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On The Procedural Enhancement of Architectural Management Processes in Georgia

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Abstract

"Quality is achieved through planning and integration; this applies both to the product and to the work processes."

(Rumane, 2017)

This paper explores architectural design processes through the Systems Engineering V-Model, critically examining practices within Georgia's construction sector. The study focuses on challenges typical of transitional economies, where weak coordination and fragmented processes result in systemic inefficiencies. Decision-making authority is often concentrated in the hands of capital owners, while developers, architects, regulators, and suppliers are seldom integrated as parts of a unified process. Consequently, collaboration frequently relies on personal trust rather than structured systems. Georgia's construction industry exemplifies these tendencies, marked by a weak client/developer institution, bureaucratic barriers, and skill shortages. Under such conditions, attention is typically directed toward the final product, with limited focus on production and organizational processes. A Central Focus Of The Paper Is The **Architect's Evolving Role** — Understood Not Merely As A Designer, But As A **Systems Integrator** Responsible For Managing Interdisciplinary Interactions And Organizing The Design Process Efficiently. Methodologically, the study employs qualitative analysis, combining literature review, case studies, and semi-structured interviews with architects. Comparative sampling aligns theoretical models with real-world practices. The Systems Engineering approach, highlights the sequence and interdependence of design stages. Ultimately, the research establishes an integrated framework linking theory and practice, offering insights for academia, industry, and policy development in Georgia's construction sector. The Study Seeks To Answer Two Main Questions: How does the **design process** operate according to the **current practices in Georgia**? And How can **Systems Engineering approaches** be applied to **enhance the efficiency and effectiveness** of the design process in Georgia? The findings reveal that in the contemporary context, the **architect's role extends beyond authorship** — the architect becomes a **coordinator with systems thinking capabilities**, responsible for the **entire lifecycle management** of buildings. Within this framework, the **V-model of Systems Engineering** is examined as an effective tool for process management and optimization. The analysis of international practice demonstrates that the SE **V-model** provides a foundation for improving **quality control**, enabling **more rational resource allocation**, and ensuring **greater transparency** in project management. In conclusion, this research bridges **theoretical analysis** and **practical experience**, contributing significantly to both the **academic understanding** of systems-based architectural processes and the **advancement of Georgia's construction industry**.

Key words: Systems engineering; Systems thinking; Integrated approach.

Relevance of the topic

For countries with transitional economies, the construction sector is typically characterized by rapid and intensive capital investment. In this process, the ultimate decision-maker is usually the owner of the capital, while other participants — the developer, architect, regulatory bodies, and suppliers — are seldom perceived as parts of a unified process. Consequently, their involvement in decision-making stages is often excluded. Collaboration among these actors is frequently based on personal relationships and trust rather than on a structured and transparent systemic framework.

Naturally, Georgia is no exception in this regard — similar tendencies are clearly observable in the local construction sector. Within this context, key challenges include a weak institutional framework for clients and developers, bureaucratic obstacles, and a deficit of professional competencies. Despite the complexity and dynamism of the construction industry in Georgia's recent history, the role of the architect has long been overlooked.

However, a growing demand has emerged for architects capable of integrating various engineering disciplines, shaping cohesive end products, and organizing supply chains in a way that meets both client interests and the challenges of a rapidly changing environment. This requires not only creative thinking but also a solid understanding of project management principles and systemic approaches.

In large-scale and complex projects involving multiple stakeholders with diverse business interests, the architect naturally assumes a central role in managing the workflow. Their responsibility extends far beyond the integration of physical components. The contemporary construction market compels architects to adapt to new conditions and develop unified management mechanisms — the so-called **design management model**, which transforms the architect from a mere executor into a **systems integrator**.

Within this framework, the **V-model of systems engineering** gains particular significance as a fundamental tool for the integration and management of multifactorial processes. This is especially relevant in countries with transitional economies, where the principal issue lies in the lack of systemic organization. Implementing the V-model in such contexts may serve not merely as an added value but as a **strategic necessity** for sustainable development and modernization of the architectural management process.

Scientific novelty

Industrial Innovations

- **Process Optimization:**
  The planning, coordination, and quality control of projects become more structured and predictable, significantly reducing inefficiencies in both time and financial resource allocation.
- **Strengthening Interdisciplinary Collaboration:**
  The collaboration between architects and engineers becomes more clearly organized, enhancing both professional communication and the overall quality of project outcomes.
- **Increased Competitiveness:**

  Companies gain the capacity to implement modern, best-practice–based procedures, which is particularly important for participation in the global construction market.

Academic Innovations

- **Modeling of Educational Programs:**
  The research findings may be utilized by universities to develop new academic courses and modules that integrate the principles of the **Systems Engineering (SE) model** into architectural professional practice.
- **Expansion of Scientific Discourse:**
  Interpreting the role of the architect through the lens of systems engineering creates a foundation for new research directions, particularly in the fields of **design management** and **interdisciplinary process studies**.

Innovations for State Regulatory Institutions

- **Support for Standardization:**
  The research can serve as a resource for governmental agencies in developing construction and design process standards based on contemporary best practices.

- **Monitoring of Quality and Efficiency:**
  The implementation of standardized procedures enables the reduction of financial and temporal losses while increasing systemic transparency across the sector.
- **Enhancement of Policy and Regulation:**
  The introduction of systemic approaches to project planning and management establishes a basis for creating more effective, long-term, and outcome-oriented regulations.

Overall, this research integrates both **theoretical and practical values**. It not only represents an academic contribution but also exerts a **direct influence on industrial practice** and the **formation of state policy**. As a result, the study can be considered a significant tool for enhancing the **efficiency, quality, and international alignment** of Georgia's construction sector.

Goal

The aim of this study is to analyze the **architectural design process** through the framework of the **Systems Engineering (SE) V-Model** in order to identify deficiencies and inefficient mechanisms present in Georgia's current design practice. The research focuses on recognizing the challenges and problems that hinder effective process management and negatively affect the quality of final outcomes.

Furthermore, the study seeks to develop **recommendations** that will contribute to improving the **efficiency and effectiveness** of architectural design processes. These recommendations will be directed toward the **standardization and integration** of design workflows by applying contemporary principles of **systems engineering**, specifically those embodied in the **V-Model approach**.

To achieve the stated research goal, the study was conducted within the analytical framework of the **SE V-Model**, addressing the following key questions:

- How is the architectural design process currently conducted within the existing practices of Georgia?
- How can systems engineering approaches be applied to enhance the efficiency and effectiveness of the design process in Georgia?

Research object

The subject of this research is the **role of the architect** examined within the context of **systems engineering** — specifically, how the architect operates within the frameworks of **systemic thinking** and **process management**.

The discussion of this topic can be approached from **two principal directions**:

- **Practical Dimension:**
  This involves analyzing the architect's participation in the planning and coordination of design processes, as well as defining their roles and responsibilities within an interdisciplinary team structure.
- **Conceptual Dimension:**
  This encompasses the understanding of the architect's function as a **conceptual capacity for process management and integration**, which provides the foundation for analyzing process efficiency and developing theoretical models.

Methodology

History of systems engineering

The term **"system"** originates from ancient Greek linguistic roots, denoting an *assembly, combination,* or *organization into a unified whole*. The term **"engineering,"** in turn, refers to the process of realizing systems — that is, integrating interdependent components in such a way that they collectively perform a common function (Gorod, 2008). Historically, the development of **systems engineering** began within the **defense industry of the United States**. Initially, it was applied to the planning and management of complex technological systems, such as aircraft and submarines. Over time, this approach evolved into a new discipline of **organizational management**, and by the 1970s, it began to be integrated into **civil industries**, particularly within the field of **construction** (Alexander, 2011). The systems engineering process represents a **comprehensive, iterative, and dynamic approach** to problem-solving, employed by project teams in a **top-down sequence**. Its objective is to transform existing **needs and requirements** into a set of **systematic product and process characteristics** that accurately reflect the project's goals and functional capabilities. The process develops progressively — each subsequent level introduces additional definitions and details, thereby giving the system an increasingly complete and coherent form (see figure #1). This process encompasses several **key components**, including:

- input and output data;
- requirements and functional analysis;
- design and development activities;
- verification and validation procedures, and
- control and feedback cycles (Lightsey, 2001).

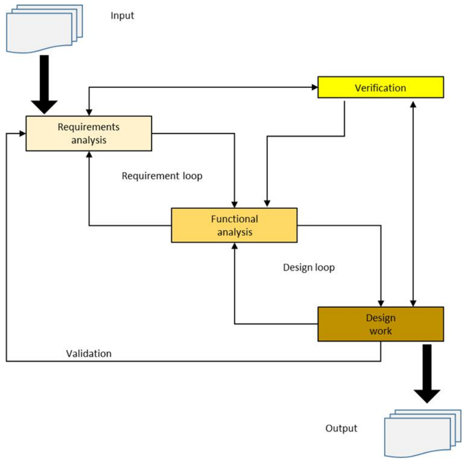

Figure #1 – Systems engineering process

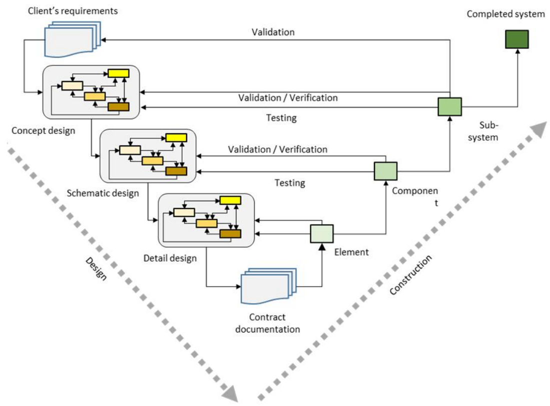

Figure #2 – Systems engineering V- model

In the design process, the above-mentioned scheme is applied **sequentially**, forming what is known as the **V-Model** (see figure #2). This model represents one of the most recognized and established approaches in **systems engineering**, emphasizing the **key stages of a project's life cycle** — *requirements analysis, system design, integration,* and *testing*.

The **primary objective** of the V-Model is to demonstrate the **sequential structure** of the process and the **significance of each phase** in achieving the project's final outcome. It places particular emphasis on the necessity of **verification and validation** at the conclusion of every stage (Forsberg, 1991), ensuring both the **accuracy of decisions** and the **alignment of the system** with its initial objectives.

One of the model's principal advantages lies in its **transparency and continuous feedback**, which allows for **step-by-step evaluation and correction** whenever necessary. In the **construction industry**, the V-Model is frequently employed to manage the **project life cycle**, as illustrated in Figure #2 (ProRail, 2013). The presented V-Model demonstrates the stages of project development and the importance of the interconnections between them. Each stage is discussed below (Lightsey, 2001).

Requirements Analysis - The first step in the systems engineering process is the **analysis of input requirements**, which serves to define both **functional** and **performance-related** requirements. At this stage, the needs of stakeholders and clients are formulated, establishing what the system must do and how well it must perform. The architect collaborates closely with the client to define the **project's goals and intended functions**.

Functional Analysis and Allocation - Through requirements analysis, **primary and secondary functions** are identified, creating a **hierarchy of relationships** among them. The subsequent step involves describing the project in terms of which element performs which function and what resources are required for each. During this phase, architects develop **schematic layouts and specifications** that describe the final product (the building or structure), spatial organization, and the **integration of adjacent engineering systems** into a coherent whole.

Requirements Loop - The execution of functional analysis and allocation leads to a deeper understanding of the requirements, followed by their **reassessment and validation**. Each identified function must be traceable to a specific requirement. This **iterative process**, known as the **requirements loop**, involves re-evaluating established demands and verifying the preliminary product's functionality to determine how precisely it meets the stated requirements.

Design Activities - This stage involves defining the **physical elements of the product** (i.e., construction components) that together form the complete structure. The resulting outcome is often referred to as the **physical architecture**. Each element must satisfy at least one functional requirement and must be capable of operating in conjunction with the other elements. At this point, architects and related specialists collaborate to ensure **design coherence and system integrity**.

Design Loop - Similar to the requirements loop, the **design loop** represents the iterative review of the **functional architecture** to confirm that the synthesized physical elements can perform the necessary functions. Here, detailed verification is carried out to assess how precisely each architectural component meets the design specifications.

Verification - This phase, known as the **verification cycle**, involves validating each requirement at every stage of project or product development. Verification methods include **inspection, demonstration, analysis** (such as modeling and simulation), and **testing**, all of which contribute substantially to **quality management** in both the product and the workflow. During this stage, **individual components as well as the complete building** are tested for compliance and performance.

Validation - Validation entails **system analysis and control**, encompassing a set of **technical management activities** used to measure progress, evaluate alternatives, and document data and decisions. The goal of system analysis and control is to ensure that the project is **ready for operation** and **complies with all technical and functional requirements**.

Research methodology

This study employs a **mixed-method approach**, integrating **qualitative analysis** with **theoretical research**. The methodology is grounded in three main components:

- A review of relevant **literature and sources**,
- An examination of the **historical development of systems engineering**, and

- A **comparative analysis of architectural practice examples**.

By nature, the research is primarily **qualitative**, as it seeks to explore and conceptualize the **role, functions, and processes** of the architect within the framework of **systems engineering**. **Quantitative data** play a secondary role — they are used mainly to **validate existing studies** and to **strengthen comparative arguments**.

The chosen methodological approach is justified by the **specific characteristics of the topic**: understanding the architect's role within the context of systems engineering requires not only **statistical analysis**, but also the **study of conceptual and procedural models**. The examination of practical case studies enables the identification of **architectural behavioral patterns**, **functional responsibilities**, and the **barriers** that emerge in relation to **systemic integration**.

The **theoretical analysis**, on the other hand, is essential for comparing existing **literature, international standards,** and **methodological models**, forming a basis for developing an **independent analytical framework and structural model**.

The research is based on the **Pattern Matching Method** (Almutairi, 2014), which involves comparing **theoretical and empirical models** to determine the degree to which **theory corresponds to practice**.

This approach is divided into **three main stages**:

1)Description of the Theoretical Model – This stage includes the review of existing literature, including theories of architecture, interdisciplinary approaches, international standards (e.g., **ISO/IEC/IEEE 15288**), and specialized sources.
Based on this analysis, the structure of the **SE V-Model** and its constituent stages were developed, along with a set of **thematic questions** (see Table #1) used for evaluating various companies and practical case studies.

The **comparative phase** follows, in which the collected data are evaluated against the theoretical model, enabling the identification of **correspondences and discrepancies** between theory and practice.

Table #1- Questionnaire

#	Systems Engineering Methods
1	Client requirements analysis
1.1	Do you conduct a **stakeholder analysis** (power vs. Interest matrix)?
1.2	Do you conduct a **survey of end users**?
1.3	Do you prepare a **project brief (design assignment)**?
2	Functional analysis
2.1	Are **requirements translated into functions**?
3	Requirements analysis loop
3.1	After **function allocation,** do you **compare the results** with the original brief?
3.2	Do you revise or adjust the brief?
3.3	Do you **add new requirements** during the process?
4	Design work
4.1	Is the **design process divided into stages?**
4.2	Do you **develop alternative design options?**
4.3	Do you **compare alternatives using checklists?**
4.4	Do you **analyze and design system interfaces?**
5	Design analysis loop
5.1	Do you **check whether the project meets its intended functions?**
5.2	Do you **adjust or refine functions** when needed?
6	Verification
6.1	Do you **evaluate whether the final project complies with the brief**?
6.2	Do you **document verification results**?
7	Validation
7.1	Do you **compare the completed project with the requirements of stakeholders and end users**?
-	Please name one problem?
-	Please describe what solution you see?

2) Comparison of Empirical Data with the Theoretical Model

The **second stage** involves comparing the **empirical data** obtained from professional practice with the **theoretical model**. For this purpose, **case study descriptions** were examined, and **structured interviews** were conducted with practicing architects.

The objective of the interviews was to **collect and evaluate empirical professional experience** using the **questionnaire presented in Table #1**. The obtained data were **organized and ranked** by company. At the subsequent stage, each company's evaluation was summarized, and an **average index** was calculated based on the following scale:

- (+1) – Fully corresponds;
- **(-1)** – Does not correspond;
- (0) – Partially corresponds (or is implemented in a modified form).

For each stage of the **Systems Engineering (SE) V-Model**, a corresponding **evaluation score** was determined, supplemented by **qualitative comments** derived from the interview data. As a result, it was possible to establish **the degree of correspondence** between each company's practice and the SE V-Model, as well as to **identify the areas of divergence** between theory and practice.

3)Analysis and Interpretation of Comparative Results

The **third stage** of the study consists of **interpreting the results** of the comparison. The analysis determines **the extent to which the existing architectural practice in Georgia** aligns with the **theoretical V-Model of Systems Engineering**, and identifies **which phases deviate most significantly** from the model.

Based on the findings, **conclusions and recommendations** were formulated, aimed at improving the **architectural design process** and transforming it into a **more efficient and structured form**.

Additionally, the research highlights **specific domains requiring further investigation** and **methodological refinement**, particularly in relation to **interdisciplinary collaboration** and **process integration**. The overall process of the comparative analysis is illustrated in **Figure #3**.

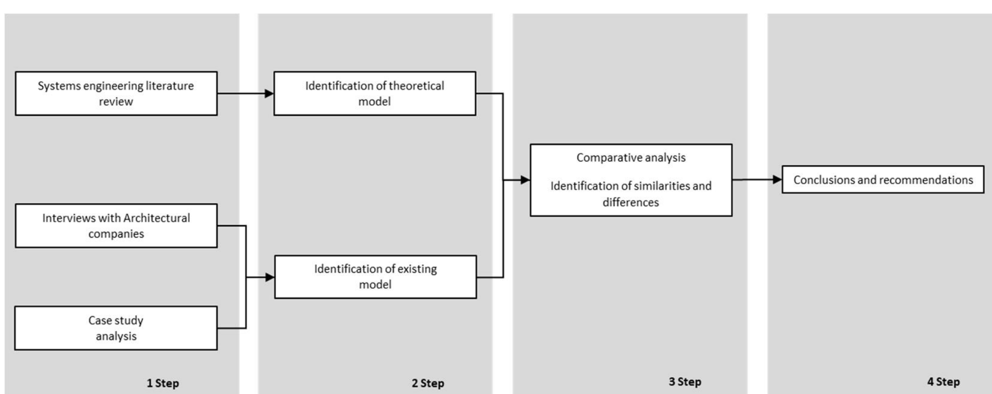

Figure #3 - Logical Diagram of the Sample Comparison Process. Adapted from Yin (2003)

Main research findings

By summarizing the results of the **interviews** and **practical case studies**, and by calculating their **average index**, the overall state of practice was revealed to be within the range of **0.2 < 1**, which is **below the average level**.

This result indicates that the **Systems Engineering (SE) approaches** remain relatively **new and underdeveloped** within Georgia's professional architectural community. Their **systematic and consistent application** is not yet established (see Table #2).

Table #2 – Cumulative analysis of results

#	Systems Engineering Method	Average Cumulative Indicator of SE Methods	Fully Corresponds (%)	Does Not Correspond (%)	Partially Corresponds (%)
1	Client Requirements Analysis				
1.1	Stakeholder Analysis (Power vs. Interest)	-0.1	33%	42%	25%
1.2	End User Survey / Requirements Identification	0	33%	33%	34%
1.3	Project Brief (Design Assignment)	0	33%	33%	34%
2	Functional Analysis				
2.1	Translation of Requirements into Functions	0.3	42%	8%	50%
3	Requirements Analysis Loop				
3.1	Comparison of Allocated Functions with the Project Brief	0.1	33%	25%	42%
3.2	Adjustment / Revision of the Brief	0.3	58%	25%	17%
3.3	Addition of New Requirements	0.3	50%	17%	33%
4	Design Work				

4.1	Division of the Design Process into Stages	0.7	67%	-	33%
4.2	Development of Alternative Design Options	0.7	67%	-	33%
4.3	Comparison of Alternatives Using Checklists	-0.2	17%	33%	50%
4.4	Interface Development and Coordination	-0.2	20%	20%	60%
5	Design Analysis Loop				
5.1	Evaluation of Whether the Project Meets Functional Requirements	0.3	42%	17%	42%
5.2	Adjustment of Functions	0.3	42%	8%	50%
6	Verification				
6.1	Assessment of Final Project Compliance with the Brief	0.7	67%	-	33%
6.2	Preparation of Verification Records	0	25%	25%	50%
7	Validation				
7.1	Comparison of the Project with Stakeholder and End User Requirements	0.1	33%	25%	42%
Cumulative Average Indicator of Compliance		0.2			

The above findings serve as a **critical indicator** that the existing processes within Georgia's construction and architectural industries operate in a **spontaneous and unsystematic manner**. The industry lacks the mechanisms necessary for **comprehensive analysis, optimization, and adaptation** of design workflows to real-world conditions.

Client Requirements Analysis - According to **Systems Engineering (SE) methodology**, the analysis of client requirements (see Table #2, sections 1.1–1.3) involves evaluating and positioning stakeholders through a **Power vs. Interest Matrix**. This stage should be preceded by **close communication and surveys** with end users, the results of which must be formally documented in a **project brief** approved by the client. This document forms the **foundation for initiating design work**. In the Georgian market, however, such formal assessments are **rarely conducted**. Architects often attempt to **identify client needs independently**, collecting the necessary data themselves. Additionally, the market's small scale means that **clients and designers often have personal relationships**, leading to what respondents referred to as a **"friendly" or "informal" ('jigruli') approach**. This tendency **weakens documentation practices** and undermines procedural consistency. Moreover, many practitioners believe that formal procedures **diminish trust**; they prefer to manage processes in a **more personal and flexible manner**, assuming that official methods **add no perceived value or competitive advantage**. Another recurring issue is that **clients themselves are often uncertain** of what they want. Their requirements and expectations are frequently **defined during the design process** in collaboration with the architect. Determining whether such a practice is **economically viable** for design firms could form the basis of **a separate study**.

Functional Analysis - In SE methodology, **functional analysis** (see Table #2, section 2.1) translates client requirements into **specific functions** — outlining the **functional zoning** and **technical characteristics** of the building systems that will guide subsequent project development. The study revealed that **all Georgian firms** implement this stage to some degree; however, **only about 50%** do so **consciously and systematically**. The main challenges identified include **lack of information and expertise**, as well as **accelerated project timelines**, which pressure firms to complete designs with minimal revisions. In many cases, **deficient functional analysis** has led to **delays or suspension of projects**. A properly executed functional analysis allows both the design team and the client to **evaluate technical and financial alternatives early** and to make **informed, cost-effective decisions** before advancing to later stages.

Requirements Loop - In SE methodology, the **requirements loop** (see Table #2, sections 3.1–3.3) occurs after client needs have been defined and translated into functions. It involves **taking a step back** to assess the results before moving forward. According to the findings, this loop is often perceived in Georgia as **redundant and time-consuming**. Yet, returning to re-evaluate early-stage outputs is **crucial** to preventing **functional, financial, and scheduling risks** later in the project. This oversight reflects a lack of structured quality assurance in the early design stages.

Design Work - Per SE methodology, the transition to **active design** begins **only after the completion of functional analysis**, once all components and their technical characteristics are clearly defined (see Table #2, sections 4.1–4.4). In this regard, **Georgian practice shows**

relative improvement, as all licensed design firms must comply with **legislative requirements** mandating **step-by-step project development**. The degree of design detailing therefore progresses gradually. Additionally, many Georgian firms **collaborate with international companies** and have **experience in global projects**, adopting — at least partially — **best international practices**. Nevertheless, certain **challenges remain**. One respondent from *Company D* explained: "Sometimes we try to close one stage before moving on to the next; sometimes we succeed, sometimes not... It depends on the client. Larger organizations with management teams follow structured steps; smaller LLCs are more spontaneous. When relationships are close, clients may later recall new ideas, forcing us to return to the conceptual stage." This observation highlights the **varying levels of client preparedness**. When clients lack technical awareness, it becomes advisable to engage **professional management teams** or **client representatives** to oversee project coordination — a practice that, according to the study, is **gradually emerging** in Georgia. While **professional designers** generally maintain **logical sequencing** and **stage discipline**, **deviations** do occur (often at the client's request), leading to **delays, rework, and risks** related to quality and scheduling. Developing and institutionalizing the **client's role** could thus become an important subject for **future research**.

Design Loop - The **design loop** (see Table #2, sections 5.1–5.2) entails **reassessing the correspondence** of the produced output with the predefined functions and technical specifications. It serves as a **secondary verification cycle** ensuring that, at project completion, the outcome fully meets client requirements and functional objectives. However, most practicing architects **do not recognize the necessity** of this step. As one respondent from *Company T* stated: "When you submit stages incrementally, each phase is checked anyway. In architecture, this is common, but in urban planning, it's rare because the core function doesn't change." Another from *Company A* added: "If the client follows us through to the end — and doesn't make arbitrary changes — then the project always aligns with the functions."

Once again, this reveals the **impact of the client's institutional maturity**, which remains a potential topic for **further investigation**.

Verification - In SE methodology, **verification** (see Table #2, sections 6.1–6.2) involves evaluating the **final product's compliance** with the **project brief** and maintaining appropriate documentation. This stage parallels the **standard approval and handover procedures** used in professional practice — the client, together with the design team, reviews the final design and cost documentation. Ideally, if the process has been **systematically managed**, no major discrepancies should arise. As one respondent from *Company D* noted: "If the client signs off on the project, that automatically means it meets the brief." However, exceptions persist: "We've sometimes had to make last-minute corrections ourselves when we saw inconsistencies" (*Company K*). "The design team acts as the regulatory unit — we make the corrections ourselves" (*Company I*). In practice, **final inconsistencies often emerge only at the handover stage**, suggesting that **systemic gaps** exist earlier in the process. Discovering major issues this late underscores the need for **rigorous verification throughout all stages**, not merely at the end. This finding indicates that **design workflows in Georgia require refinement and standardization**, and that **deficiencies in verification** merit **further targeted research**.

Validation - According to SE methodology, **validation** (see Table #2, section 7.1) involves assessing and confirming the **final product's compliance with all stakeholder requirements**. While this step is less relevant for **small-scale projects**, it is **critical for large and urban-scale developments**. Best international practices emphasize the **necessity of this phase**, as one respondent from *Company I* noted: "There must be a system of indicators used by the implementing authority — for example, the municipality. Evaluation should address not only the design quality but also the quality of implementation. Without monitoring, adaptation becomes impossible." In the Georgian context, however, this stage often takes alternative forms: "If we count public review as part of the process, then yes — but generally, everything is embedded earlier and checked during the first phase" (*Company T*).

Some firms lack such experience entirely: "We haven't really had such cases in practice — we simply don't have clients who require that" (*Company V*). Others exclude validation altogether: "I have no experience with that" (*Company E*), though later admitting, "We do end up making corrections at the final stage." (*Company E*). These insights reinforce the broader conclusion that **design processes in Georgia remain largely spontaneous and under-optimized**. The industry lacks comprehensive systems for **analyzing, refining, and adapting** project workflows to evolving real-world conditions.

Application of the research results

The findings of the present study may serve as a **foundation for regulating the construction market in Georgia**, a process that should be **explicitly initiated and led by the national government**.

Conclusion (Answers to the research questions)

How is the architectural design process currently conducted within the existing practices of Georgia?

The study revealed that **companies engaged in state-funded projects** tend to align more closely with the **Systems Engineering (SE) model** than those in the private sector. This is largely due to the fact that **public projects are often financed by international institutions** (such as the **Asian Development Bank**), which require adherence to **Western standards** — including clear task formulation, phased control, documentation evaluation, and **lifecycle**

monitoring of infrastructure. In contrast, **private sector projects** generally lack comparable institutional mechanisms, except in cases where **foreign design-management firms** lead the process. Consequently, the work of architectural companies becomes **dependent on external factors**. An **underdeveloped client institution**, **bureaucratic inefficiencies**, **outdated methodologies**, and **deficits in professional development** all hinder systematic practice. According to the study (see Table #2), **Georgian clients** rarely generate consistent demand for **high-quality projects** due to insufficient experience and the **absence of pre-planning culture**. Frequently, there is no **formal project brief**, which should serve as the foundation for design work. Moreover, a **lack of feedback** between stages and **poor documentation practices** further weaken process continuity. Another critical gap is that **no single actor assumes responsibility** for managing the **entire infrastructure lifecycle**, resulting in spontaneous and disorganized workflows. To address these issues, it is essential to establish **cause-and-effect relationships** and conduct **further research** aimed at eliminating unsystematic practices. Despite these challenges, several of the studied companies have demonstrated **initial steps consistent with the SE model**, although their **level of effectiveness** requires additional examination.

How can systems engineering approaches be applied to enhance the efficiency and effectiveness of the design process in Georgia?

The research indicates that **elements of the SE model** are **already partially applied** within some Georgian companies, providing a foundation for delivering results that **meet client expectations and quality standards**. Within this framework, a **systemic approach** plays a crucial role in **requirements management**, **process control**, and **risk mitigation**. However, the **efficiency dimension** remains weak — projects are frequently completed with **resource overruns**, including **delays**, **budget deviations**, and **staff overextension**. The **comprehensive implementation** of the SE model could help **reduce these inefficiencies**. It is also necessary to **consider company size and capacity**. For **small firms**, full adoption of the model may not be cost-effective due to the investments required in **staff training, IT systems, and process adaptation**. For these organizations, a **flexible or simplified version** of the model would be more appropriate. Conversely, **large companies** — particularly those collaborating with the **government**, **international donors**, or **major clients** — benefit significantly from adopting the SE model, which ensures **transparency**, **quality control**, and **process optimization**. In such contexts, it becomes not only a **competitive advantage** but often a **mandatory standard**. The implementation of the SE model aligns with **Georgia's national development strategy**, especially in the context of **international infrastructure projects**. Therefore, adopting this approach in **large organizations** could set a **standard** that smaller firms may gradually follow over time. Ultimately, the **integration of systemic approaches** will contribute to achieving **desired project outcomes** while ensuring **optimal use of resources**, benefiting not only individual companies but also the **architectural and construction sectors as a whole**.

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საქართველოში თანამედროვე არქიტექტურული მენეჯმენტის პროცესების პროცედურული გაუმჯობესებისა და განვითარების საკითხებისთვის

პავლე სახანბერიძე; თინათინ ჩიგოგიძე

„ხარისხი მიიღწევა დაგეგმვისა და ინტეგრაციის გზით; ეს ეხება როგორც პროდუქტს, ასევე სამუშაო პროცესებს.“

(Rumane, 2017)

ნაშრომი სწავლობს არქიტექტურული პროექტირების პროცესს „სისტემური ინჟინერიის“ V - მოდელის ჭრილში და მიზნად ისახავს საქართველოს სამშენებლო სექტორში არსებულ პრაქტიკათა კრიტიკულ შეფასებას. კვლევა განსაკუთრებულ ყურადღებას ამახვილებს იმ სირთულეებზე, რომლებიც დამახასიათებელია გარდამავალი ეკონომიკის მქონე ქვეყნებისთვის — სადაც პროცესების არასაკმარისი კოორდინაცია და ინტეგრაციის ნაკლებობა ხშირად იწვევს სისტემურ არაეფექტიანობას. ამ პროცესში საბოლოო გადაწყვეტილების მიმღები რგოლი, როგორც წესი, თავად კაპიტალის მფლობელია, ხოლო დანარჩენი მონაწილეები — დეველოპერი, არქიტექტორი, მარეგულირებელი ორგანოები და მომწოდებლები — იშვიათად აღიქმებიან ერთიანი პროცესის ნაწილებად და, შესაბამისად, უმეტეს შემთხვევაში, გამორიცხულია მათი ჩართულობა გადაწყვეტილების მიღების ეტაპებზე. თანამშრომლობა ხშირად ეფუძნება პირად ურთიერთობებსა და ნდობას, ვიდრე სტრუქტურირებულ და გამჭვირვალე სისტემურ წესრიგს. ასეთ პირობებში ყურადღება ძირითადად კონცენტრირებულია საბოლოო პროდუქტზე, მაშინ, როცა

წარმოებისა და ორგანიზების პროცესები ხშირად მეორეხარისხოვნად რჩება. კვლევის მთავარი მიზანია, გამოვლინდეს საქართველოში საპროექტო პრაქტიკაში არსებული ხარვეზები — როგორ ვლინდება პროცესების სირთულე, სად ჩნდება ხარვეზები და რა სახის არაეფექტიანი პრაქტიკები ამცირებს პროექტირების ხარისხს. კვლევა პასუხს გასცემს შემდეგ კითხვებს: როგორ მიმდინარეობს საპროექტო სამუშაოების პროცესი საქართველოში არსებული პრაქტიკის მიხედვით? და, როგორ გამოვიყენოთ სისტემური ინჟინერიის მიდგომები საპროექტო სამუშაოების პროცესის ეფექტურობის და ეფექტიანობის ამაღლებისთვის საქართველოში? ამასთან, ნაშრომი გვთავაზობს რეკომენდაციებს, რომლებიც ხელს შეუწყობს თანამედროვე სისტემური მიდგომების დანერგვას. მეთოდოლოგიურად, კვლევა ეფუძნება ხარისხობრივ ანალიზს — ლიტერატურის მიმოხილვას, კონკრეტული შემთხვევების შეფასებას და პრაქტიკოს არქიტექტორებთან ნახევრადსტრუქტურირებულ ინტერვიუებს. კვლევა მნიშვნელოვანია როგორც პრაქტიკული, ისე თეორიული თვალსაზრისით: სამშენებლო ინდუსტრიისთვის ის შეიძლება გახდეს პროცესების ოპტიმიზაციისა ინსტრუმენტი, ხოლო აკადემიური სფეროსთვის — ინტერდისციპლინარული მოდელების დანერგვისა და სასწავლო პროგრამების განვითარების საფუძველი. სახელმწიფო სტრუქტურებისთვის კი ნაშრომი ღირებული იქნება სტანდარტიზაციისა და რეგულაციების დახვეწის კუთხით. კვლევის საგანი შეეხება არქიტექტორის, როგორც ინტერდისციპლინარული პროცესების კოორდინატორისა და სისტემური აზროვნების მატარებლის როლის გააზრებას. დასმული კვლევითი კითხვები მიმართულია იმაზე, თუ როგორ მიმდინარეობს საპროექტო სამუშაოები საქართველოს კონტექსტში და რა პოტენციალი აქვს სისტემური ინჟინერიის მიდგომების გამოყენებას ეფექტიანობის ასამაღლებლად. აღნიშნული საკითხის განხილვა ორი ძირითადი მიმართულებით შეიძლება განხორციელდეს - პირველი, **პრაქტიკული მიმართულება, რაც** გულისხმობს არქიტექტორის მონაწილეობის ანალიზს საპროექტო სამუშაოების დაგეგმვასა და კოორდინაციაში, ინტერდისციპლინარული გუნდის ფარგლებში მისი როლებისა და პასუხისმგებლობების განსაზღვრას და პროცესების ინტეგრაციის მექანიზმების გამოკვლევას. მეორე **კონცეპტუალური მიმართულება**, რომელიც ფოკუსირდება არქიტექტორის როლზე, როგორც სისტემური ინჟინერიის პროცესებში ჩართულ ინტერდისციპლინარულ კოორდინატორზე. ეს მოიცავს არქიტექტორის ფუნქციის გააზრებას, როგორც პროცესების მართვისა და ინტეგრაციის კონცეპტუალურ შესაძლებლობას, რომელიც ქმნის საფუძველს პროცესების ეფექტურობის ანალიზისა და თეორიული მოდელების შემუშავებისთვის. საბოლოოდ ნაშრომი ქმნის ინტეგრირებულ ჩარჩოს, რომელიც აერთიანებს თეორიულ ცოდნასა და პრაქტიკულ გამოცდილებას და წარმოადგენს მნიშვნელოვან რესურსს საქართველოს სამშენებლო ინდუსტრიის განსავითარებლად.

საკვანძო სიტყვები: სისტემური ინჟინერია; სისტემური აზროვნება;
ინტეგრირებული მიდგომა.