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A STUDY OF THE PROSPECTS AND CHALLENGES OF IMPLEMENTING ADVANCED 3D TECHNOLOGIES IN UZBEKISTAN'S LIGHT INDUSTRY

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Abstract: This article analyzes the increasing economic activity of small and medium-sized enterprises (SMEs) in Uzbekistan under the conditions of globalization, with particular emphasis on the growing trend of outsourcing services in the light industry sector. The study explores the application of 3D automated design systems (ADS), specifically the capabilities of the CLO3D software, to improve production efficiency, enhance product quality, and optimize time expenditures. During the research, the standard avatar size models provided by CLO3D were modified based on various size typologies (OCT-17-326-81 and DOB-Größentabelle), and comparative analysis was conducted on the variations in subordinate size indicators. The study revealed significant discrepancies between the typologies. These differences were analyzed through graphical interpretation and were identified as one of the key factors contributing to inconsistencies between virtual models and physical prototypes. The findings justify the need to develop a standardized digital database of body measurements and fabric characteristics to ensure greater precision and reliability in virtual design processes.

Keywords: Small and Medium-Sized Enterprises (SMEs); Outsourcing; 3D Design Systems; CLO3D; Digital Avatar; Simulation; Light Industry; Virtual Prototyping; Apparel Technology; Garment Visualization.

Introduction. In the context of globalization, the rapidly changing business environment requires companies to adopt more flexible and efficient management strategies. From this perspective, **outsourcing**—the practice of delegating certain business functions to external service providers—is gaining increasing attention. Through outsourcing, companies are able to redirect their internal resources toward more critical tasks, reduce costs, and enhance operational efficiency. [1]. This approach is not only relevant for large corporations, but also holds significant importance for small and medium-sized enterprises (SMEs). SMEs represent a vital segment of Uzbekistan's economy, accounting for approximately 56% of the country's gross domestic product (GDP). Their role in fostering economic growth, employment, and innovation makes them key beneficiaries of efficient management practices such as outsourcing. [2]. In recent years, the extensive integration of digital technologies and the increasing demand for external services have transformed outsourcing into a particularly relevant strategic tool for small and medium-sized enterprises (SMEs). According to the State Committee of the Republic of Uzbekistan on Statistics and IT Park Uzbekistan, the outsourcing services market has been expanding at an annual growth rate of approximately 15–20 percent. [3]. This serves as evidence of the sector's growing potential and future prospects.

The light industry sector, particularly the textile and garment-knitting industries, plays a significant role in Uzbekistan's economy. In recent years, the number of small and medium-sized enterprises (SMEs) operating in this sector has increased, and many have begun actively utilizing outsourcing services. As of February 1, 2024, a total of 68,691 industrial enterprises are operating across the country. Regionally, the highest concentration of such enterprises is found in Tashkent city (11,930), followed by Fergana region (7,635) and Tashkent region (7,273) [4].

In recent years, enterprises in Uzbekistan have been increasingly integrating with foreign markets. As a result, international clients have significantly raised their expectations regarding product quality, delivery timelines, and service standards. However, a number of practical time-related issues have been observed within the production chain. [5]. In particular:

1. Problems in the logistics system – Customs clearance and transportation delays, both in exporting finished products and importing raw materials, are among the primary obstacles. These issues often result in the failure to fulfill orders on time, thereby undermining customer trust. [3].
2. Limited Technical Capabilities – Small and medium-sized enterprises often lack access to modern equipment. As a result, they are unable to efficiently fulfill large-volume orders within a short timeframe.
3. Communication and Time Zone Differences – Time zone disparities remain a significant challenge in communication with foreign clients. This often leads to delays in clarifying and approving technical specifications.
4. Quality Issues and Reproduction – Defects identified in the products often necessitate re-production, which in turn delays the overall production schedule.
5. Demand for Customized Orders – Each foreign client typically requires unique designs, standards, and documentation, which necessitates additional time and effort to fulfill.

Modern digital technologies play a crucial role in addressing these challenges. In particular, 3D modeling and automated design technologies (ADT) significantly accelerate the production process [6-8]. With the help of digital mannequins and body scanners, customer-specific measurements are accurately determined, garments are designed in a virtual environment, and tested before any physical sample is produced [9,10]. This approach not only saves time and costs, but also reduces errors at the logistics stage. Therefore, an in-depth study of the capabilities of modern 3D design systems was undertaken by our research team.

Materials and methods. The aim of this study is to analyze advanced modern three-dimensional design systems and to investigate the characteristics of digital avatars in the CLO3D software as a potential source of defects and mismatches that arise during the virtual fitting process compared to real-life garment shapes.

Research Objectives:

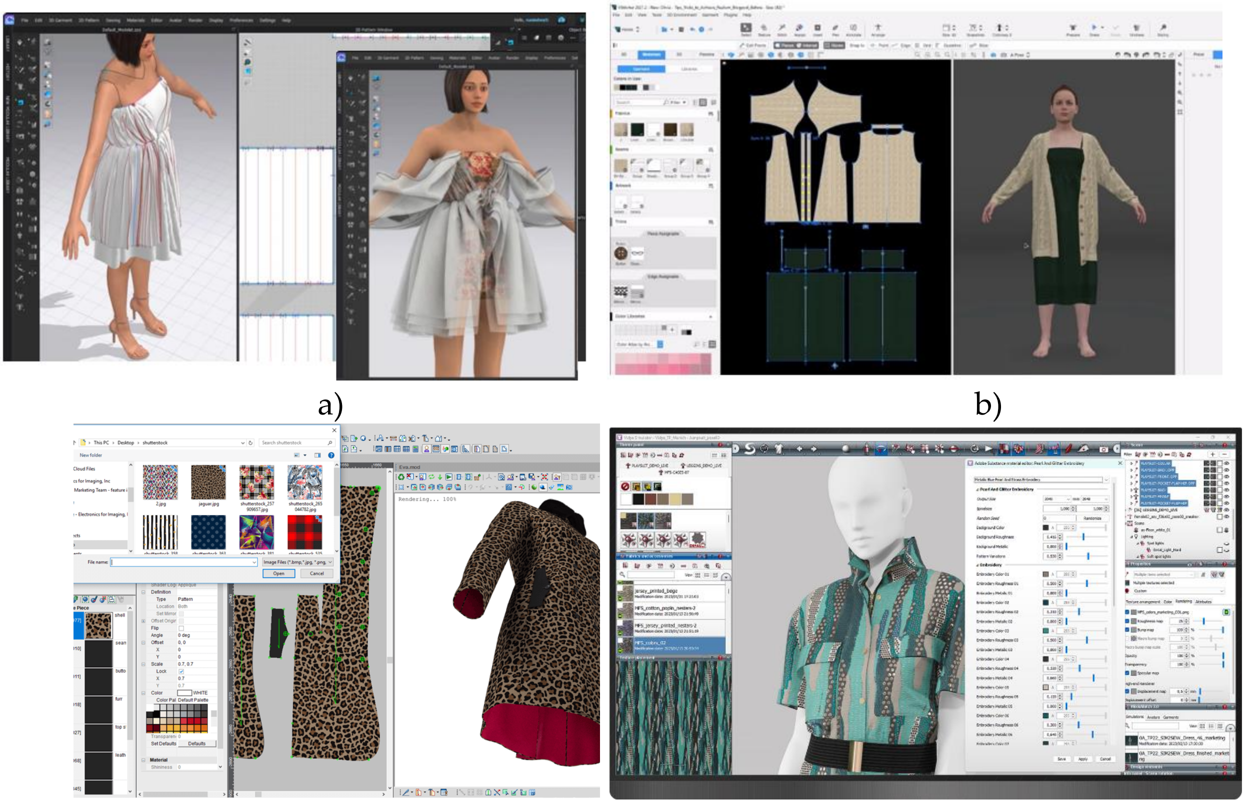
1. To study the capabilities and limitations of modern automated design technologies (ADTs) and to select the most suitable software for the research.
2. To investigate the avatar-specific features of the selected software.
3. To modify the standard leading measurements of the digital avatar based on different size typologies and to identify the resulting changes in subordinate measurements.
4. To conduct a comparative analysis between the obtained subordinate indicators and the dimensional standards of the typologies, and to develop recommendations based on the findings.

To accomplish the stated objectives, methods such as literature review, comparative analysis, and computational evaluation were employed. The CLO3D software was utilized to carry out the practical experiments.

At present, several leading innovative automated design technologies (ADTs) offering 3D modeling capabilities are widely used in the fashion industry. These include CLO3D (South Korea), VStitcher (Browzwear, Singapore), Optitex (Israel), Assyst Vidya (Germany), Gerber AccuMark 3D (USA), Julivi (Ukraine), Tuka3D Fit (Tukatech, USA), and Style3D Studio (China) [11-13]. These software platforms typically consist of similar modules that perform functions such as pattern making, 3D avatar editing, 3D garment design, fabric property configuration, 3D stitching, and virtual fitting, among others. Despite their functional similarities, each ADT possesses unique features and specialized tools tailored to different stages of the digital fashion design workflow.:

The CLO3D software offers advanced 3D visualization capabilities, allowing users to configure avatars in any desired size, color, and posture. It supports simultaneous 2D and 3D construction, enabling designers to work in both environments in real time. The platform facilitates comprehensive testing of fabric properties such as texture, transparency, thickness, print patterns, and imagery. CLO3D also enables simulation of technical elements such as pins, pleats, elastic bands, seams, and steam effects. In addition, it supports parametric modeling, realistic rendering of individual garments or entire collections, and provides an extensive library of patterns, accessories, seams, and textiles (Figure 1a) [14]. The software is well-suited for use by designers, fashion brands, freelancers, and startups.

The VStitcher module, developed by Browzwear, features integrated 2D and 3D workspaces and supports the visualization of realistic fabric properties, including stretch and pressure indicators. It allows for the manipulation of multi-layered textures and the simulation of various body postures. This software is primarily designed for users working within large-scale enterprises (Figure 1b) [15]. However, it should be noted that the licensing cost of the program is relatively high.



a) b)

b) d)

Figure 1. Fragments of working interfaces from modern 3D automated design technologies (ADTs): a) CLO3D; b) VStitcher; c) Optitex; d) Assyst Vidya software

The Optitex software offers a range of advanced features, including precise fabric simulation, color management, and print placement tools. It provides a distance and tension map between the avatar and the garment, tools for multi-layer seam construction, an avatar editor, and capabilities for measuring and modeling in 3D based on the physical and visual properties of fabrics. Additionally, the Runway Designer 3D module enables dynamic 3D presentations of fashion models (Figure 1c) [16]. It is primarily suitable for furniture design, engineering, and sewing factories. However, the software operates exclusively on the Windows platform and has a licensing cost exceeding $1,000 per quarter.

Assyst Vidya (currently integrated with Style3D) provides efficient real-time visualization. It enables the creation of avatars based on individual body measurements or the selection from standard size templates. The software allows for the bidirectional transfer of 3D construction changes to 2D patterns and vice versa. It supports precise simulation of draping and pleats, visualization of fabric stretching under real tensile forces, reinforcement of materials (e.g., through additional lining fabrics), and detailed work with prints (Figure 1d). However, the software is primarily intended for corporate users, and convenient licensing options for individual designers are not available. Additionally, the learning curve is relatively steep, with limited access to free tutorials and educational resources.[17].

The Gerber AccuMark 3D software provides a wide range of capabilities, including testing various fabrics, silhouettes, colors, and prints; evaluating the fit quality of garments across individual or graded size groups; visualizing construction lines on patterns; assessing the alignment of lines with virtual mannequin objects; analyzing ease allowances; correcting construction flaws in 2D and verifying the results in 3D; and examining fabric stretch zones. The Tuka3D Fit (Print Visualizer) software offers functionalities such as creating 3D models, generating animations, testing and developing fabrics, modifying their properties, editing prints, mapping tension distribution, and conducting virtual 3D photo shoots. In Style3D Studio, users can visualize fabrics, patterns, and avatars in 3D and modify them in real time. The software also provides AI-powered reconstruction of garments and avatars based on 2D images, along with high-quality rendering of the created 3D models. However, several systemic issues have been identified in virtual reality (VR)-based technologies. Research has shown that the emergence of fit-related defects can be attributed to the lack of structured training datasets in VR applications, the absence of standardized methods for modifying construction patterns, and the unavailability of systematized data linking construction modifications with the morphological characteristics of the body. [18,19]. These studies have focused on identifying fit defects in virtual environments and their underlying causes, developing criteria for assessing fit quality, and establishing methods for correcting, verifying, and parameterizing construction patterns. However, the principles governing the modification of digital avatars and their impact on fit quality have not been sufficiently explored.

According to multiple sources, including Geeker.ru, DesignLessons.ru, and OpenAI materials, CLO3D is widely recognized as one of the most universal and user-friendly 3D design software platforms. Moreover, CLO3D is considered one of the most affordable solutions specifically tailored for the fashion industry, offering student discounts that make it highly accessible for independent designers and students. The official website and YouTube channel of the software provide comprehensive instructional materials. The official YouTube channel has over 85,500 subscribers and more than 900 videos available [20]. In addition, users can access free guidance and tutorials through the official channel. With each semi-annual update, online webinars are held to introduce new features, which are translated into more than nine languages. Many users acquire the necessary skills to work with the software during the 30-day trial period, which often leads them to purchase the full version. For these reasons, CLO3D was selected as the primary software for this research. Based on our previous research conducted using this software, [11-13,21] A significant discrepancy was identified between the external shape of the physical prototype and its virtual counterpart. In the present study, the aim was to analyze the influence of digital body forms—namely, avatar measurement characteristics—and to assess their compatibility with existing sizing typologies as a contributing factor to such discrepancies. The CLO3D software provides a range of avatars with predefined base measurements. The size options for female body types are categorized into six main groups, each differentiated by height and fullness within a matrix structure. These groups include: Missy Curvy, Missy Straight, Petite Curvy, Petite Straight, Plus Curvy, and Plus Straight. The Missy and Petite categories each contain 10 body types, while the Plus category includes 6 body types. Figure 2 presents a sequential visualization of body shape variations within the Missy Curvy group. The measurement parameters of these body types were recorded and further processed using Microsoft Excel for comparative analysis (Figure 3).

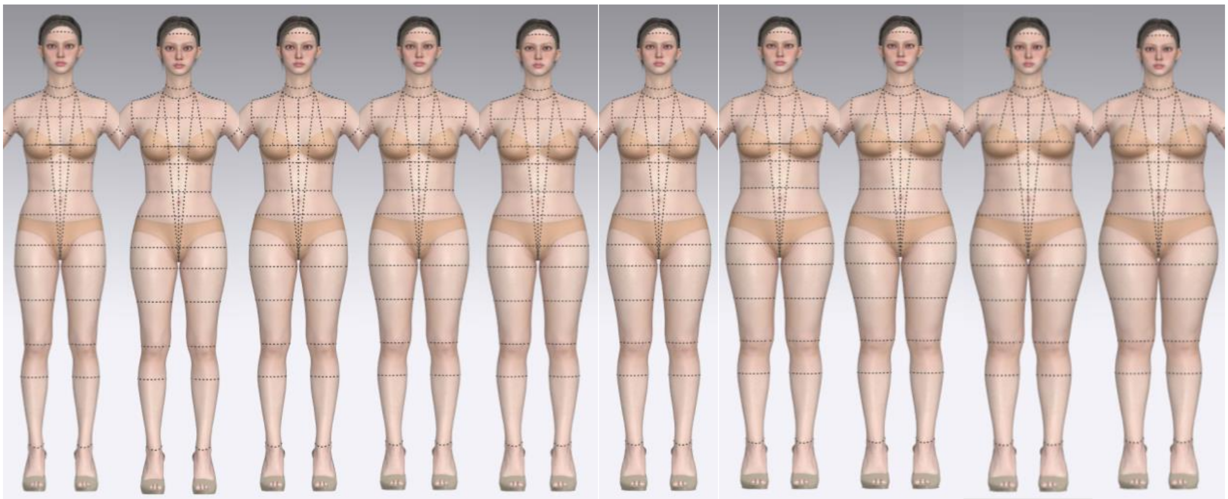


Figure 2. Visual representations of body types included in the Missy Curvy group from the software's avatar database

Figure 3. Fragment of a table displaying dimensional indicators

	Dimensional Features	Avatar	2	4	6	8	10	12	14	16	18	20
T1	Height	Missy Curvy	166,37	166,37	166,37	166,37	166,37	166,37	166,37	166,37	166,37	166,37
		Missy Straight	166,37	166,37	166,37	166,37	166,37	166,37	166,37	166,37	166,37	166,37
		Petite Curvy	158,75	158,75	158,75	158,75	158,75	158,75	158,75	158,75	158,75	158,75
		Petite Straight	158,75	158,75	158,75	158,75	158,75	158,75	158,75	158,75	158,75	158,75
T7	Waist Height	Missy Curvy	102,87	102,87	102,87	102,87	102,87	102,87	102,87	102,87	102,87	102,87
		Missy Straight	102,87	102,87	102,87	102,87	102,87	102,87	102,87	102,87	102,87	102,87
		Petite Curvy	97,79	97,79	97,79	97,79	97,79	97,79	97,79	97,79	97,79	97,79
		Petite Straight	97,47	97,47	97,79	97,79	97,79	97,79	97,79	97,79	97,79	97,79
T10	Neck Point Height	Missy Curvy	141,1	141,25	141,22	141,24	141,26	141,33	141,56	141,65	141,85	141,76
		Missy Straight	141,08	141,06	141,12	141,21	141,21	141,35	141,41	141,6	141,73	141,68
		Petite Curvy	134,17	134,14	134,06	134,31	134,29	134,57	134,68	134,72	134,78	134,85
		Petite Straight	133,99	133,95	133,97	134,12	134,19	134,55	134,47	134,49	134,69	134,74
T12	Front Shoulder Height to Bust Line	Missy Curvy	77,47	77,47	77,47	77,47	77,47	77,47	77,47	77,47	77,47	77,47
		Missy Straight	77,47	77,47	77,47	77,47	77,47	77,47	77,47	77,47	77,47	77,47
		Petite Curvy	72,39	72,39	72,39	72,39	72,39	72,39	72,39	72,39	72,39	72,39
		Petite Straight	72,39	72,39	72,39	72,39	72,39	72,39	72,39	72,39	72,39	72,39
T13	Neck Circumference	Missy Curvy	34,92	35,56	36,2	37,15	37,78	38,42	39,37	40	40,64	41,59
		Missy Straight	34,92	35,56	36,2	37,15	37,15	38,42	39,37	40	40,64	41,59
		Petite Curvy	34,92	35,56	36,2	37,15	37,78	38,42	39,37	40	40,64	41,59
		Petite Straight	34,92	35,56	36,2	37,15	37,78	38,42	39,37	40	40,64	41,59
T16	Bust Circumference (level 3)	Missy Curvy	83,82	86,68	89,54	92,07	94,61	98,43	102,55	107	111,76	116,84
		Missy Straight	83,82	86,68	89,54	92,07	92,07	98,43	102,55	107	111,76	116,84
		Petite Curvy	83,82	86,68	89,54	92,07	94,61	98,43	102,55	107	111,76	116,84
		Petite Straight	83,82	86,68	89,54	92,07	94,61	98,43	102,55	107	111,76	116,84
T17		Missy Curvy	69,21	69,7	73,66	76,2	78,74	82,55	86,36	90,81	95,57	100,65
		Missy Straight	69,21	71,12	73,66	76,2	76,2	82,55	86,36	90,81	95,57	100,65

	Lower Bust Circumference (level 4)	Petite Curvy	69,21	71,12	73,66	76,2	78,74	82,55	86,36	90,81	95,57	100,65
		Petite Straight	69,21	71,12	73,66	76,2	78,74	82,55	86,36	90,81	95,57	100,65
T18	Waist Circumference	Missy Curvy	64,45	66,36	68,58	71,12	73,66	78,1	82,55	87,63	93,35	99,06
		Missy Straight	68,26	70,17	72,39	74,93	77,47	81,92	86,36	91,44	97,16	102,87
		Petite Curvy	65,72	67,63	69,85	72,39	74,93	79,37	83,82	88,9	94,61	100,33
		Petite Straight	69,53	71,44	73,66	76,2	78,74	83,18	87,63	92,71	98,43	104,14

Results and discussion. To analyze the variation of subordinate measurements during the adjustment of existing base size parameters to the required dimensions—and to assess their compatibility with various sizing typologies—typical body types were selected from the OST 17-326-81 (RF) standard, specifically for height 164 and fullness group II (size range 84–104), as well as from the DOB-Größentabelle der deutschen Damen (based on 1994 measurements). These indicators were aligned with the key measurement parameters used for avatars, and the avatar was modified accordingly. The fact that many researchers have acknowledged the advantages of the "EMCO SEV" and "Müller & Sohn" pattern-making systems provided justification for basing the comparative analysis on the Russian and German body type standards. Since the measurement indicators of these two typologies differ significantly [22], For each typology, specific avatar measurement parameters were individually input. To achieve this, only three key measurements of the avatar—namely, HPS (High Point Shoulder height), Inseam (height of the buttock fold), and Bust Circumference (level 3)—were adjusted according to the dimensional standards of the respective typology. The resulting changes in subordinate measurements were recorded, and indifference intervals between adjacent sizes were determined. Table 1 presents a fragment of the comparative analysis of measurements across size gradations. The results were compared with typological reference data, and based on this comparison, graphical representations were constructed (Figures 4–7).

Table 1. Comparative analysis of subordinate measurement indicators when the avatar's primary dimensions are adjusted according to typological standards

			Measurements						Interval	General Differences	Differences between typological and avatar measurements					
	Measurement Indicators		84	88	92	96	100	104			84	88	92	96	100	104
T10	High Point Shoulder (HPS)	OCT 17-326-81	140,7	140,8	140,9	141	141,1	141,2		0,5						
		GFR	146,6	146,9	147,2	147,5	147,8	148,1		1,5						
		Avatar & OCT	140,7	140,8	140,9	141	141,1	141,2	0,1	0,5	0	0	0	0	0	0
		Avatar & GFR	146,6	146,9	147,2	147,5	147,8	148,1	0,3	1,5	0	0	0	0	0	0
T12	Inseam Height	OCT 17-326-81	73,9	73,8	73,7	73,6	73,5	73,4		-0,5						
		GFR	80,3	79,9	79,5	79,1	78,7	78,3		-2						
		Avatar & OCT	73,9	73,8	73,7	73,6	73,5	73,4	-0,1	-0,5	0	0	0	0	0	0
		Avatar & GFR	80,3	79,9	79,5	79,1	78,7	78,3	-0,4	-2	0	0	0	0	0	0
T16	Bust Circumference (Level 3)	OCT 17-326-81	84	88	92	96	100	104		20						
		GFR														
		Avatar & OCT	84	88	92	96	100	104	4	20	0	0	0	0	0	0
		Avatar & GFR	84	88	92	96	100	104	4	20	0	0	0	0	0	0
T7	Waist Height	OCT 17-326-81	102,6	102,8	103	103,2	103,4	103,6		1						
		GFR	106							0						
		Avatar & OCT	104,9	105,1	105,3	105,5	105,7	105,9	0,2	1	2,3	2,3	2,3	2,3	2,3	2,3
		Avatar & GFR	110,8	111	111,2	111,4	111,6	111,8	0,2	1	4,8	5	5,2	5,4	5,6	5,8
T17	Bust Circumference (Level 4)	OCT 17-326-81	73	76,4	79,8	83,2	86,6	90		17						
		GFR	74	77	80	84	88	92		18						
		Avatar & OCT	71	75,1	79,2	83,3	87,4	91,5	4,1	20,5	-2	-1,3	-0,6	0,1	0,8	1,5
		Avatar & GFR	70,3	74,4	78,5	82,6	86,7	90,8	4,1	20,5	-3,7	-2,6	-1,5	-1,4	-1,3	-1,2

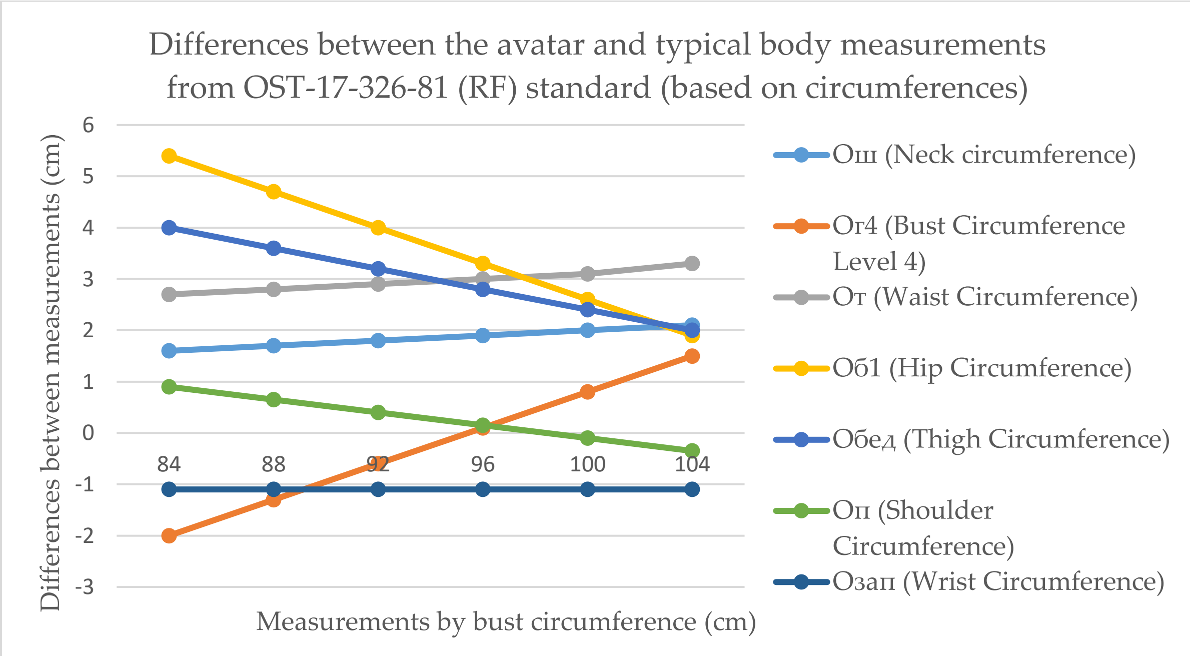


Figure 4. Differences in subordinate measurements (based on circumferences) across sizes when the avatar's primary dimensions are adjusted according to the OST-17-326-81 (RF) typology

According to the research findings, significant discrepancies were observed between the avatar's subordinate measurements and the size indicators of the OST-17-326-81 typology. In particular, at size 84, the avatar's neck circumference (Ош) exceeded the typological value by 1.6 cm, and the waist circumference (От) by 2.7 cm. These differences increased by approximately 0.1 cm per size, reaching 2.1 cm and 3.3 cm, respectively, at size 104. The bust circumference level 4 (Ог4) demonstrated the most pronounced growth dynamics, increasing by 0.3 cm with each subsequent size. Measurements such as thigh circumference (Обед) and shoulder circumference (Оп) showed a decreasing trend across sizes in the avatar. Notably, the hip circumference (Об1) recorded the highest discrepancy—5.4 cm larger than the typical measurement at size 84—and decreased steadily by 0.7 cm per size, reaching 1.9 cm at size 104. Only the wrist circumference (Озап) remained consistently 1.1 cm smaller than the standard value across all sizes (see Figure 4). Further differences were also observed in other dimensional parameters such as height, length, width, and arc measurements. These are reflected in the following numerical indicators: although the waist height (Вт) and arm length (Др) measurements of the avatar followed the same inter-size interval pattern as the typology, they were consistently larger by 2.3 cm and 1.3 cm, respectively, in each size.The chest height level 1 (Вг1) indicator of the avatar differed from the typology by 0.3 cm per size. While it was 0.9 cm greater than the typology at size 84, it gradually decreased to 0.6 cm less at size 104, demonstrating a downward trend. Measurements such as chest width (Шг), bust separation (Цг), and shoulder width (Шс) showed inter-size decreases of 0.2 cm, 0.1 cm, and 0.3 cm, respectively. At size 104, these values were 0.9 cm, 2.6 cm, and 4.0

cm smaller than the corresponding typological indicators.It is worth noting that the methods used to measure back length to waist (Дтс) and front length to waist level 1 (Дтп1) in the avatar differed significantly from those used in the typology due to the variation in anthropometric reference points [22,23], which resulted in relatively larger discrepancies. Specifically, the Дтп1 measurement in the avatar was 8.6 cm smaller than the typology at size 84 and increased by 0.4 cm per size, reaching 10.6 cm at size 104. Similarly, Дтс showed a difference of 2.3 cm at size 84 and 2.8 cm at size 104, increasing by 0.1 cm per size.Thus, the largest inter-size interval was observed for Дтп1. Overall, it was found that when primary measurements were used to generate the avatar, most circumferential measurements were larger, while height and length measurements were relatively smaller compared to the OST-17-326-81 typological standards (Figure 5).

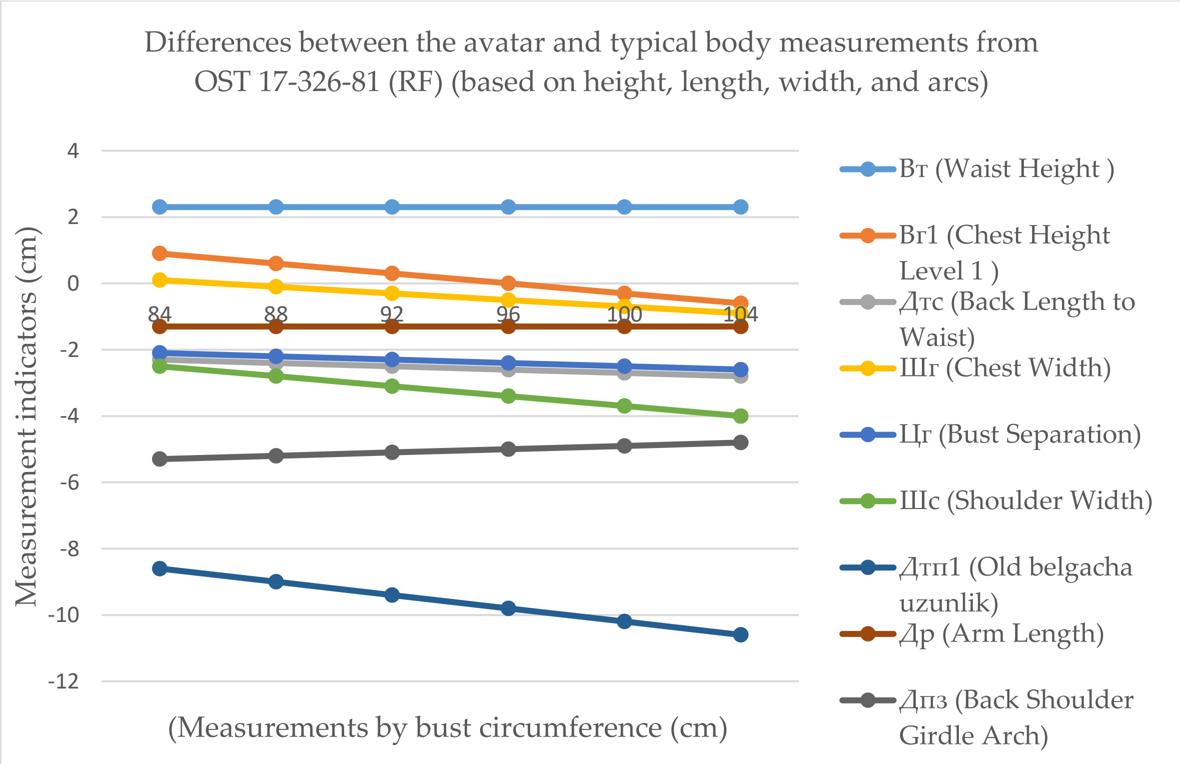


Figure 5. Differences in subordinate measurements across sizes (based on height, length, width, and arcs) when the avatar's primary dimensions are adjusted according to the OST-17-326-81 (RF) typology

Similarly, when the leading avatar dimensions were adjusted in accordance with the DOB-Größentabelle der deutschen Damen typology (based on 1994 measurements), the resulting subordinate circumference measurements revealed the following differences (Figure 5):

For neck circumference (Ош), the inter-size growth dynamics followed a 0.4 cm interval; the avatar exceeded the typological value by 1 cm at size 84, and this difference increased to 3 cm by size 104.At size 84, the avatar's hip (Об1) and thigh (Обед) measurements were 2.7 cm larger than the typology, decreasing at intervals of 0.1 cm and

0.2 cm per size, respectively, resulting in differences of 2.2 cm and 1.7 cm at size 104. The avatar's waist circumference (Oт) was 3 cm smaller than the typological value at size 84, but this discrepancy decreased to 1 cm by size 104.The wrist circumference (Озап) was initially 0.9 cm smaller at size 84 and continued to decrease with a 0.1 cm interval per size, reaching a difference of 1.4 cm at size 104.It was also found that in the compared typology, the inter-size indifference interval for bust circumference (Ог4) was not uniform, indicating inconsistency across size ranges. [14]. For this particular measurement, the avatar's body at size 84 was 2.7 cm smaller than the typological value. The difference decreased by 0.1 cm in the following size and then sharply dropped by 1.1 cm at size 92, resulting in a 1.5 cm deviation. In subsequent sizes, the differences continued to decline at a consistent 0.1 cm interval.

In the comparative analysis with the typology, the closest match in terms of circumferential measurements was observed for the shoulder circumference (Оп), which showed a consistently small difference of 0.1 cm less than the typological standard across all sizes.

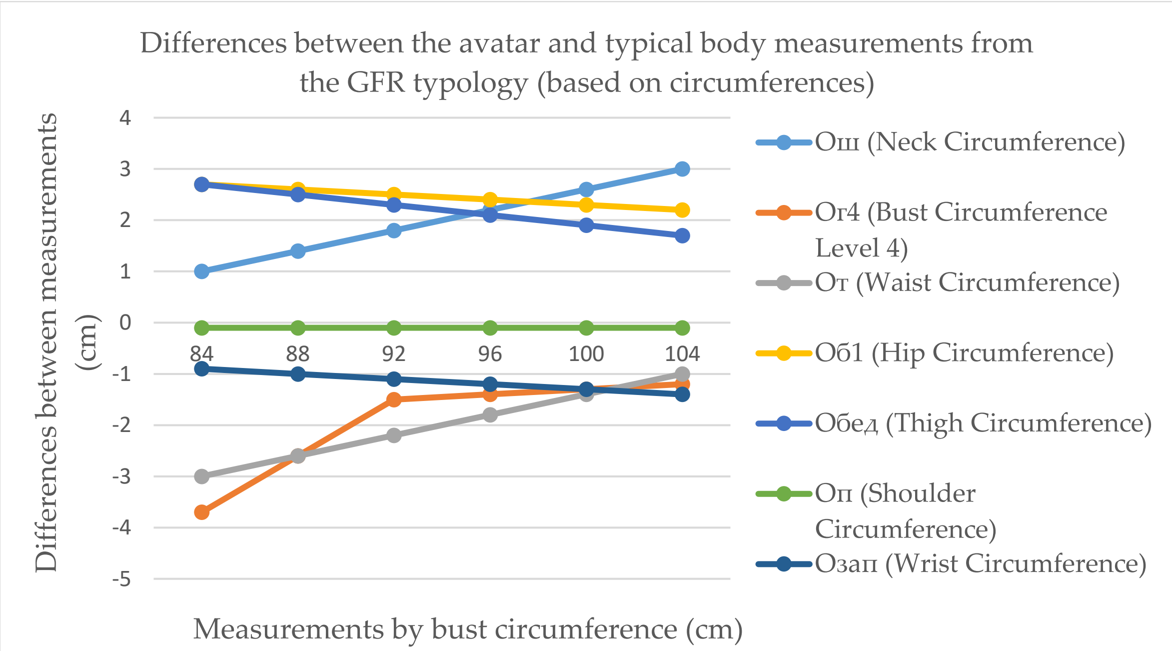


Figure 6. Differences in subordinate measurements across sizes (based on circumferences) when the avatar's primary dimensions are adjusted according to the DOB-Größentabelle der deutschen Damen (GFR) typology

In the comparative analysis graph of height, length, and width dimensions between the avatar and the DOB-Größentabelle der deutschen Damen standard (Figure 7), the waist height (Вт) in the avatar was found to be greater than the typological value, showing a difference of 4.8 cm at size 84 and 5.8 cm at size 104, with an inter-size difference interval of 0.2 cm. The chest height level 1 (Вг1) in the avatar was smaller than the typology and continued to decrease at a rate of 0.3 cm per size.The chest width (Шг), bust separation (Цг), shoulder width (Шс), and arm length (Др) were also smaller in the avatar compared to the typology, with differences of 1.9 cm, 0.25 cm, 0.4 cm, and 2.9 cm, respectively, at size 84. Notably, Шг showed the largest divergence dynamic, decreasing by 1 cm per size, and reaching 6.9 cm at size 104.As previously noted, the measurement methods for back length to waist (Дтс) and front length to waist level 1 (Дтп1) differ significantly in the avatar compared to the typology standard, resulting in relatively large discrepancies. Specifically, the avatar's Дтп1 measurement was 10.9 cm smaller than the typology at size 84 and increased by 0.3 cm per size, reaching 12.4 cm at size 104. The Дтс measurement in the avatar followed the same indifference interval as in the typology but consistently remained 3.6 cm smaller across all sizes. Such notable differences may lead to misalignment between virtual garment prototypes and real body morphology, resulting in poor fit quality, unexpected distortions, or failed outcomes when virtually testing garments constructed based on standard sizing systems.

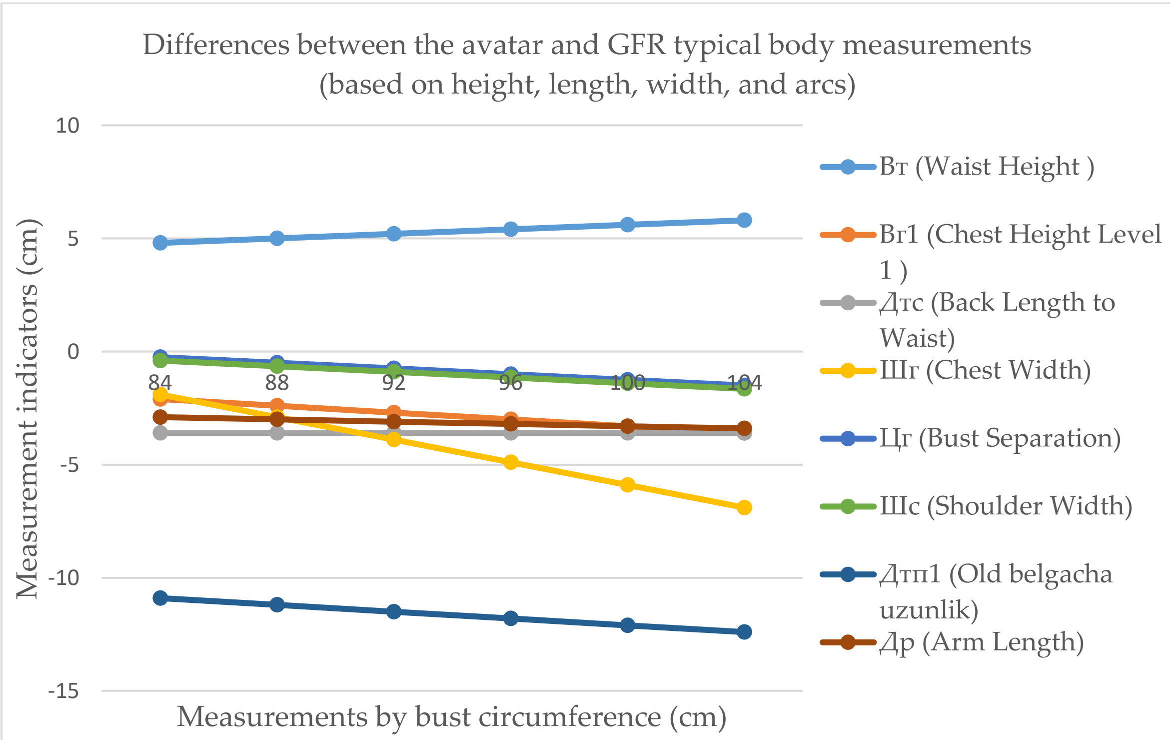


Figure 7. Differences in subordinate measurements across sizes (based on height, length, and width) when the avatar's primary dimensions are adjusted according to the DOB-Größentabelle der deutschen Damen (GFR) typology

Conclusion. In conclusion, the share of small and medium-sized enterprises (SMEs) operating in Uzbekistan's light industry and economy through outsourcing services is steadily increasing. While these services offer broad opportunities, they also entail certain issues and limitations. In addressing such challenges, modern digital design technologies play a partially significant role. However, as demonstrated through the case of the CLO3D software, there are still unresolved and understudied aspects in predicting garment shapes with real-world accuracy using advanced design systems in the fashion industry. The experiments and analyses conducted in this study revealed notable discrepancies between virtual garment forms generated in CLO3D and their corresponding physical prototypes. One of the contributing factors to these differences is the specific morphology of the digital avatar and the degree of compatibility between its measurement parameters and various typological standards. In particular, when the avatar's primary dimensions were adjusted to match the OST 17-326-81 (RF) typology, the largest inter-size deviations were observed in bust circumference level 4 (Ог4) and hip circumference (Об1). In contrast, relatively smaller deviations were found in waist height (Вт), arm length (Др), and neck circumference (Ош).Similarly, in the comparative analysis based on the DOB-Größentabelle der deutschen Damen typology, the most significant deviations were identified in Ош (neck), От (waist), Обед (thigh), and Шг (chest width). The closest alignment with the typology was observed in Оп (shoulder), Дтс (back length to waist), Шс (shoulder width), and Цг (bust separation).

The presence of such differences between typological and avatar-based measurements, along with the lack of clear rules for modifying avatar parameters, affects the quality of virtual clothing design outcomes. It also impacts the degree of alignment between virtual prototypes and physical garments, particularly in terms of fit quality. These findings underscore the necessity of accounting for such discrepancies in the digital pattern-making process when designing garments in virtual environments.

References

1. Deloitte. https://www2.deloitte.com

2. Global Outsourcing Survey 2020. O‘zbekiston Respublikasi Davlat statistika qo‘mitasi (2023). Kichik va o‘rta biznes faoliyati statistik ko‘rsatkichlari. https://stat.uz

3. UZEX Research Center (2024). Xizmatlar bozori tahlili: Autsorsing xizmatlari segmenti. https://uzex.uz

4. Statistika agentligi ma’lumotlari. Eng ko‘p sanoat korxonalari mavjud hududlar reytingi. https://stat.uz/img/press-reliz-yanvar-maj uzb.pdf

5. Turgunov Sh. "Yengil sanoat eksportida vaqt menejmenti", Iqtisodiyot va innovatsiyalar, 2023.

6. М.А.Абдукаримова, Н.А.Усманова, М.З.Камолова “Методы прогнозирования модных элементов женской одежды с использованием временных рядов” // Международный форум «Научное сотрудничество в евразийском пространстве: цифровизация и модернизация промышленности с применением искусственного интеллекта», Душанбе – 2025. p. 167-173.

7. Usmanova N.A., Abdukarimova M.A., Mahsudov Sh.A. “Информационные модули автоматизации процесса формирования структуры промышленной коллекции женской одежды” // “Қурилиш ва таълим” илмий журнали. Наманган муҳандислик-қурилиш институти. Наманган-2023 №5-6. p. 226-232.

8. Усманова Н.А., Абдукаримова М.А., Камолова М.З. Актуальность разработок дизайна одежды для различных типовых фигур // Universum: технические науки: электрон. научн. журн. 2024. 7(124). 27-33 с. URL: https://7universum.com/ru/tech/archive/item/17992

9. Usmanova N.A., Abdukarimova M.A., Kamolova M.Z. “A periodical analysis of components in women’s attire exemplified by the “Carolina Herrera” brand” // “Advances in Science and Technology” LXI International Scientific-Practical Conference. Moscow 2024. p.112-115

10. M.A.Abdukarimova, R.A.Lutfullayev, N.A.Usmanova, Sh.A.Mahsudov. “Evaluation of aestheticity of women's dress models based on deep learning models” // Scientific and Technical journal Namangan institute of engineering and technology. Namangan -2024, Vol. 9, Issue 4. p. 94-100.

11. M.A.Abdukarimova, M.Z.Kamolova. “Kiyimlarni 3D loyihalash texnologiyalari va ulardan foydalanish istiqbollari // International Scientific and Practical Conference “Problems and Solutions of Design - Education and Production Integration”, April 28, 2025. p. 87-93.

12. Usmanova N.A., Abdukarimova M.A., Kamolova M.Z., Ismoilova S.B. “Research on the process of building dress shapes in 3D space” // Scientific and Technical journal Namangan institute of engineering and technology, Namangan. Vol. 9 Issue 2, 2024. ISSN 2181-8622. p. 3-12.

13. Kamolova M.Z., Usmanova N.A., Abdukarimova M.A. “Clo3D vositasida yaratilgan virtual kiyim shaklining tadqiqoti” // “Oʻzbekistonda yangi iqtisodiy islohotlar sharoitida paxta, toʻqimachilik, yengil sanoat va matbaa sohalari texnologiyalarini rivojlantirishning istiqbollari va muammolari” Respublika miqyosidagi ilmiy-amaliy anjuman// 2024-yil 21-22 may. p. 179-183.

14. https://www.clo3d.com/en/

15. https://browzwear.com/products/v-stitcher

16. https://optitex.com/

17. https://www.assyst.de/en/products/3d-vidya/index.html

18. Peng X., Kuzmichev V. Prediction of Clothing Fit by Means of Digital Twin of Female Bodies// Технология текстильной промышленности, 2019, № 4 (382). 121-126.

19. Ван, С. Создание цифровых двойников узла "пройма-рукав" / С. Ван, В.Е.Кузьмичев // Известия вузов. Технология текстильной промышленности, 2020, 1(385), p.177-184.

20. http://www.youtube.com/@CLO3D

21. Kamolova M.Z., Abdukarimova M.A., Usmanova N.A., Mahsudov Sh.A. “Study of The Prospects for the Application of Digital Technologies in the Fashion Industry in the Development of the Creative Economy” // Scientific and Technical journal Namangan institute of engineering and technology, Namangan. Vol. 9 Issue 3, 2024. ISSN 2181-8622. p. 59-70

22. Д.А.Галун. Исследование взаимодействия процессов проектирования и реализации одежды: Дис. канд. техн. Наук. / М., 2005.

23. G.Hofenbitzer. Grundschnitte und Modellentwicklungen. Schnittkonstruktion für Damenmode. Band 1. VERLAG EUROPA-LEHRMITTEL · Nourney, Vollmer GmbH & Co. KG Düsselberger Straße 23 · 42781 Haan-Gruiten. Europa-Nr.: 62369. 2. Auflage 2018. ISBN 978-3-8085-6237-6

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