



INTEGRATION OF SOCIAL ENGINEERING AND MATHEMATICAL SCIENCES

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Abstract

The article extensively examines the application of mathematical modeling, probability theory, statistics, graphs, and algorithms in understanding social engineering processes. Social engineering is a set of psychological and social influence methods aimed at harming information systems and organizations or acquiring data by exploiting the human factor. Its effectiveness is often assessed through data analysis and probabilistic approaches. Therefore, mathematical approaches play a crucial role in identifying effective social engineering strategies and preventing them.

Keywords: Social engineering, research, innovation, mathematical modeling, statistics, SPSS, information technology, data analysis.

Introduction

Today, with the widespread use of information technologies and social networks, the human factor has emerged as the weakest yet most influential component of information security. Although organizations and individuals place great emphasis on technical measures to ensure data security, many attacks are carried out through psychological influence and manipulation. Social engineering is a set of strategies that exploit people's behavior, trust, and social relationships to obtain data or gain unauthorized access to systems. The main characteristic of this process is that it aims to deliberately alter people's decision-making

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mechanisms rather than bypass technical defenses. Therefore, combating social engineering requires not only technical tools but also understanding human behavior, measuring it, and predicting it in advance.

The effectiveness of social engineering processes is often evaluated intuitively and, in many cases, carried out based on experience. However, with the increase and growing complexity of attacks, it has become clear that this approach is insufficient. Attack scenarios and their outcomes occur in a changing social environment, so it is necessary to analyze them accurately and systematically. Here, mathematical approaches – especially probabilistic models, statistical analysis, graphs, and algorithms – play an important role. Mathematical methods make it possible to represent social engineering processes in a numerical form, assess their risk level, determine the probability of success, and measure the effectiveness of protective measures. As a result, processes related to social engineering are managed “based on knowledge,” and decisions are made based on more objective criteria.

Ensuring sustainable development of society requires the ability to anticipate social processes and manage them purposefully. From this perspective, the concepts of social forecasting and social engineering are closely interconnected. Social forecasting is the scientific prediction of the future state of social processes, events, and changes occurring in society. It helps identify development trends in demographic changes, social relations, value systems, the labor market, and other social spheres. Social forecasting outlines probable scenarios of societal development and enables the early identification of social problems. “Social forecasting belongs to sociology, serving as a field of sociological research (prospects of social phenomena and processes), and covers the entire thematic field of sociological science. At the same time, it is part of an interdisciplinary complex of future studies”[1, 14].

Social engineering, on the other hand, is the activity of consciously, deliberately, and systematically influencing social processes within society. Its main goal is to improve social systems, address existing problems, and direct societal development toward specific objectives. Educational reforms, social programs, and employment policies are practical manifestations of social engineering.



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These two concepts are closely interconnected. Social forecasting serves as the scientific foundation for social engineering. In other words, without developing forecasts about the future of society, effective social management and planning cannot be carried out. Social engineering, in turn, relies on the results of these forecasts to actively influence the development of society. In this regard, there arises a need to develop a methodological system for teaching higher mathematics based on the integration of mathematics with other fundamental disciplines within the framework of higher engineering education. This system should include the goals and content of mathematics education, the methods and didactic tools of teaching, as well as the organizational forms of instruction.

In addition, probability theory and statistical analysis serve to accurately measure the success level of social engineering methods. The outcomes of social engineering attacks are often uncertain and dependent on random factors, making it necessary to represent these processes through a probabilistic approach. Based on statistical data, it is possible to analyze attack types, audience characteristics, employees' awareness levels, and other indicators to determine which factors most significantly influence the success of an attack. This, in turn, enables targeted optimization of security training, policies, and control measures.

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In the system of engineering education, the integration of fundamental and professional training is very important. However, to ensure this integration, a deep mastery of fundamental disciplines is necessary, and among them, mathematical subjects form the systemic foundation. Therefore, ensuring the integration of mathematics with fundamental disciplines is one of the most important tasks in the process of forming the professional competence of an engineer.

Another important aspect of the integration of mathematics and social engineering is the automatic detection and prevention of threats through algorithmic approaches. Today, artificial intelligence and machine learning technologies enable the analysis of large volumes of data, the detection of anomalies, and the prediction of attack likelihood. For example, phishing attacks can be identified based on the content of email messages, sender addresses, access logs, and user behavior. Additionally, algorithmic systems can be developed to assess the level of trust among users and to prevent the spread of malicious messages. These approaches increase the speed and efficiency of detecting social engineering attacks and taking countermeasures.

The methodology of mathematics is related to the subjects of pedagogy, psychology, and child psychology. The methodology of elementary mathematics is closely connected with the teaching methodologies of other subjects (with mathematics as the core subject, as well as methodologies for teaching the native language, natural sciences, drawing, and other subjects). The teacher aims to develop students' skills in performing mental operations such as analysis, synthesis, comparison, generalization, and classification. It is very important for the teacher to take this into account in order to correctly implement interdisciplinary connections. "Innovative activity requires the teacher to direct their mental, intellectual, and physical energy toward a specific goal, to acquire knowledge, skills, and competencies, to supplement practical activities with theoretical knowledge, and to develop abilities in cognition, design, communicative speech, and organizational skills"[2, 78].

The subject of mathematics plays a major role in developing a person's intellect and attention, in fostering determination and willpower to achieve set goals, in



ensuring algorithmic discipline, and in expanding thinking. Mathematics is the foundation of understanding the world; it reveals the specific laws of events and phenomena around us and plays an important role in the development of production, science, technology, and engineering. Therefore, mathematical culture is considered an integral part of universal human culture.



Mathematical modeling is the process of representing, analyzing, and predicting real-life processes, events, and systems using mathematical methods. It is widely used in almost all fields of science and technology, including physics, economics, biology, engineering, medicine, and social sciences. A mathematical model is a simplified representation of a real object or process that serves to reduce complexity while preserving the essential characteristics.

“The process of mathematical modeling consists of several stages. First, the problem under study is identified and its objective is determined. In the next stage, the important factors of the real process are selected, and the relationships between them are expressed in the form of mathematical equations, formulas, or algorithms. Then the constructed model is solved, meaning calculations are performed. In the final stage, the obtained results are analyzed and compared with the real situation, and the correctness of the model is evaluated”[3, 37].

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Mathematical models can be of various types. For example, deterministic models are based on exact laws and do not take randomness into account. Stochastic models, on the other hand, consider random factors and are built based on probability theory. Likewise, static models do not account for the time factor, whereas dynamic models study the changes of a process over time.

RESULTS


The findings of the conducted research showed that the integration of social engineering and mathematics expands the possibilities for deeper analysis of social processes and their effective management. Through the mathematical models and statistical analyses developed during the research, some important patterns of social systems were identified, and their practical significance was substantiated.

Results of Mathematical Modeling of Social Processes.

During the research, a number of mathematical models representing social processes were developed. In particular, as a result of modeling population growth, information dissemination, social behavior, and decision-making processes, it was determined that these processes are governed not by randomness, but by specific mathematical laws. Models constructed based on probability theory and differential equations made it possible to predict stability and instability states in social systems in advance. The results obtained indicate that mathematical modeling enables the quantitative assessment of the dynamics of social processes. In particular, it was found that there is a direct relationship between the speed of information dissemination and the response of social groups to it. This fact is of great importance in developing targeted information strategies in social engineering processes.

Statistical Analysis Results

Based on the results of statistical analysis, interrelationships between social factors and mathematical indicators were identified. Correlation and regression analyses showed that certain social indicators have a significant impact on the

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parameters of mathematical models. In particular, it was proven that population size, education level, and access to information directly influence the development rates of social processes. Through mean values and variance indicators, differences between social groups were identified, and their mathematical expressions were developed. These results demonstrate that, alongside qualitative observations, it is necessary to use quantitative indicators when analyzing social systems.

Effectiveness of the Integrative Approach

The research results confirmed that the integration of social engineering and mathematics is more effective compared to traditional approaches. By using mathematical methods, it became possible to reduce subjective interpretation of social processes and analyze them based on accurate and reliable data. “It was found that models developed on the basis of the integrative approach serve to optimize the decision-making process in managing social systems. In particular, the advantages of mathematical approaches became clearly evident in forecasting social problems, assessing risks, and comparing alternative solutions” [4, 39].

Practical Significance of the Results

The obtained results are significant because they demonstrate practical applicability in the field of social engineering. It was established that, using mathematical models, it is possible to plan social projects, assess their expected outcomes in advance, and utilize resources efficiently. This is particularly important in areas such as social management, education, information security, and public relations. Moreover, the research results indicate the necessity of teaching social engineering and mathematics in an integrated manner at higher education institutions. Such an approach helps students develop analytical thinking skills and form a scientifically grounded approach to social processes.



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Overall Results

Overall, the research results confirmed that the integration of social engineering and mathematics is an effective scientific tool for studying social processes. The findings obtained through mathematical modeling and statistical analysis expand the possibilities of identifying the laws of development of social systems, as well as managing and forecasting them. This demonstrates the scientific and practical significance of this integrative approach.

DISCUSSION

The results of this study showed that the integration of social engineering and mathematics is an effective and scientifically grounded approach for analyzing social processes. The obtained findings expand the possibility of studying social phenomena not only qualitatively but also based on quantitative indicators. This provides higher accuracy and reliability compared to traditional social analysis methods. During the research, the developed mathematical models served to reveal the internal structure and development dynamics of social processes. In particular, the patterns identified in the models of information dissemination and social behavior are of significant importance in the practice of social engineering. These findings indicate that changes occurring in social systems are often not random but are formed based on certain mathematical relationships. This expands the possibilities of forecasting and managing social processes in advance. This indicates the necessity of using mathematical and statistical approaches in the decision-making process in the field of social engineering. At the same time, the statistical results also revealed that social processes are complex and multi-factorial, which means that it is difficult to fully cover all factors in modeling. It should also be noted that the study has certain limitations. In particular, mathematical models reflect the ideal state of social processes and cannot fully encompass all psychological, cultural, and subjective factors in real life. In addition, the quality and volume of statistical data directly affect the accuracy of the results. In future research, these limitations can be reduced by using a broader empirical data base and applying more complex models.

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Overall, the discussion results show that the integration of social engineering and mathematics creates an important methodological foundation for the scientific analysis, forecasting, and management of social processes. This approach enables the adoption of precise, systematic, and effective decisions in solving social problems and represents a promising direction for future scientific research.

CONCLUSION

This study confirmed that the integration of social engineering and mathematics is an effective scientific approach for studying social processes. It was found that the use of mathematical modeling and statistical analysis methods during the research expands the possibilities of identifying the laws of development of social systems, as well as quantitatively assessing and forecasting them. At the same time, the limitations identified during the study outline new directions for future scientific research.

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