЛІТАТИВНЕ СТОХАСТИЧНЕ МОДЕЛЮВАННЯ ПРОЦЕСУ ПРИЙНЯТТЯ ГНУЧКИХ ЕКСТРЕНИХ РІШЕНЬ В УМОВАХ НЕВИЗНАЧЕНОСТІ

Старостіна А. О., Панасюк Ю. М.

У статті надано інноваційний методологічний підхід прийняття гнучких екстрених рішень в умовах невизначеного бізнес-середовища шляхом застосування квалітативного стохастичного моделювання. Дослідження спрямоване на трансформацію кількісних підходів у якісну площину, що дозволяє здійснювати оперативне та адаптивне реагування на динамічні зміни у бізнес-середовищі за умов обмеженості вихідних даних. Запропоновано вдосконалену адаптивну модель, яка підвищує ефективність стратегічного прийняття управлінських рішень в умовах невизначеності. Новизна дослідження полягає у впровадженні комплексного методологічного підходу, який інтегрує інструменти квалітативного стохастичного моделювання, маркетингового аналізу та технік стратегічного управління. Практична значущість роботи полягає у здатності оцінювати загальні тенденції та складні взаємозв'язки у кризових умовах, і як наслідок, приймати гнучкі екстрені рішення. Методологія дослідження ґрунтується на багатовимірному підході, що поєднує системний і порівняльний аналіз, адаптивне стохастичне та якісне моделювання, а також процес маркетингового дослідження. Такий методологічний підхід дозволяє досягти більш цілісного розуміння складних бізнес-середовищ і забезпечує надійний механізм прийняття рішень в умовах інформаційних обмежень і невизначеності. Основним результатом дослідження є розробка квалітативного підходу прийняття гнучких екстрених рішень у середовищі, що характеризується обмеженою інформацією та високою невизначеністю. Квалітативна модель пропонує інноваційний підхід подолання складних бізнес-викликів та розриву між недостатністю кількісних даних і стратегічним прийняттям рішення.

Ключові слова: гнучкі рішення, квалітативне моделювання, стохастичний аналіз, бізнес-середовище, маркетингове дослідження, невизначеність.

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