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APPLICATION SYSTEMS ENGINEERING THEORY IN SOLVING SYSTEM ANALYSIS TASKS

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Abstract

This study is devoted to the implementation of new effective proposals related to the improvement of the next version of the system. Such proposals increase the reliability of the software and reduce the number of user complaints. Particular attention is paid to the procedure for justifying proposals submitted for inclusion. The basis of the justification is standardized tools, with the help of which the content of each software solution is checked for compliance with the property of emergence.

Keywords: propositions, superposition, emergence, synergy, independence, standard, quality

1 Introduction

The modern understanding emphasizes systems as organized wholes where the behavior of the entire system cannot be fully understood by analyzing parts in isolation. Instead, system analysis now focuses on interactions, feedback loops, and goal-directed processes. It should be noted that the peculiarity of emergence is the numerous definitions and algorithms of its proof. In this regard, a special place in the work was occupied by the analysis of the content of the property of systemicity. As a result, seven important circumstances related to the analysis of the definitions of systems and four grounds concerning the presence of a system in an emergent state were identified [1-2].

1. The diverse historical definitions of a *system* converge on a central idea: a system is an organized set of interconnected components working together toward a defined purpose.

2. Through system theory and system analysis, this concept has matured into a powerful analytical tool that emphasizes structure, function, interaction, and feedback.

3. Understanding systems in this way enables us to model complexity, identify relationships, and create solutions that reflect the dynamic nature of real-world problems.

4. Emergence is a fundamental characteristic of complex systems, where novel properties and behaviors arise from the interactions among individual components.

5. These properties cannot be fully understood or predicted by analyzing the parts in isolation. As systems grow in complexity – technologically, socially, and biologically -recognizing and managing emergent behavior becomes essential.

6. Rather than resisting emergence, system designers and analysts must adopt holistic, adaptive approaches that embrace uncertainty and encourage desirable outcomes.

7. Understanding emergence allows us to better design, anticipate, and evolve systems in a dynamic and interconnected world.

The study yielded practical recommendations for substantiating the Emergence property.

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2. These properties cannot be fully understood or predicted by analyzing the parts in isolation. As systems grow in complexity – technologically, socially, and biologically–recognizing and managing emergent behavior becomes essential.

3. Rather than resisting emergence, system designers and analysts must adopt holistic, adaptive approaches that embrace uncertainty and encourage desirable outcomes.

4. Ultimately, understanding emergence allows us to better design, anticipate, and evolve systems in a dynamic and interconnected world.

The conducted analysis allowed to reveal an important contradiction. Many applications of system theory, incompatible with each other, are used within the same technology. Based on this, the research problem was identified “It is impossible to find a one-to-one relationship between applications of a system without a means of testing them for the property of emergence”. Thus, the methodological provisions of system theory are used as the object of research. Fig. 1 shows the framework of the study.

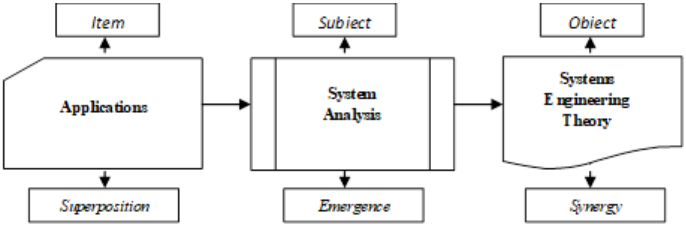

Figure 1. Research Conceptual Scheme

During the system analysis managed to link typical applications with systems theory.

Systems Engineering Theory grounds is the foundational principles and frameworks that guide the design and management of complex engineering systems [3-5]. This concept emphasizes the interrelationships between various components of a system and the necessity to consider human needs and societal contexts in engineering practices.

2 Tasks Standardization

The developed approach allows, using the theory of systems, to ensure the independence of the analysis from external influences. Thus, a synergetic effect is ensured as a result of the imposition of new applications on the current model of the system. The goal of the study is to develop a procedure that provides effective communication between different applications of systems theory. In accordance with the stated goal, it is necessary to solve four tasks of different durations.

The first task, dedicated to assessing the current situation, is aimed at finding a model for connecting the applications used (ROI & Company Value).

The second task is aimed at considering options for assessing the activities of an enterprise over a short period of time (up to a year)

The third task is related to the selection of the best medium-term scenario for the development of the organization (up to three years)

The fourth task is devoted to the development of instructions for the sustainable functioning of the enterprise in the long term.

In the course of solving the identified problems, requirements were developed for the development of an enterprise standard, on the basis of which the organization is protected from accepting ineffective proposals for improving the system. Table 1 shows the results of applying the standard during various interactions with the organization's users.

Table 1

Example of using the organization standard in various applications

	Questionnaire	**Presentation**	**Practical example**	**Executive Summary**
Contradiction	"Do you feel more productive at home or in the office?"	Conflicting views on productivity highlight systemic contradictions in work environments.	Disagreement between ROI and Company Value highlights contradictory evaluation approaches.	Emphasizes need to resolve contradictions between theoretical models and practical outcomes.
Problem	"What are your biggest struggles while working remotely?"	Identifies lack of alignment between system applications and user realities.	One-to-one correspondence between indicators (e.g. ROI and Company Value) is not established	Defines core system integration problems impacting decision-making processes.
Purpose	"What would help you work better remotely?"	Sets the direction for harmonizing diverse system applications.	Procedure must enable reliable translation of data into meaningful insights.	Articulates the objective of bridging system theory and application.
Tasks	List 3 tools you use daily to stay organized.	Lists phases of work: identifying gaps, modeling tools, scenario evaluation, and instructions creation.	ROI & Value mapping-> short term analysis--> medium-term strategy --> long-term sustainability	Breaks down system integration into manageable phases with different time scopes.

Results	"Has your productivity improved or worsened since going remote?"	Highlights measurable impact of proposed systems integration.	Indicates abnormal system state due to misaligned inputs, leading to inaccurate decisions.	Stresses the importance of complete and accurate input data to obtain reliable system outcomes.
Novelty	"What is something new you've done since working remotely?"	Introduction of emergence testing and contradiction mapping in early system design phases.	Use of intermediate parameters and diagnostics to refine the model.	Proposes innovation in system analysis by integrating theory-based diagnostics from the start.

Thus, the presence of a standard allows you to protect the system from ineffective actions, which allows you to increase the level of trust on the part of all participants in the organization..

3 Conclusions

The practical results of the study showed that the developed procedure allows organizing software testing in accordance with the requirements of the standard. During its use, organizational type errors (errors of the second kind according to Deming) are identified, which are difficult to determine using typical software debugging tools.

The scientific novelty consists in the fact that unique standardized means are used in the process of proving the reliability of software. They are based on the provisions of the theory of systems, such as the study of emergence, the analysis of complaints in terms of commoditization, etc. As a result, the image of the software product and the reputation of the developers are enhanced.

System analysis, when grounded in Systems Engineering Theory, enables effective navigation of complexity through structured concepts like emergence and contradiction. The Standard Design demonstrates how theoretical principles can be practically applied to improve decision-making and system outcomes.

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