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Nykytiuk Iryna
Entrepreneur, Master's Degree in International Law
Taras Shevchenko National University of Kyiv
ORCID: 0009-0008-4860-538X

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PASTRY ARCHITECTURE AS AN EMERGING DISCIPLINE: A FRAMEWORK FOR STRUCTURAL ENGINEERING, STABILITY, AND RISK MANAGEMENT IN LARGE-SCALE CUSTOM CAKES

Summary. *The increasing complexity of contemporary custom cake production has transformed pastry creation from a primarily culinary activity into an interdisciplinary process involving engineering principles, structural planning, logistics management, and risk assessment.*

Modern large-scale custom cakes frequently incorporate multi-tiered structures, suspended decorative elements, asymmetrical compositions, and transportation requirements that present challenges comparable to those encountered in temporary architectural installations.

Despite these developments, the professional pastry industry lacks a standardized framework for evaluating structural stability, material performance, transportation reliability, and project-specific risks associated with complex edible constructions. Existing professional knowledge remains largely experience-based and fragmented, limiting opportunities for standardization, scalability, and academic development.

This article introduces Pastry Architecture as an emerging interdisciplinary discipline that integrates principles of structural engineering, food science, project management, logistics, and artistic design. The study proposes the Nykytiuk Pastry Architecture Framework (NPAF), a systematic methodology for the planning, *construction, transportation, and installation of large-scale custom cakes. Additionally, the article introduces the Cake Structural Risk Matrix (CSRM), a practical risk-assessment model developed specifically for edible structures.*

The proposed framework contributes to the professionalization of advanced pastry production by establishing a conceptual foundation for future research, educational programs, and industry standards. The findings suggest that engineering-based methodologies may become increasingly important as the scale, complexity, and commercial value of custom cake projects continue to expand.

Key words: *pastry architecture, cake engineering, structural stability, edible construction, risk management, food design, custom cakes, engineering methodology, pastry innovation.*

Introduction. The global custom cake industry has experienced substantial transformation during the last two decades. Cakes are no longer viewed solely as desserts intended for consumption; increasingly, they function as large-scale artistic installations that serve as central visual elements at weddings, luxury events, corporate celebrations, exhibitions, and public ceremonies. This evolution has expanded the technical requirements placed upon pastry professionals and introduced challenges that extend well beyond traditional culinary practice.

Contemporary custom cakes frequently incorporate complex geometries, multiple structural levels, suspended decorative elements, edible sculptures, and transportation over considerable distances. In many cases, these creations exceed one meter in height and require advanced support systems to maintain stability throughout production, transportation, installation, and presentation. Such requirements increasingly resemble the challenges encountered in architecture, structural engineering, and project management rather than conventional pastry preparation alone.

Researchers in food science have long recognized that food products possess measurable physical and mechanical properties that influence their behavior during processing, transportation, storage, and presentation [7; 5]. Similarly, engineering disciplines have demonstrated that structural reliability depends upon factors such as load distribution, material performance, environmental conditions, and risk mitigation strategies [3]. These principles are directly relevant to large-scale custom cakes, which function as temporary edible structures subjected to various mechanical and environmental stresses.

Despite these similarities, the majority of contemporary pastry education and professional literature remains focused on recipe formulation, decoration techniques, flavor development, and aesthetic presentation. Comparatively little attention has been devoted to systematic approaches for structural assessment, transportation planning, installation procedures, and failure prevention within complex cake constructions. As a result, many technical solutions remain based on personal experience rather than standardized methodologies.

The absence of formal engineering frameworks creates significant operational challenges. Structural collapse, transportation damage, environmental degradation, and installation failures can lead to substantial financial losses, reputational harm, and compromised customer satisfaction. These risks become increasingly significant as projects grow in complexity and commercial value.

At the same time, advancements in food engineering have demonstrated the importance of understanding material behavior and structural performance within food systems [9].

Material selection, density distribution, moisture migration, and environmental stability all influence the long-term reliability of food-based structures. While these concepts have been studied extensively within food science, they have not been systematically integrated into professional cake design methodologies.

This article argues that the evolution of contemporary custom cake production necessitates the development of a new interdisciplinary framework capable of integrating artistic creativity with engineering reliability. This framework is referred to as Pastry Architecture.

For the purposes of this study, Pastry Architecture is defined as the systematic application of engineering principles, structural analysis, material evaluation, logistics planning, risk management, and design methodologies to the creation of large-scale edible structures. The concept recognizes that modern custom cakes increasingly require the same type of planning, assessment, and quality-control processes commonly employed in architecture and engineering projects.

The primary objectives of this article are fourfold:

1. To define Pastry Architecture as an emerging professional discipline.
2. To introduce the Nykytiuk Pastry Architecture Framework (NPAF) as a structured methodology for large-scale custom cake production.
3. To develop the Cake Structural Risk Matrix (CSRM) as a risk-evaluation tool for edible structures.
4. To establish a conceptual foundation for future research, professional training, and industry standardization.

While previous literature has examined food materials, culinary design, and engineering principles separately, the NPAF and CSRM models proposed in this study represent original conceptual frameworks developed by the author for the systematic management of structural stability and risk in large-scale custom cakes.

By formalizing these concepts, the study seeks to bridge the gap between traditional pastry practice and contemporary engineering-based approaches to complex cake design, thereby contributing to the ongoing professionalization of the pastry industry.

Literature Review. The development of contemporary custom cake production has occurred at the intersection of multiple disciplines, including food science, food engineering, design theory, materials science, logistics, and project management. While each of these fields has contributed valuable knowledge relevant to the production of complex edible structures, their findings have rarely been integrated into a unified framework specifically applicable to large-scale custom cakes.

Food Science and Material Behavior

Food science research has consistently demonstrated that food products possess measurable physical and mechanical properties that influence their structural performance under varying environmental and operational conditions [7;

5]. Characteristics such as density, moisture content, compressive strength, thermal sensitivity, and rheological behavior affect the stability and reliability of food systems throughout their lifecycle.

According to Ramaswamy and Marcotte [9], food materials respond predictably to external forces and environmental changes, making it possible to evaluate their performance using engineering-based analytical approaches. These principles are particularly relevant to cake production, where multiple layers, fillings, support structures, and decorative components interact within a single integrated system.

The structural behavior of food products has also been examined through microstructural analysis. Aguilera and Stanley [1] demonstrated that food materials exhibit organized internal structures that directly influence their mechanical properties and resistance to deformation. Such findings suggest that large-scale cakes may be evaluated not merely as culinary products but as engineered assemblies composed of materials with distinct structural characteristics.

Despite these advances, food science literature has largely focused on processing efficiency, preservation, texture, and sensory quality rather than the design and management of large-scale edible constructions. Consequently, significant opportunities remain for applying food engineering principles to structural planning within professional pastry production.

Engineering Principles and Structural Stability

Structural engineering provides a well-established theoretical foundation for understanding stability, load transfer, redundancy, and failure prevention in complex systems. Engineering literature emphasizes that successful structures depend upon the interaction of materials, support systems, environmental conditions, and anticipated loading scenarios [3].

Ashby [3] argues that material selection represents one of the most critical stages in engineering design because performance requirements must be evaluated before construction begins. This principle has direct relevance to pastry production, where cake compositions, fillings, support elements, and decorative materials must be selected according to project-specific structural demands.

Similarly, Gibson and Ashby [3] demonstrated that structural performance depends not only upon material strength but also upon geometry, load pathways, and system organization. In the context of custom cake production, these concepts suggest that stability cannot be achieved through stronger materials alone but requires deliberate planning of support systems and load-transfer mechanisms.

Traditional cake design often relies upon empirical methods and practitioner experience. While such approaches may be effective for conventional projects, they become increasingly insufficient as structures grow in size, complexity, and economic value. Engineering methodologies therefore offer a valuable framework for improving predictability and reducing project risk.

Design Thinking and Culinary Innovation

The relationship between aesthetics and functionality has become an increasingly important area of study within contemporary food design. Steen [10] argues that culinary innovation is most effective when technical functionality and visual expression are developed simultaneously rather than independently.

Within luxury hospitality markets, consumers increasingly seek products that provide memorable experiences in addition to practical utility. Consequently, food products frequently serve symbolic, artistic, and experiential functions that extend beyond nutrition.

Custom cakes represent a particularly significant example of this trend. In many contemporary events, the cake serves as both a food product and a visual centerpiece. Designers must therefore balance artistic objectives with technical constraints, creating structures that are simultaneously visually striking, transportable, stable, and safe.

However, current food-design literature provides limited guidance regarding the engineering challenges associated with achieving these objectives. Existing research generally focuses on user experience, presentation, and creativity rather than structural reliability and risk mitigation.

Risk Management and Project Planning

Risk assessment methodologies have long been utilized within engineering, manufacturing, transportation, and construction industries to identify potential failure mechanisms before implementation.

Project management literature consistently demonstrates that proactive risk identification reduces uncertainty, improves resource allocation, and increases project success rates. Structured risk assessment enables organizations to implement preventive measures rather than relying upon reactive problem-solving strategies.

The pastry industry, however, has historically lacked formalized risk-management frameworks. Many professionals evaluate transportation risks, environmental exposure, installation challenges, and structural vulnerabilities through experience rather than systematic analysis.

This gap becomes increasingly problematic as custom cake projects expand in scale and complexity. A wedding cake exceeding one hundred servings may represent several days of labor, substantial material costs, and significant reputational risk. Consequently, the adoption of structured risk-management methodologies appears both necessary and commercially advantageous.

Research Gap

The literature reviewed above demonstrates that substantial knowledge exists regarding food materials, engineering design, risk assessment, and culinary innovation. However, these disciplines have largely evolved independently.

No widely recognized framework currently integrates:

- Structural engineering principles
- Food-material performance analysis
- Transportation planning
- Installation procedures
- Risk-management methodologies

Advanced cake-design practices into a single operational system specifically designed for large-scale custom cakes.

This fragmentation creates a significant theoretical and practical gap within both academic literature and professional pastry practice.

The present study addresses this gap through the introduction of Pastry Architecture as an interdisciplinary framework and through the development of two original conceptual models:

The Nykytiuk Pastry Architecture Framework (NPAF), a systematic methodology for planning and executing large-scale custom cake projects.

The Cake Structural Risk Matrix (CSRM), a structured model for evaluating project-specific risks associated with edible structures.

Together, these models seek to establish the conceptual foundation of Pastry Architecture as an emerging professional discipline that bridges the fields of engineering, food science, logistics, and artistic design.

Methodology

Research Design

This study employs a conceptual framework methodology designed to synthesize principles from structural engineering, food science, logistics management, and professional pastry production into a unified operational model. Conceptual framework research is particularly appropriate when an emerging field lacks standardized methodologies and requires the development of new theoretical structures capable of guiding future investigation and professional practice.

The research does not seek to evaluate a single cake project or compare individual production techniques. Instead, it aims to establish a systematic model capable of addressing recurring challenges encountered in large-scale custom cake production. The proposed framework was developed through interdisciplinary analysis of engineering principles, food-material behavior, transportation logistics, project management methodologies, and advanced pastry-production practices.

The resulting framework is intended to function as both a conceptual model and a practical decision-making tool for professionals involved in the design and execution of complex edible structures.

Identification of Core Structural Challenges

The development of the framework began with identification of recurring operational challenges observed in large-scale custom cake projects.

A review of professional practices and technical requirements revealed six categories of challenges that consistently influence project success:

1. structural instability;

2. uneven load distribution;
3. material deformation;
4. transportation-related damage;
5. environmental exposure;
6. installation and assembly failures.

While traditional pastry methodologies frequently address these issues individually, there is currently no standardized system that integrates them into a comprehensive planning process.

The present study therefore treats these challenges as interconnected variables requiring coordinated evaluation throughout the entire project lifecycle.

Interdisciplinary Framework Development

The proposed methodology was developed by adapting established concepts from multiple disciplines.

From structural engineering, the framework incorporates:

- load distribution analysis;
- support-system planning;
- center-of-gravity evaluation;
- redundancy design principles;
- failure prevention strategies. [3; 6].

From food science and food engineering, the framework incorporates:

- material-performance evaluation;
- density assessment;
- moisture-management considerations;
- environmental sensitivity analysis;
- structural behavior of food systems. [1; 5].

From project management and risk-management literature, the framework incorporates: risk identification procedures; probability-impact assessment; preventive planning methodologies; contingency development strategies. [9].

Finally, from contemporary pastry practice, the framework incorporates:

- artistic design requirements;
- production workflow considerations;

- transportation procedures;
- installation protocols;
- customer-specific customization requirements.

The integration of these disciplines forms the basis of the proposed Pastry Architecture methodology.

Development of the Nykytiuk Pastry Architecture Framework (NPAF)

The primary outcome of the research process is the development of the Nykytiuk Pastry Architecture Framework (NPAF).

The NPAF model was originally developed by Nykytiuk as a systematic methodology for large-scale custom cake engineering. The framework organizes project execution into six sequential stages, each addressing a specific category of structural, operational, and logistical requirements.

Rather than treating cake construction as a purely artistic or culinary process, the framework approaches each project as a temporary engineered structure that requires planning, analysis, implementation, monitoring, and verification.

The six-stage model serves as the central organizing structure of the proposed discipline of Pastry Architecture.

Nykytiuk Pastry Architecture Framework (NPAF)

The central contribution of this study is the introduction of the Nykytiuk Pastry Architecture Framework (NPAF), a systematic methodology designed for the planning, engineering, construction, transportation, and installation of large-scale custom cakes.

Unlike traditional cake-production approaches that focus primarily on recipe formulation and decorative execution, the NPAF model treats complex cakes as temporary architectural systems whose reliability depends upon the interaction of multiple structural and operational variables.

The framework establishes a repeatable methodology intended to improve project predictability, reduce risk, and facilitate professional standardization.

CLIENT REQUIREMENTS
▼
CONCEPTUAL DESIGN
▼
STRUCTURAL ENGINEERING ASSESSMENT
▼
MATERIAL & STABILITY ANALYSIS
▼
RISK EVALUATION
▼
TRANSPORTATION PLANNING
▼
INSTALLATION & QUALITY VERIFICATION
▼
PROJECT DELIVERY

Fig. 1. The Nykytiuk Pastry Architecture Framework (NPAF), an original six-stage methodology for the planning and execution of large-scale custom cake projects

Stage 1: Conceptual Design

The first stage establishes project objectives and defines all major design requirements. These include dimensions, serving capacity, artistic vision, venue characteristics, transportation distance, environmental conditions, and client expectations.

At this stage, aesthetic goals must be evaluated alongside structural feasibility. Design concepts that cannot be safely executed within identified constraints require modification before production planning begins.

Early integration of technical assessment significantly reduces downstream project risks.

Stage 2: Structural Engineering Assessment

The second stage evaluates the structural requirements of the project. Key considerations include:

- anticipated load distribution;
- center-of-gravity location;
- support-system requirements;

- reinforcement strategies;
- structural redundancy.

The assessment determines whether the proposed design can maintain stability throughout production, transportation, installation, and presentation.

Support structures are selected according to anticipated loading conditions rather than solely according to visual requirements.

Stage 3: Material and Stability Analysis

The third stage focuses on material behavior and environmental performance.

Cake compositions, fillings, coverings, decorative materials, and support components are evaluated according to:

- density;
- compressive resistance;
- moisture sensitivity;
- temperature tolerance;
- long-term dimensional stability.

Material selection plays a critical role in determining overall structural reliability and must therefore be aligned with project-specific performance requirements [3].

Stage 4: Risk Evaluation

Following structural and material assessment, project-specific risks are identified and categorized.

Potential risks include:

- structural failure;
- transportation damage;
- environmental degradation;
- installation complications;
- decorative-component failure.

The results of this stage directly inform mitigation strategies implemented during later phases of project development.

Stage 5: Transportation Planning

Transportation represents one of the most significant sources of failure in large-scale custom cake projects.

This stage evaluates:

- route complexity;
- travel duration;
- vibration exposure;
- packaging requirements;
- temperature-control measures;
- loading and unloading procedures.

Transportation planning is treated as an engineering consideration rather than an operational afterthought.

Stage 6: Installation and Quality Verification

The final stage includes project delivery, assembly, stabilization, and final inspection.

Quality verification procedures confirm that the completed structure satisfies both aesthetic and structural requirements prior to presentation.

Contingency measures are also implemented when elevated project risk has been identified during earlier stages.

Successful completion of this stage marks the transition from production to operational deployment of the finished edible structure.

Cake Structural Risk Matrix (CSRM)

One of the defining characteristics of engineering disciplines is the systematic identification and management of risk before construction begins. In contrast, risk assessment within professional cake production has historically been based primarily on individual experience and informal decision-making processes.

As project complexity increases, reliance on intuition alone becomes increasingly insufficient. Large-scale custom cakes may involve substantial material costs, extensive labor investment, transportation over long distances, and significant reputational consequences in the event of failure. Consequently, the implementation of structured risk-assessment methodologies becomes essential.

To address this challenge, the present study introduces the **Cake Structural Risk Matrix (CSRM)**, an original risk-evaluation model developed as part of the broader Nykytiuk Pastry Architecture Framework.

The CSRM model was developed specifically for edible structures and provides a systematic method for identifying, classifying, and mitigating project-specific risks before production begins.

IMPACT	LOW	MEDIUM	HIGH
LOW PROBABILITY	L	L	M
MEDIUM	L	M	H

Fig. 2. Cake Structural Risk Matrix (CSRM)

L = Low Risk

M = Moderate Risk H = High Risk

VH = Very High Risk

Figure 2. Cake Structural Risk Matrix (CSRM), an original risk-classification model for evaluating project-specific threats in large-scale edible structures.

Risk Categories

The CSRM identifies four primary categories of project risk:

Structural Risk

Structural risk refers to the possibility of failure resulting from inadequate support systems, excessive loading, improper load transfer, material weakness, or instability of the overall structure.

Structural collapse represents the most severe category of project failure because it may compromise the entire edible structure.

Transportation Risk

Transportation risk includes damage resulting from vibration, acceleration, braking forces, handling procedures, and packaging deficiencies.

Numerous complex cakes remain structurally stable during production but fail during transportation due to insufficient planning of dynamic loading conditions.

Environmental Risk

Environmental risk arises from exposure to factors including:

- elevated temperatures;
- humidity fluctuations;
- direct sunlight;
- prolonged display periods;
- venue-specific environmental conditions.

Environmental factors may alter material behavior and significantly reduce structural reliability.

Installation Risk

Installation risk occurs during unloading, assembly, positioning, and final presentation.

Projects requiring on-site assembly frequently involve elevated risk due to time constraints, venue limitations, and handling complexity.

Risk Assessment Process

The CSRM methodology evaluates each identified risk according to two criteria:

1. Probability of occurrence.
2. Potential impact upon project success.

The combination of these variables determines overall risk classification. For example:

Scenario	Probability	Impact	Risk Level
Decorative element detachment	Medium	Moderate	Moderate
Filling deformation	Low	Moderate	Low
Transportation	High	Major	High

damage			
Structural collapse	Medium–High	Critical	Very High

Projects exhibiting High or Very High-Risk classifications require implementation of additional mitigation strategies.

Risk Mitigation Strategies.

Recommended mitigation measures include:

- redundant support systems;
- reinforced internal structures;
- alternative transportation procedures;
- environmental-control measures;
- on-site assembly protocol
- emergency stabilization plans.

The objective is not to eliminate risk entirely but rather to reduce the probability and severity of potential failures.

The incorporation of formal risk-management procedures represents one of the principal distinctions between traditional cake production and the proposed discipline of Pastry Architecture.

Structural Design Principles in Pastry Architecture

The successful execution of large-scale custom cakes depends upon the application of fundamental structural principles commonly encountered in engineering and architecture.

Although edible structures differ significantly from conventional construction materials, they remain subject to the same physical laws governing stability, load transfer, equilibrium, and material performance.

The present framework adapts these principles to the unique requirements of pastry production.

Load Distribution

Load distribution represents one of the most important determinants of structural reliability.

Every component incorporated into a cake contributes to the overall loading condition of the structure. This includes:

- cake layers;
- fillings;
- support elements;
- decorative components;
- sculptural features.

Failure to distribute these loads appropriately may result in localized stress concentrations that exceed material capacity.

Engineering literature consistently demonstrates that successful structures rely upon predictable load-transfer pathways [3]. The same principle applies to edible structures.

Within the NPAF model, structural loads should be transferred through dedicated support systems rather than through edible materials alone.

DECORATIVE ELEMENTS

▲ |

VISUAL LOAD ZONE

|

UPPER TIER

| | |

INTERNAL SUPPORTS

| | |

MIDDLE TIER

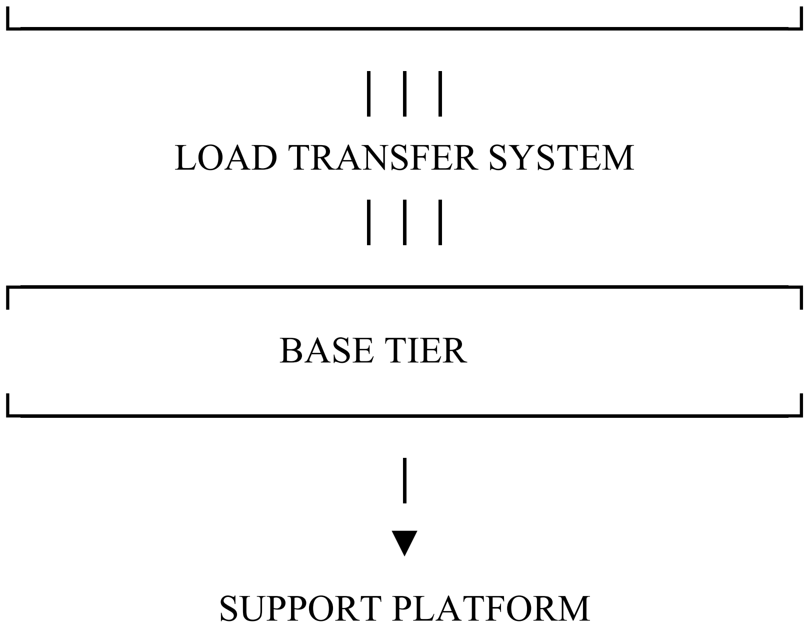

Fig. 3. Structural Components of a Large-Scale Custom Cake

Figure 3. Conceptual model illustrating load transfer through a multi-tier custom cake structure.

The figure demonstrates how structural loads are transmitted through internal support systems toward the primary base platform. Stability depends upon the integrity of these support pathways rather than the strength of decorative components.

Center of Gravity Management

As structures increase in height and complexity, center-of-gravity management becomes increasingly important.

Asymmetrical designs, suspended decorations, floating elements, and sculptural projections may shift the center of gravity away from the structural centerline.

When this occurs, overturning forces increase significantly.

The NPAF methodology therefore requires evaluation of center-of-gravity placement during the conceptual-design stage rather than after production has begun.

Early identification of stability concerns allows corrective measures to be incorporated before construction proceeds.

Structural Redundancy

Redundancy is widely recognized as a fundamental principle of engineering reliability.

A redundant system contains secondary support pathways capable of maintaining functionality in the event of localized component failure.

Within pastry architecture, redundancy may include: additional support columns; secondary reinforcement systems; backup transportation platforms;

modular assembly strategies.

The incorporation of redundancy significantly reduces the likelihood of catastrophic failure.

Material Performance

Material behavior plays a central role in structural reliability.

Cake compositions differ substantially in density, moisture content, compressive strength, and environmental sensitivity.

Consequently, material selection should be based upon performance requirements rather than solely upon aesthetic or culinary considerations.

This principle reflects established engineering methodologies emphasizing the relationship between material properties and structural performance [3].

Environmental Stability

Environmental conditions remain among the most underestimated variables in custom cake production.

Temperature fluctuations, humidity exposure, prolonged display periods, and transportation conditions may significantly influence material behavior.

The NPAF framework therefore requires environmental assessment as part of the planning process.

Environmental stability should be evaluated throughout:

- production;
- storage;
- transportation;
- installation;
- presentation.

This approach ensures that structural reliability is maintained throughout the entire project lifecycle.

Commercial and Industry Applications

The practical value of Pastry Architecture extends beyond theoretical discussion and offers significant benefits for professional pastry businesses, hospitality organizations, educational institutions, and industry stakeholders.

The increasing demand for large-scale custom cakes has created a market environment in which technical reliability is becoming as important as artistic quality. Clients commissioning premium cake projects frequently invest substantial financial resources and expect consistent performance throughout transportation, installation, and presentation.

Consequently, businesses capable of delivering structurally reliable products gain significant competitive advantages.

The implementation of the Nykytiuk Pastry Architecture Framework (NPAF) may improve operational performance in several areas.

First, systematic planning reduces production uncertainty by identifying structural vulnerabilities before fabrication begins. Early detection of potential failures decreases material waste, minimizes redesign requirements, and improves resource allocation.

Second, standardized methodologies increase consistency across projects. Traditional cake production often relies heavily on the experience of individual professionals. While expertise remains valuable, dependence upon tacit knowledge may limit scalability. The adoption of structured procedures facilitates knowledge transfer and organizational standardization.

Third, engineering-based planning supports workforce development. Employees can be trained using documented procedures rather than relying exclusively on informal mentorship. This approach enhances operational continuity and reduces organizational dependence upon individual specialists.

Fourth, the framework provides a foundation for quality assurance. By incorporating structural evaluation, risk assessment, and verification procedures into project workflows, businesses can improve reliability while reducing operational losses associated with transportation damage and structural failure.

From a commercial perspective, these advantages contribute directly to customer satisfaction, brand reputation, and long-term business sustainability.

Applications in Hospitality and Event Industries

Large-scale cakes are frequently commissioned for weddings, corporate events, luxury celebrations, exhibitions, and promotional campaigns.

These projects often involve:

- complex logistics;
- strict delivery schedules;
- venue-specific requirements;
- substantial financial investments.

The application of Pastry Architecture principles may improve project outcomes by ensuring that technical planning receives the same level of attention as artistic design.

As event expectations continue to increase, engineering-based methodologies are likely to become increasingly valuable within premium hospitality markets.

Educational Applications

The emergence of Pastry Architecture also creates opportunities for curriculum development within culinary education.

Most pastry programs emphasize recipe development, baking techniques, and decorative skills. However, relatively little instruction is devoted to structural planning, risk management, transportation engineering, or large-scale project execution.

The NPAF model may serve as a foundation for educational modules addressing:

- structural stability;
- support-system design;
- transportation planning;
- environmental analysis;
- project management.

Such educational initiatives would help prepare future professionals for the technical realities of contemporary custom cake production.

Discussion. The findings of this study suggest that contemporary custom cake production has evolved beyond the boundaries of traditional pastry practice and increasingly requires interdisciplinary expertise.

The growing complexity of edible structures has created challenges that cannot be adequately addressed through culinary knowledge alone. Professionals must simultaneously consider material behavior, structural stability, transportation logistics, environmental conditions, and project-specific risks.

The proposed concept of Pastry Architecture provides a framework for integrating these considerations into a coherent professional methodology.

Unlike traditional approaches that frequently separate artistic design from technical planning, the NPAF model treats both dimensions as interconnected components of a single system. This integration reflects broader trends observed in architecture, engineering, and industrial design, where aesthetic objectives and functional performance are developed concurrently rather than sequentially.

The introduction of the Cake Structural Risk Matrix (CSRM) further contributes to the professionalization of the field by establishing a formal process for evaluating uncertainty and implementing preventive measures.

While previous literature has addressed food materials, engineering concepts, and culinary innovation independently [1; 3; 10], few studies have attempted to synthesize these disciplines within a unified framework specifically applicable to custom cake production.

The present study therefore contributes to both professional practice and academic discourse by proposing a new conceptual model capable of supporting future research, education, and industry standardization.

Future investigations may expand upon the framework through empirical testing of structural-performance models, quantitative evaluation of support systems, transportation simulations, and material-behavior analysis under varying environmental conditions.

Such research would further strengthen the scientific foundation of Pastry Architecture as an emerging discipline.

Original Contribution to the Field

The principal contribution of this study is the formal introduction of Pastry Architecture as a distinct interdisciplinary field that integrates structural engineering, food science, logistics management, risk assessment, and artistic design within a unified professional framework.

While previous literature has explored these domains independently, no widely recognized methodology currently exists for their systematic application to large-scale custom cake production.

The present study introduces two original conceptual models developed by the author:

Nykytiuk Pastry Architecture Framework (NPAF)

The NPAF represents an original six-stage methodology for planning, constructing, transporting, installing, and evaluating complex edible structures.

The framework establishes a repeatable process capable of improving reliability, consistency, scalability, and risk management within professional cake production.

Cake Structural Risk Matrix (CSRM)

The CSRM represents an original risk-classification model specifically designed for large-scale edible structures.

The matrix provides a systematic approach for evaluating project-specific vulnerabilities and implementing preventive mitigation strategies before production begins.

Together, these models establish a conceptual foundation for future research, professional education, and industry-wide standardization.

To the author's knowledge, this is the first published framework that combines engineering design principles, material-performance analysis, transportation planning, risk-management methodology, and advanced pastry production into a unified operational system.

Conclusion. This article has introduced Pastry Architecture as an emerging interdisciplinary discipline situated at the intersection of structural engineering, food science, logistics management, risk assessment, and artistic design.

The increasing complexity of contemporary custom cake projects demonstrates the need for methodologies that extend beyond traditional pastry techniques and incorporate systematic planning procedures commonly associated with engineering and architectural practice.

The study proposed two original conceptual contributions:

The Nykytiuk Pastry Architecture Framework (NPAF), a six-stage methodology for the planning and execution of large-scale custom cake projects.

The Cake Structural Risk Matrix (CSRM), a structured model for evaluating and mitigating project-specific risks associated with edible structures.

Together, these models provide a foundation for improving structural reliability, operational efficiency, transportation safety, and professional standardization within the custom cake industry.

The findings suggest that future advancements in large-scale cake production will increasingly depend upon the integration of engineering-based methodologies capable of addressing the technical demands of contemporary edible structures.

Future research should focus on empirical validation of the proposed framework, quantitative structural analysis, environmental-performance testing, transportation simulations, and curriculum development dedicated to the emerging discipline of Pastry Architecture.

As the scale and sophistication of custom cake projects continue to expand, Pastry Architecture may serve as a valuable framework for supporting innovation, reliability, and professional excellence across the global pastry industry.

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