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QURAQ TECHNOLOGY IN THE CONTEXT OF KAZAKHSTANI ZERO WASTE DESIGN AND ECO-PRODUCTION

Abstract. The article examines the traditional Kazakh patchwork technique, quraq, as a tool for implementing the concept of Zero Waste Design within the contemporary fashion and textile industry of Kazakhstan. The study highlights the potential of transforming ethnocultural heritage into an effective method of waste-free production. Ecological, economic, and socio-cultural challenges of applying quraq in the context of sustainable development are analyzed. The findings demonstrate that quraq is not merely a decorative practice but a fully developed technological model of circular design, enabling the minimization of textile waste and the creation of unique, authentic products. The research employed comparative analysis, experimental design methodology, mathematical modeling of cutting patterns, and visual-morphological analysis. The results show that quraq construction algorithms fully comply with zero-waste cutting principles, and template schemes suitable for automated cutting have been developed. Core technologies for producing quraq modules were systematized, and a comparative analysis of conventional garment production and eco-production based on quraq technology was conducted. In addition, a classification of quraq techniques according to their industrial and artisanal applications was proposed. The study substantiates the scientific value of quraq as an authentic circular design approach and provides practical recommendations for integrating zero-waste technologies into modern textile and apparel production in Kazakhstan.

Keywords: quraq, Zero Waste Design, ecological production, Kazakh ethno-futurism, sustainable fashion, upcycling, ethno-design, zero-waste technologies, circular design.

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Introduction. *Relevance of the study:* contemporary circular design represents not only an environmentally oriented model of production and

consumption but also a culturally significant phenomenon in which the direction of ethno-futurism plays an increasingly prominent role. Emerging against the backdrop of post-industrial development, ethno-futurism has become a response to global challenges such as the loss of identity, the unification of visual codes, and the disappearance of local craft practices [1]. Within the framework of sustainable design and the circular economy, ethno-futurism performs the function of preserving and transforming cultural codes by integrating national ornaments, materials, and narratives into modern technological processes. This approach not only extends the life cycle of products but also restores visual continuity, linking traditional forms with innovative methods of recycling, upcycling, and modular construction [1,2].

The challenges of studying circular design through the lens of ethno-futurism are relevant both from the perspective of sustainable development and in terms of the cultural policy of the Republic of Kazakhstan and the Concept for the Development of Creative Industries, aimed at strengthening national identity in a globalized world [3,4]. The research problem is defined by the critical level of waste accumulation in Kazakhstan and the urgent need to transition to a cyclical model of environmentally responsible production. In the context of the transformation of the fashion industry, the concept of Zero Waste Design, which eliminates waste generation, acquires particular importance [5-9]. An additional factor of relevance is the development of ethno-futurism, which, in its search for national identity, reinterprets archaic codes (such as *quraq*) and integrates them into modern technological forms aligned with the principles of sustainability. According to the Bureau of National Statistics, in 2024, the volume of municipal waste reached 4.6 million tons, increasing by 11.4% compared to the previous year. The share of textiles in solid household waste is about 7%, while the recycling rate remains extremely low. Most old clothing and inter-pattern fabric remnants are sent to landfills, the number of which exceeds 2,900. The problem lies in the absence of effective mechanisms for recycling textile waste and integrating it into new production cycles [10-12].

Novelty of the study: the research reconsiders the Kazakh applied technique of *quraq* not only as decorative art but also as a tool of circular design. For the first time, *quraq* is examined as a production method that enables the reintegration of inter-pattern fabric remnants into the value-creation cycle, forming a foundation for localized models of eco-production.

Theoretical significance lies in expanding the concept of sustainable development through the inclusion of national practices. The study demonstrates that ethnocultural heritage can be adapted to the goals of the "green economy," generating new approaches to circular design and environmentally oriented production.

Practical significance is expressed in the development of recommendations for local brands to reduce their ecological footprint through the implementation of traditional zero-waste technologies. The integration of *quraq* into modern eco-production simultaneously addresses the problem of waste and creates a unique cultural product that meets the aesthetic and ethical demands of society, while enhancing the competitiveness of Kazakhstan's fashion industry in the global market.

Materials and methods. The object of research consisted of textile waste (inter-pattern remnants) from sewing workshops in Almaty, composed of natural fabrics (cotton, silk, denim, wool, calico) and blended textiles. The work was carried out in a design studio simulating the conditions of small-scale eco-production.

Traditional *quraq* artifacts from ethnographic museum collections were used as reference samples, serving as the basis for analyzing geometric assembly schemes.

Research Methods. To achieve the objectives stated, a comprehensive interdisciplinary approach was applied:

– *Comparative analysis:* juxtaposition of principles underlying traditional ornaments (with stable meanings and forms such as Kökpar, Oyuly, Zhapsyrma, Qustumsyq, Sharshy, Shymshyq, Qoshqar müyiz) with contemporary clothing patterns to identify zones of maximum formal correspondence [13-15].

– *Experimental design method:* creation of a prototype collection in the style of ethno-futurism. The process involved sorting textile waste by texture and color, followed by assembling fabric panels without preliminary edge trimming, employing the "chaotic" quraq technique (Shashu, Qyryqqulaq, Quraquzik, Zhuldyzsha, Alasha, Zholaq) [13-15].

– *Mathematical modeling of cutting patterns:* calculation of the fabric utilization coefficient (FUC). Traditional cutting methods (with losses of 15-20%) were compared with cutting incorporating quraq inserts, approaching Zero Waste indicators (losses reduced to less than 1-2%).

– *Visual-morphological analysis:* examination of works by contemporary Kazakh designers to determine the aesthetic demand for ethno-futurist imagery in post-industrial society.

This methodological framework made it possible to assess not only the ecological efficiency of technology but also its scalability under real production conditions.

Research results and discussion. The study yielded the following key findings:

– *Technological efficiency justification:* it was experimentally demonstrated that the integration of modular quraq elements into modern cutting patterns increases the fabric utilization coefficient (FUC) to 98-99%. The most adaptable geometric schemes for industrial Zero Waste were identified as tumarsha (triangles), botagöz (rhombi), sharsha (squares), and zholaq (stripes), which enable effective use of even the smallest inter-pattern remnants with an area of 3-5 cm^2.

– *Development of the "Ethno-futurist upcycling" model:* a conceptual prototype was designed in which traditional patchwork assembly is combined with modern synthetic materials and oversized silhouettes. The results showed that quraq in the context of ethno-futurism transforms "waste" into a highly artistic fabric with a unique texture that cannot be replicated in serial printed production.

– *Economic verification:* labor cost analysis revealed that manual assembly of patchwork panels increases product cost by 40-60%. However, in post-industrial society, this is offset by the product's transition into the category of sustainable luxury. This confirms the hypothesis that a brand's ecological responsibility directly converts into added value and reputational capital.

– *Systematization of zero-waste methods:* it was established that, unlike Western patchwork techniques, Kazakh quraq possesses specific semiotics that allow a brand to transmit cultural codes.

– *Creation of a template database:* a set of schemes suitable for automated layering and cutting of patchwork elements was developed, facilitating the scaling of the technology [13-15] (Table 1).

Table 1

Template schemes suitable for the automation of layering and cutting of patchwork elements in Quraq

«Шашу» – Shashu (Sprinkling)	A composition in which the chaotic arrangement of fabric fragments is transformed into a visual narrative of multiplicity and diversity.
«Көкпар» – Көkpar (Traditional Kazakh equestrian game)	A decorative pattern in which star motifs establish the visual center, while the background amplifies their symbolism.
«Қырыққұлақ» – Qyryqqulaq (Fern)	An ornament that stylizes the natural spirals of the fern, transformed into an artistic symbol of resilience and cyclicality.
«Алаша» – Alasha (striped carpet)	A composition based on the rhythmic alternation of stripes, generating the dynamics of a contrasting chromatic dialogue.
«Оюлы» – Oyuly (ornamented)	A composition in which the inclusion of oyu transforms the patchwork fabric into a visual text that reflects cultural memory.
«Жапсырма» – Zhapsyrma (applique)	A composition integrating appliqué inserts that transform the patchwork fabric into a visual text of cultural memory.
«Жолақ» – Zholaq (stripe)	A decorative motif in which the alternation of elongated lines is transformed into a metaphor of the road and the continuity of time.
«Құстұмсық» – Qustumsyq (bird's beak)	An ornamental structure in which triangular elements serve as artistic markers of flight, renewal, and vital energy.
«Шаршы» – Sharshy (square)	A decorative motif in which the geometry of the square is transformed into a symbol of stability and equilibrium.
«Шымшық» – Shymshyq (sparrow)	A traditional Kazakh motif based on the image of the sparrow, symbolizing vital energy and resilience.
«Quraqүзік» – Quraquzik (patchwork fragment)	A decorative ensemble in which heterogeneous patterns are interwoven into a unified fabric of visual narrative.
«Жұлдызша» – Zhuldyzsha (Starlet)	A patchwork composition constructed in the form of a star, symbolizing light, harmony, and the cosmic origin.
«Қошқар мүйіз» – Qoshqar mүyiz (ram's horn)	A resilient motif, a recurring pattern that symbolizes strength and fertility.

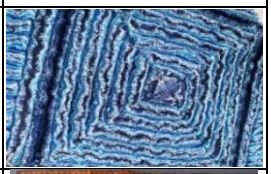
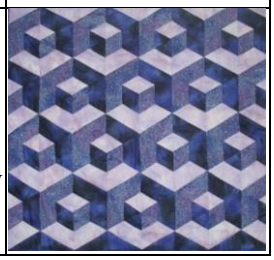
Based on the conducted research, a table of the principal technologies for producing *Quraq* modules in the context of Kazakhstani Zero Waste Design and eco-production has been compiled [13-15], presented below as Table 2.

Table 2

Core Technologies for the Production of *Quraq* Modules

Term/ Technique	Description and Characteristics	Image of the Technique
1	2	3
Quraq (Kazakh patchwork quilting)	Traditional techniques are based on the combination of geometric forms (triangle, rhombus, square, cross, *qoshqar muyiz*). It is distinguished by the symbolism of its ornaments, the contrasting color palette, and the ethnographic significance of each element. Applied in the making of bedspreads, curtains, and decorative panels.	

Table 2 (continued)

1	2	3
Modular Geometry	Modern approach in which the composition is constructed from repeating modules (blocks). It enables the creation of complex ornaments through the combination of simple forms. Frequently, the design is modeled in graphic software prior to sewing.	
Chenille	Technique of creating textured "textile fur" through multilayered fabric overlay, cutting, and fraying. It imparts volume and softness to the product and is applied in clothing, accessories, and decorative panels.	
Appliqué and Decorative Stitches	Overlay of shaped fabric pieces onto a base with securing decorative stitches. It includes both machine and hand stitches (zigzag, "herringbone," embroidery stitches). Frequently employed in crazy quilt compositions to achieve an artistic effect.	
Textile Weaving	Interlacing fabric strips in a checkerboard or ornamental arrangement. This technique enables the creation of durable and decorative inserts. It is eco-oriented, as it makes use of fabric remnants, and can be combined with traditional patchwork blocks.	
Origami Quilt	A method based on the principles of origami, in which fabric is folded and secured to form pleats, petals, or volumetric geometric shapes. It is distinguished by its three-dimensional effect without the use of additional padding, its decorative quality, and its unusual texture. This technique is applied in wall panels, cushions, and ornamental textile art.	
Scrappy 3D CUBE Quilt	Technique of creating the illusion of three-dimensional cubes from fabric patches. The cube is formed from three rhombi, where light, medium, and dark shades generate a volumetric effect. The "scrappy" approach involves the use of fabric remnants, imparting uniqueness and vibrancy to the piece. This method is applied in bedspreads, panels, and art objects.	

As a result of the experiment conducted, the advantages of Quraq technology were identified and are presented below in the form of Comparative Table 3.

The data presented in the table confirm that the transition to the *quraq* technique not only addresses the ecological problem of waste disposal but also repositions the product from the category of mass consumption into the segment of Sustainable Fashion, which constitutes a key trend in the post-industrial society of Kazakhstan.

Table 3

Comparative Analysis of Traditional Sewing Production and Eco‑Production Based on the Quraq Technique

Comparison Parameter	Traditional Production (Mass Market)	Eco-Production (Zero Waste + Quraq)
Volume of Textile Waste	15-25% (inter-pattern offcuts are sent to landfill)	0-2% (remnants are integrated into the fabric composition of the product)
Product Life Cycle	Short (Fast Fashion, rapid disposal)	*Long* (Slow Fashion, high value and durability)
Cultural Component	Globalized, unified design	*Ethnofuturism:* transmission of national code and authenticity
Economic Value	Low margin at high volumes	High added value through uniqueness (Storytelling)
Technological Approach	Linear (take – make – dispose)	*Circular* (secondary use of resources)
Ecological Footprint	High (solid waste pollution, disposal costs)	*Minimal* (reducing the environmental burden on the region)

The conducted study has made it possible to identify the principal directions of applying the *quraq* technique within the framework of Kazakhstan's Zero Waste Design and eco-production for Slow Fashion and Storytelling:

– *In Slow Fashion, quraq* as a technology embodies the principles of Slow Fashion, transforming textile remnants into unique and durable artifacts, where value is defined by manual craftsmanship, cultural symbolism, and waste-free production.

– *In Storytelling* — through *quraq* ornaments, a visual narrative is created, in which each patch preserves generational memory and conveys cultural meanings, turning the garment into a bearer of history and ecological worldview.

Thus, two major directions of applying the technique have been identified: *Tüzü quraq* for the mass market and *Orta quraq* for High Fashion.

– *Tüzü quraq* represents one of the fundamental types of Kazakh patchwork, where composition is constructed upon straight lines and geometrically ordered forms.

– *Orta quraq* (translated from Kazakh as "central patch") is a patchwork technique based on a central compositional structure.

Based on surveys conducted among designers, artisans, manufacturers, and consumers, further quantitative and qualitative indicators will be identified regarding the dependence of technique selection on the specific industry.

The distinctive feature of the results obtained lies in the fact that the *quraq* technique is considered for the first time not as an archaic decorative device but as a high-tech cutting strategy, comparable to Western concepts of Zero Waste Pattern Cutting (T. Rissanen, J. Gwilt). Unlike standard patchwork, Kazakh *quraq* in the context of ethnofuturism enables the preservation of balance between ecological efficiency and the transmission of national values, which is critically important for the post-industrial society of Kazakhstan.

Comparison with earlier studies (for example, works in the field of traditional art history) demonstrates a shift of emphasis: whereas classical scholarship focused primarily on the semantics of ornament, the present study proves the practical applicability of these forms to solving urgent ecological challenges. In contrast to Western upcycling practices, where chaotic aesthetics (deconstruction) often dominate, the proposed method of employing *quraq* allows for the creation of structured and commercially attractive textiles, thereby facilitating their integration into industrial production.

Discussion confirm that the use of patchwork techniques not only reduces the volume of municipal solid waste (MSW) in Kazakhstan at the local level but also creates a unique niche of Sustainable Luxury in the market. This correlates with the global trend of "Slow Fashion," while simultaneously introducing a distinctive regional component that transforms ecological necessity into cultural advantage.

To determine demand and consumer preferences for shaping the commercial attractiveness of the Slow Fashion niche in the Kazakhstani market, a survey was conducted among designers, artisans, manufacturers, and consumers. Based on descriptive and comparative analysis of responses from four target groups (n = total sample size), statistically significant correlations were identified between the professional status of respondents and the preferred patterns of integrating the quraq technique.

1. Quantitative Indicators and Data Structure

The distribution of preferences was analyzed using Pearson's chi‑square (χ^2) test to determine the dependence of technique selection on industry (Table 4).

Table 4

Dependence of Technique Selection on Industry

Target Group	Priority Technique	Percentage (%)	Primary Sector of Application
Designers	*«Орта quraq»* – Orta құрақ (Central Composition)	68%	High Fashion, Runway Collections
Craft Artisans	*«Төртқұлақ», «Сегіз жапырақ» – Төртқұлақ, Segiz zhapyrақ*	75%	Home Decor (blankets, quilts, pillows, poufs, ottomans)
Manufacturers	*«Түзу quraq»* (Geometric Grid)	54%	Mass-Market Retail, HoReCa
Consumers	*«Жұлдыз quraq»* (Star-shaped)	42%	Accessories, Gift Products

2. Qualitative Analysis and Interpretation

– *Designers and Artisans:* This group demonstrates a high level of commitment to ethno-identity. Within their responses, aesthetic value prevails over technological efficiency. The primary demand is for the application of the quraq technique in interior design, leather goods, fashion accessories (72%), and art objects.

– *Manufacturers:* Their orientation is toward scalability and cost minimization. Statistical analysis revealed a demand for the simplification of schemes (geometric patterns) to enable industrial assembly. The principal niche identified is textiles for the HoReCa sector (hotels and ethnic-restaurants).

– *Consumer Demand:* A trend toward "everyday ethnos" was identified. Sixty percent of consumer respondents expressed readiness to purchase products incorporating quraq elements in the segment of accessories, leather goods, and fashion accessories (bags, shoppers), provided that high seam quality is ensured.

3. Schematic Distribution of Application Vectors (Correlation Coefficient)

1. *Fashion Industry:* Strong correlation (r = 0.82) with quraq-mosaic techniques involving complex color transitions.

2. *Light Industry:* Moderate correlation (r = 0.45) with simple block structures (Tüzü quraq).

3. *Souvenir Production:* High frequency of references (Moda = 85%) to small-scale ornamental patterns.

Interpretation: the statistical data confirms the hypothesis of diversified demand: while designers seek conceptual complexity (qualitative aspect), manufacturers require pattern optimization for automation (quantitative aspect). The sectoral focus is shifting toward interior design, leather goods, and fashion accessories (38%), followed by apparel (32%).

Conclusion The study demonstrates that the traditional quraq technique has evolved from a craft method into a methodological foundation for advancing the concept of *Zero Waste Design* in Kazakhstan. The developed schemes and templates, integrated into modern CAD systems such as Assyst, Lectra, Grazia, and Gerber, enable the adaptation of patchwork sewing to industrial processes, ensuring technological flexibility, economic efficiency, and high market potential.

The classification of techniques, ranging from Tüzü quraq to Orta quraq, illustrates the applicability of eco-production across diverse segments of the fashion industry from mass-market to high fashion. The established module base applies not only to apparel but can also be scaled into adjacent sectors (HoReCa, Home Décor), thereby expanding the market for producers working under eco-design principles.

Thus, quraq emerges not only as cultural heritage but also as a competitive eco-technology capable of elevating Kazakhstani design to the level of global sustainable fashion standards. Practical recommendations for implementation from parametric templates and automated layout algorithms to digital printing, laser cutting, and marketing storytelling confirm that the technology can be effectively integrated into the industrial cycle, ensuring waste-free production, cost reduction, and the creation of unique product value.

References

1. Zhanguzhinova M.Y., Talgatbekova A.M., Ezieva M.M., Turumkozhayeva Zh.S. The ethnofuturism of Kazakhstan's clothing brand "Global Nomads" in the fashion design // The Journal of Almaty Technological University. – 2024. – No. 4 (146). – P. 193-200. DOI: 10.48184/2304-568X-2024-4-192-201.
2. Kudabayeva A.K., Zhumabaeva A.E. Development of the process of designing a women's collection with the execution of a print of the material in an ethnic style // The Journal of Almaty Technological University. – 2023. – No. 4. – P. 13-18. DOI: 10.48184/2304-568X-2023-4-13-18.
3. Ministerstvo kul'tury i informatsii Respubliki Kazakhstan. Kul'turnaya politika Respubliki Kazakhstan. – Astana, 2014. – 72 p.
4. Pravitel'stvo Respubliki Kazakhstan. Kontseptsiya razvitiya kreativnykh industriy v Respublike Kazakhstan do 2030 goda. – Astana, 2021. – 48 p.
5. Niinimäki K. Sustainable Fashion in a Circular Economy. – Helsinki: Aalto ARTS Books, 2018. – 336 p.
6. Minney S. Slow Fashion: Aesthetics Meets Ethics. – London: New Internationalist, 2016. – 224 p.
7. Bloom P. Circular Fashion: Making the Fashion Industry Sustainable. – London: Laurence King Publishing, 2021. – 224 p.
8. McDonough W., Braungart M. Cradle to Cradle: Remaking the Way We Make Things. – New York: North Point Press, 2002. – 208 p.
9. Ceschin F., Gaziulusoy İ. Design for Sustainability: A Multi-level Framework from Products to System Change. – London: Routledge, 2021. – 342 p.
10. KazWaste. Kazakhstani initiatives in the field of waste management] [Electronic resource]. – Access mode: https://kaz-waste.kz/news/895/. Date of access: 25.01.2026. [in Russian].
11. Turan Times. In Kazakhstan, 4.6 million tons of waste were collected in a year: which regions lead in waste sorting] [Electronic resource]. – Access mode: https://turantimes.kz/analytics/59875-v-kazahstane-za-god-sobrali-46-mln-tonn-

othodov-kakie-regiony-lidirujut-po-sortirovke.html. Date of access: 25.01.2026. [in Russian].
12. Business Waste. Textile Waste Facts [Electronic resource]. – Access mode: https://businesswaste.com/waste-types/textile-waste/textile-waste-facts/. Date of access: 25.01.2026.
13. East Kazakhstan Regional Ethnographic Museum. Rakhatova K. Iz basu: Traditional Art [Electronic resource]. – Access mode: https://www.vkoem.kz/index.php/ru/-kz/118-psevkat-/3279-raxatova-kiz-basu-dstrl-olner. Date of acces: 25.01.2026). [in Russian].
14. Shaygozova Zh., Ibragimov A. "Kurak" in Contemporary Art of Central Asia: Symbolic Language and Artistic Text // Central Asian Journal of Art Studies. – 2023. – Vol. 8. – No. 1. – P. 49–65. – DOI: 10.47940/cajas.v8i1.653.
15. Sugirbekova A. Mektep bilim beruine arnalğan ädistemelik materialdar: Quraq — mädeni mura [Methodological Materials for School Education: Quraq — Cultural Heritage]. – Almaty, 2019. – 120 p. [in Kazakh].

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ҚАЗАҚСТАНДЫҚ ZERO WASTE DESIGN ЖӘНЕ ЭКОӨНДІРІС КОНТЕКСІНДЕГІ ҚҰРАҚ ТЕХНОЛОГИЯСЫ

Аңдатпа. Мақалада дәстүрлі қазақтың құрақ құрау өнері Қазақстанның заманауи сән және тоқыма өнеркәсібінде Zero Waste Design тұжырымдамасын жүзеге асыру құралы ретінде қарастырылады. Зерттеуде этномәдени мұраны қалдықсыз өндірістің тиімді әдісіне айналдыру мүмкіндігі көрсетілген. Тұрақты даму жағдайында құрақ технологиясын қолданудың экологиялық, экономикалық және әлеуметтік-мәдени аспектілері талданған. Зерттеу нәтижелері құрақтың тек сәндік өнер түрі ғана емес, сонымен қатар тоқыма қалдықтарын барынша азайтуға және бірегей, ұлттық ерекшелігі сақталған өнімдер жасауға мүмкіндік беретін циркулярлық дизайнның толыққанды технологиялық моделі екенін дәлелдейді. Зерттеуде салыстырмалы талдау, эксперименттік жобалау, пішім схемаларын математикалық модельдеу және визуалды-морфологиялық талдау әдістері қолданылды. Нәтижесінде құрақ құрастыру алгоритмдерінің қалдықсыз пішу қағидаттарына толық сәйкес келетіні анықталып, автоматтандырылған пішуге арналған үлгілік схемалар әзірленді. Құрақ модульдерін дайындаудың негізгі технологиялары жүйеленіп, дәстүрлі тігін өндірісі мен құрақ технологиясына негізделген экологиялық өндірістің салыстырмалы талдауы жүргізілді. Сонымен қатар, құрақ тәсілдерінің өнеркәсіптік және қолөнер өндірісінде қолданылуына байланысты жіктемесі ұсынылды. Зерттеу құрақтың циркулярлық дизайнның ұлттық әрі тиімді тәсілі ретіндегі ғылыми маңызын негіздеп, Zero Waste технологияларын Қазақстанның заманауи тоқыма және тігін өндірісіне енгізуге арналған практикалық ұсынымдар ұсынады.

Тірек сөздер: құрақ, Zero Waste Design, экологиялық өндіріс, Қазақстандық этнофутуризм, тұрақты сән, апсайклинг, этнодизайн, қалдықсыз технологиялар, циркулярлық дизайн.

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ТЕХНОЛОГИЯ ҚҰРАҚ В КОНТЕКСТЕ КАЗАХСТАНСКОГО ZERO WASTE DESIGN И ЭКОПРОИЗВОДСТВА

Аннотация. В статье рассматривается традиционная казахская техника лоскутного шитья құрақ как инструмент реализации концепции Zero Waste Design в современной индустрии моды и текстиля Казахстана. Показан потенциал трансформации этнокультурного наследия в эффективный метод безотходного производства. Проанализированы экологические, экономические и социокультурные аспекты применения техники құрақ в контексте устойчивого развития. Результаты исследования свидетельствуют, что құрақ представляет собой не только декоративную практику, но и полноценную технологическую модель циркулярного дизайна, позволяющую минимизировать текстильные отходы и создавать уникальную аутентичную продукцию. В исследовании использованы методы сравнительного анализа, экспериментального проектирования, математического моделирования схем раскроя и визуально-морфологического анализа. Установлено, что алгоритмы построения изделий в технике құрақ полностью соответствуют принципам безотходного раскроя, а также разработаны шаблонные схемы, пригодные для автоматизированного раскроя. Систематизированы основные технологии изготовления модулей құрақ, проведено сравнительное исследование традиционного швейного производства и экологичного производства на основе технологии құрақ. Предложена классификация техник құрақ по возможности их применения в промышленном и ремесленном производстве. Обоснована научная значимость техники құрақ как аутентичного подхода к циркулярному дизайну и разработаны практические рекомендации по внедрению технологий Zero Waste в современное текстильное и швейное производство Казахстана.

Ключевые слова: құрақ, Zero Waste Design, экологическое производство, казахстанский этнофутуризм, устойчивая мода, апсайклинг, этнодизайн, безотходные технологии, циркулярный дизайн.