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ANALYSIS OF QUALITY CONTROL METHODS IN THE FURNITURE FACTORY "DIVA DIVANI" VRANJSKA BANJA

Damjan Stanojević[1], Anastasija Temelkova[2], Elena Jevtoska[2], Zoran Trposki[2]

[1]Academy of Technical and Educational Vocational Studies, Serbia
Department of Vranje
[2]Ss. Cyril and Methodius University in Skopje, Republic of North Macedonia
Faculy of Design and Technologies of Furniture and Interior - Skopje
Email: damjan.stanojevic@akademijanis.edu.rs; temelkova@fdtme.ukim.edu.mk; jevtoska@fdtme.ukim.edu.mk; trposki@fdtme.ukim.edu.mk

ABSTRACT

The goal of the research presented in the paper is the analysis of various quality control procedures in a factory that produces upholstery products. The upholstery industry is very developed in Vranje; the competition is high, so quality control has a huge impact on the company's operations. Quality control is one of the key elements in the production management system in a furniture factory. Its role is to ensure that each product meets defined technical, aesthetic, and functional requirements, as well as the expectations of end users. Establishing systematic quality control–from incoming control of raw materials, through process control at all stages of production, to final control of finished products–enables the detection and elimination of defects at an early stage, thereby significantly reducing the costs of repairs and complaints. This paper presents a complete quality control system in a furniture factory, from start to finish, and presents the conclusions reached, as well as their implementation for the better business of the company.

Keywords: quality system, furniture, wood technology.

1. INTRODUCTION

The furniture factory is a key place where creativity, tradition, and modern technology come together to create furniture of the highest quality. With many years of experience in production, the factory emphasizes precision in every step of the process–from the selection of the highest quality materials to the final processing.

Quality control is the foundation of its business, ensuring that each piece of furniture meets the highest standards. Using modern technologies and tools, as well as the dedication of its craftsmen, each product receives attention to the smallest detail. The diverse range of furniture covers all the needs of a modern home–from classic and traditional to innovative and modern designs. In addition to functionality, the factory strives to bring elegance and a unique aesthetic to each piece of furniture. It proudly offers the possibility of personalization, allowing customers to adapt the design to their wishes and taste. By choosing its products, customers gain durability and comfort that lasts for generations.

Environmental responsibility is a priority–materials that comply with the principles of sustainable development are used. The team of experts is dedicated to innovation, following global trends and constantly improving production processes. It also strives to provide customers with an exceptional user experience, from the initial consultation to the delivery of the product.

Furniture from the factory is not only functional but also emotionally valuable–it brings warmth and a personal touch to every home. With a wide selection of colors, materials, and styles, the factory satisfies the requirements of even the most demanding customers.

If we want to be part of the world, quality control is essential. This means that a manufacturer, if he wants to export his goods to the demanding European market, must control his products, which must be in compliance with the technical and technological standards that prevail there. When it comes to product quality, these standards are clearly defined, and they mainly relate to safety, health, and consumer protection in general. But it is not enough for a company to achieve that quality just once; it must also maintain it. Quality is assessed by highly educated people from various fields, technologists, economists, chemists, and other experts.

2. MATERIAL AND METHODS

The analysis of quality control methods was carried out at the furniture factory "Diva Divani" in Vranjska Banja. The complete quality control in the production process from start to finish, by stages, as well as the final quality control of the product, is presented.

The basics of the quality policy are:

a) "Satisfied customer" is the primary value on which the company's management and production processes are based.

b) Development of a quality culture at all organizational levels.

c) Take into account the characteristics of the product and the products offered.

d) Strive for the optimization of business processes in order to achieve the highest level of efficiency and effectiveness.

e) Adopt a method that will enable timely resolution of customer complaints.

For wood products, it is necessary to have an FCS certificate from the supplier. Wood products, chipboard, plywood, hardboard, and MDF, in addition to the above FCS standard, must have the E1 mark with a tendency to achieve a reduction of formaldehyde to the E0 level.

Diva Divani does not require but strongly recommends obtaining an ISO 9001 certificate, the exception being packaging materials (pallets, boxes, nylon, and other raw materials that do not enter the final product). Suppliers of materials that do not have an ISO 9001 certificate for them are subject to a possible audit by Diva Divani. Diva Divani Procurement decides on the execution of the audit. Suppliers are obliged to provide the purchasing office with valid certificates. The purchasing office is obliged to keep a register of all certificates and check their validity. The supplier is required to provide a REACH declaration.

a. Receipt of goods for storage

- Warranty

The manufacturer must guarantee that all raw materials comply with the requirements and regulations of Diva Divani as well as international regulations, for which they must have the appropriate certificates, as well as that they meet the delivery requirements of Diva Divani. For certain materials, Diva Divani may request additional certificates from the supplier, which in this case are delivered as a separate document. The warranty applies to the raw materials presented 24 months from the date of delivery (in other words, from the moment of transport, the liability towards Diva Divani in accordance with the agreed transport clauses comes into force).

The warranty covers all physical defects, functional and aesthetic, all deviations from the reference sample, and valid documentation resulting from an inadequate production process or improper handling or transport of the raw materials.

- Nonconformity

Products received from suppliers are always controlled, while the operators who perform this work are responsible for the good performance of that work; therefore, they perform the check immediately during the process.

Formalization and recording are carried out on special documents with records of nonconformity and are handled accordingly.

The warehouseman performs qualitative and quantitative controls of incoming goods. In the event of non-compliance with the requirements for raw materials, Diva Divani reserves the right to refuse the delivery of goods in part or in full, with the help of a commission, which draws up a report and sends it

to the supplier with a request for an analysis of the causes of the complaint submitted, defining corrective and preventive measures.

It is mandatory that all raw wood materials and solid wood comply with the FSC standard. The FSC label indicates that each piece of wood incorporated into the furniture comes from a forest where there is no illegal logging or genetically modified wood, that the logging does not cause landslides in those areas or leaching of fertile soil, or that it has led to the displacement of the population due to deforestation.

Upon receipt, the following checks are performed:

- Checking the dimensions of the material (wood and wood products) based on the dimensions shown on the supplier's invoice - mandatory control for each delivery,
- Checking the relative humidity level of the material - mandatory control for each delivery,
- Visual inspection of the quality of the material - mandatory control for each delivery,
- Checking the quantity of material received and the quantity specified in the supplier's document - mandatory control for each delivery,
- Material storage.

Figure 1 shows the material (fir sawn timber) used for the production of upholstered furniture. Fir (Spruce) Wood Company Standard.

L4000 x P145 x H22 (tolerance ±1mm)
L3500 x P145 x H22 (tolerance±1mm)
L4000 x P175 x H22 (tolerance ±1mm)
L3500 x P175 x H22 (tolerance ±1mm)
L4000 x P200 x H45 (tolerance +1mm)

Figure 2 shows the checking of the relative humidity of the material with an electric moisture meter. An important parameter that directly affects the quality of the structure and the finished product. The control is carried out by the warehouseman, and the control is mandatory for each delivery.

The company's standard for wood is 12% (tolerance is ± 2%)



Figure 1. *Material to use.*



Figure 2. *Measuring moisture content in wood.*

As for the visual inspection of the material quality, it is usually carried out by the technician in charge of the wood together with the head of the department (control is mandatory upon each delivery).

Criteria for classifying the external appearance of wood

- dimension of knots and their frequency (position is not important),
- cracks, rings, resin pockets (size and density),
- color, fiber deformation, rot, insects,
- deviations due to uneven shrinkage – curvature, distortion, lateral curvature.

Figure 3 shows the wood quality classes by appearance.

- Class CPC (G4-0 SRPS EN 1611-1) – high resistance (clean wood without knots),
- Class I high resistance (net surface: 83-100%, knots ≤ 10 mm),

- Class II (G4-2 SRPS EN 1611-1) – normal (medium) resistance (net area: 67-83% 10 mm ≤ knots ≤ 20 mm),
- Class III (G4-3 SRPS EN 1611-1).



Figure 3. *Wood quality classes.*

As for wood panels, incoming quality control is carried out by a technologist with the head of the production unit and the warehouseman, and control is mandatory upon each delivery.

- 18 mm chipboard, raw or laminate, must be compatible with the standard EN 312 - type 2 or P3, three-layer coating EN 13501-1, class D-s1, d0, formaldehyde class E1 or E0 (must be marked on each package of the material),
- All wood panels (chipboard, hardboard, plywood) must comply with E1 or E0 (standard EN 120), which means that the formaldehyde content must be ≤ 8 mg / 100 g.

Sadržaj formaldehida Proizvod je dostupan u klasi formaldehida	**E1** EN 120 (U skladu sa D.M. 10/10/08)	**UNI EN 312** **(mg / 100g)**	**≤ 8mg / 100g.**



Figure 4. *Standard for formaldehyde content.*

Their goal is to use all materials with the E0 standard in the future.

The E0 label for HCHO or formaldehyde, according to the European standard, indicates the complete absence of formaldehyde emissions (below 0.5 mg/L) in products that have this label.

The warehouse keeper is obliged to check the quantity of each delivery and compare it with the quantity in the manufacturer's invoice.

All these checks must be carried out before storing the material in the warehouse. In the event of a discrepancy between the ordered and received material, or in the event of nonconformity of the material, the purchasing office should be informed, which will inform the supplier about the return of the goods.

As for the production unit, cutting sponge and conflin, polyurethane, conflin, pleats, felt, and TNT are controlled.

Experimental methods for checking physical and mechanical characteristics can only be performed in an accredited laboratory. It is desirable to perform these tests frequently, but it is not necessary for each delivery. The test consists of density (UNI 6349, DIN 53420, ISO 1855), bearing capacity (BS 4443, Pt.1M.5, UNI 6351, DIN 53577, ISO 3386), deterioration (BS 4443, Pt.1M.5, UNI

6351, DIN 53577, ISO 3386), tensile strength (BS 4443, Pt.1M.5, DIN 53577), permanent deformation (BS 4443, Pt.1M.5, UNI 6351, DIN 53577), dynamic resistance (UNI 6356 Pt.2), elastic limits (UNI 6357) and air permeability.

3. RESULTS

The Quality Control Team, in cooperation with the process technologists, is responsible for the detection and assessment of nonconformities found in the material. If a defect is determined, the quality tool coordinator draws up an official report, which informs the supplier of the defects found. At the same time, the data is recorded in the DDPR system for further processing and monitoring. The report contains all relevant information, including:

- Invoice number and date,
- Date of receipt of the material,
- Detailed description of the nonconformity found,
- Notes and additional comments related to the defect,
- Official response from the supplier,
- Defined corrective and preventive measures to be taken.

This data is systematically presented in the form of a tabular report, covering a period of one month, enabling trend analysis and decision-making with the aim of improving quality.

ID	Data	Difetto materiale	Fornitore	Materiale In Fornitura	Descrizione Difetto	Stato difetto	ogovor firme	note	AZIONI
135	06.01.2019	MATERIALE NON CONFORME A SPECIFICHE RICHIESTE	VIN PRODUKT	vijak za mehanizam tipa FREEDOM(1364mm)	nisu uradjeni po crtezu (1364mm) 20kom. Umetak je veci a treba da bude 31,5.	CHIUSO		20kom	Zamena izvrsena.
136	06.01.2019	MATERIALE NON CONFORME A SPECIFICHE RICHIESTE	VIN PRODUKT	MN218-SHAINE	na dve metalne nogice rastojanje izmedju rupa je bilo manje treba 167 a njihovo rastojanje je 155 radili smo doradu u nasoj radionici , kao i na pet nogica gde smo malo prosirivali rupe, jer je isti slucaj ali smo u pitanju 5mm razlika.	CHIUSO		pod fakturom dosle 12 komada, dorada je vrsena na 7 u nasoj radionici	kontrolisati u FB306
137	09.01.2019	MATERIALE NON CONFORME A SPECIFICHE RICHIESTE	TAMI TRADE	SCHIENALI IN METALO per porto	Nemaju cist navoj, odnosno ima farbe na njemu, potrebno je svaku rupu opet urezati.	CHIUSO	U procesu smo resavanja tog problema. Vec smo kupili novu masinu i poceli sa ugradnjom novih (blind zakovica) Ove stare kolicine na zalost mozemo i mi doci kod Vas u fabrici da Vam resimo. Saljem Vam sliku da vidite kako smo resili taj problem.		kontrolisati sledecu isporuku
138	10.01.2019	MATERIALE NON CONFORME A SPECIFICHE RICHIESTE	AVENTURIN	najlon 1800x0.08gr	NAJLON ZA DRUGO POKRIVANJE SE CEPA.Pri povlacenju on pukne.	CHIUSO	dobavljac ce izvrsiti zamenu. Sve sto nije dobro ostavite sa strane i vraticemo. Samo me obavestite koje je kolicina u pitanju.	Prijavljeno na 650kg	obavestimo proizvodjaca
139	10.01.2019	MATERIALE NON CONFORME A SPECIFICHE RICHIESTE	EURO SPIN	OVONAVOJNI VIJAK M8X120	NEMA NAVOJ CELOM DUZINOM	CHIUSO	poveca najvise po 10mm sa obe strane i deo u sredini bez navoja bi bio 20mm		U razgovoru sa tehnickom pripremom prihvacen je predlog da vijak ima u sredini deo od 20mm bez navoja. Moze i cela duzina vijka da bude u navoju. Vraceno i nije fakturisano
140	10.01.2019	MATERIALE NON CONFORME A SPECIFICHE RICHIESTE	FURTECO	mecc. coppia WS 189-5 LISBONA	cevi stizu sa vecom dimenzijom 132(nsama potreno 1168), tockici su veci .(pogledati zapisnik)	CHIUSO			Sledeca isporuka bice rekontrolisana. Trenutno za proizvodnju narucili kolicine koje su potrebne (tockice, srafove, cevi od dobavljaca VIN PRODUKT-a per ti deokvi mogu da se upotrebe za sklop mehanizma).
141	11.01.2019	MATERIALE NON CONFORME A SPECIFICHE RICHIESTE	VIN PRODUKT	MN220-ORSON	Prema crtezu metalna nogica treba da ima visinu 110mm, nama su stigle sa visinom od 120mm.	CHIUSO		6 metalnih nogica bice vraceno dobavljacu.	uradioli kojizno odobrenje.
142	16.08.2019	MATERIALE NON CONFORME A SPECIFICHE RICHIESTE	NAVLAKA ZADUSEK CLIO	Leder Lux	Primetili smo tragove odnosno plave mrlje, smatramo da su presikani tragovi hemijske olovke (slika - imamo trag hemijskom olovkom na naliciu). Zelimo da ukazemo da se stavljaju nalepnice(etikete) na pakovanju, a ne ispis markerom.	CHIUSO	Sto se tice obelezavanja dimenzija i br. komada na dzaku lepisano markerom, mozemo pisti na etiketi i tako ce biti za sve sledece isporuke, osim ovih koje su vec zavrsene.Sto se tice hemijske na najfesluku, ona mora ostati jer se najfesluk mora obelezavati u izradi navlake. Da bi resili ovaj problem, koristicemo u buduce dvenu olovku i videti da li to daje bolje rezultlete.	posiati obavesenje dobavljacu	treba kontrolisati
143	20.06.2019	MATERIALE NON CONFORME A SPECIFICHE RICHIESTE	KOSMOPEL L	pelle grigio perla 25	pojava crvenih tacaka.	CHIUSO	Per quanto riguarda pelli già tagliate o salotti già fatti, possiamo inviarti una bottiglia di colore per provare a coprire i piccoli puntini colorati. Penso che una buona parte del problema sia possibile risolvere.	bice slopirana, kolicina u magacinu 154.06	
144	20.06.2019	MATERIALE NON CONFORME A SPECIFICHE RICHIESTE	NISI DREAM	MATERASSO ORIGINE 160X192X13	Imamo dva duseka sa zutim mrljama, ne mozemo ih koristiti u proizvodnji.	CHIUSO			
147	22.06.2019	MATERIALE NON CONFORME A SPECIFICHE RICHIESTE	RENATO NISI	NEW TAORMINA DA 160CM CON BAIONETE	stigli su mehanizmi na kojima ne postoje rupe na prednjem delu. Sva 10 mehanizama su bez rupa.	CHIUSO	In merito al suo problema con le reti New Taormina le inoltro questa comunicazione inviata in data 8 ottobre 2018 in merito alle modifiche delle reti NEW TAORMINA. Dal 1 Gennaio vengono prodotte senza foro.	Ovaj slucaj resavamo u proizvodnji, a u buduce vise pazrije molim.	
148	22.06.2019	MATERIALE NON CONFORME A SPECIFICHE RICHIESTE	VIN PRODUKT	VINKLA OSAKA	Stigle su nam vinkle sa rupama koje nisu uradjene po crtezu. Rupe trebaju biti 67 one su 66	CHIUSO		Fakturom su stigle 620 vinkli, 20 kom. uzeli za proizvodnju i obrezili jer su bile hitne, ostatak vracamo dobavljacu na popravku	vratili i popravka je uradjena

Figure 5. *Display of detected material errors.*

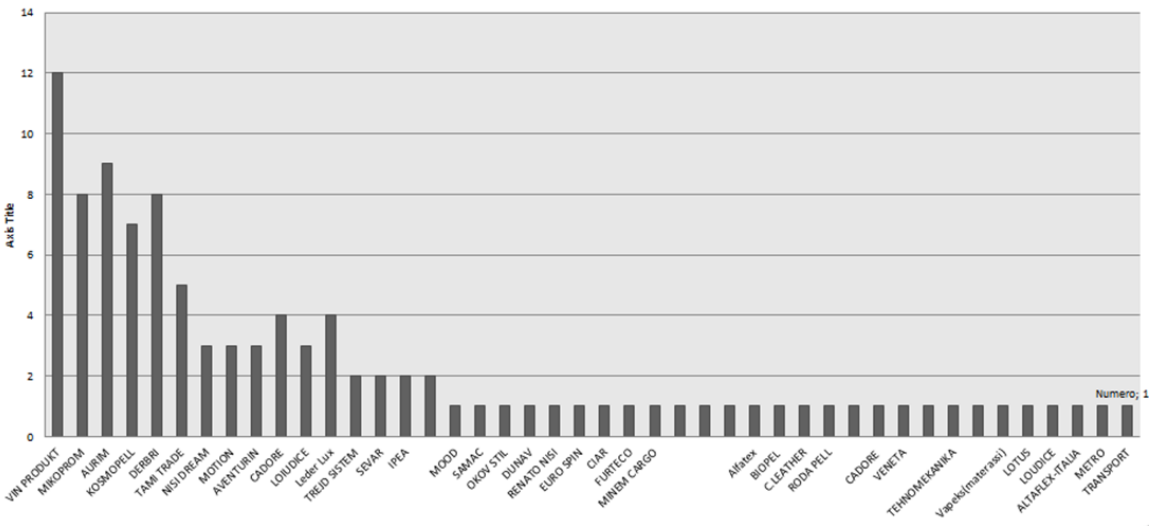


Figure 6. *Graphical representation of recorded nonconformities of raw materials by supplier.*

4. DISCUSSION

Quality control in the assembly process of wooden frame structures plays a crucial role in the production cycle of a furniture factory, as it directly affects the stability, durability, and overall quality of the final product. It includes:

- systematic inspection of materials,
- assembly precision,
- quality of joints and
- used adhesives.

Figure 7 shows examples of compliant and non-compliant joints

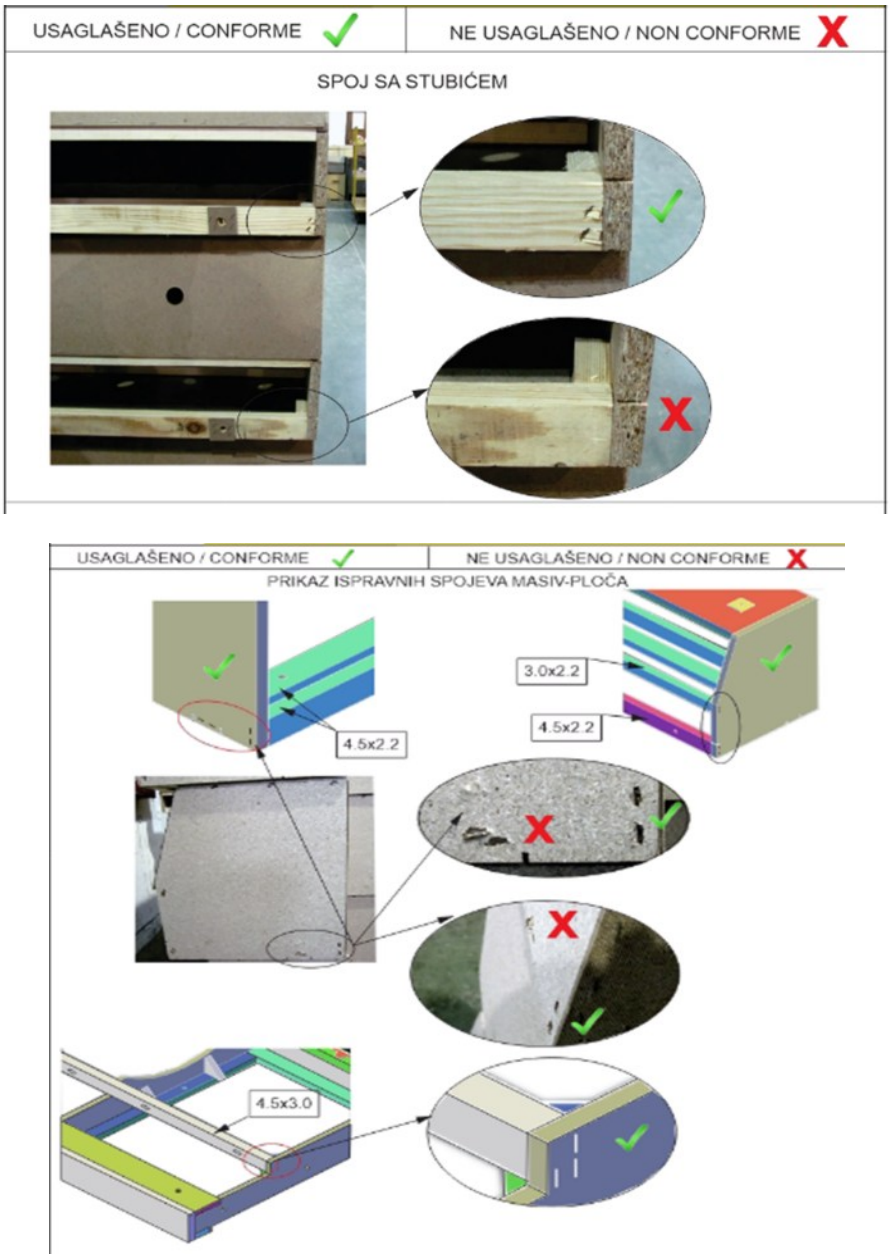


Figure 7. *Display of correct and incorrect connections.*

Figure 8 shows a diagram of the total number of recorded errors in all production processes.

Produzione 2023	Diffeti totale	100%
TAGLIO PELLE	421	29.3%
TAPPEZZERIA	353	24.6%
CUCITO	464	32.3%
TAGLIO TESSUTO	36	2.5%
ASSEMBLAGGIO FUSTI	30	2.1%
TAGLIO FUSTI	20	1.4%
UFFICIO TECNICO	2	0.1%
MESSA IN BIANCO	8	0.6%
CINGHIATURA		0%
MATERIALE PELLE	45	3.1%
MATERIALE TESSUTO	45	3.1%
GOMMA		0.0%
NON DEFINITO	11	0.8%
Totale	1435	

Produzione 2022	Diffeti totale	
TAGLIO PELLE	586	31%
TAPPEZZERIA	411	22%
CUCITO	383	20%
TAGLIO TESSUTO	43	2%
ASSEMBLAGGIO FUSTI	45	2%
TAGLIO FUSTI	35	2%
UFFICIO TECNICO	17	1%
MESSA IN BIANCO	17	1%
CINGHIATURA	1	0%
MATERIALE PELLE	235	12%
MATERIALE TESSUTO	82	4%
GOMMA	5	0%
NON DEFINITO	50	3%
Totale	1910	

Produzione DA APRILE 2021	Diffeti totale	
TAGLIO PELLE	337	28%
TAPPEZZERIA	161	13%
CUCITO	294	24%
TAGLIO TESSUTO	31	3%
ASSEMBLAGGIO FUSTI	43	3%
TAGLIO FUSTI	20	2%
UFFICIO TECNICO	33	3%
MESSA IN BIANCO	11	1%
CINGHIATURA	4	0%
MATERIALE	281	23%
Totale	1225	

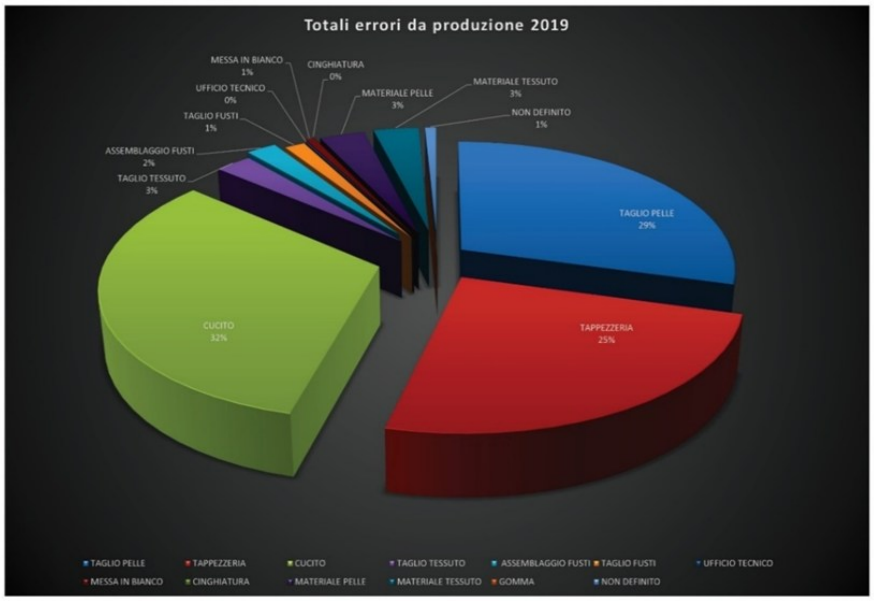


Figure 8. *Diagram of the total number of recorded errors in all production processes.*

Figure 9 shows a graphical representation of total complaints in percentages.

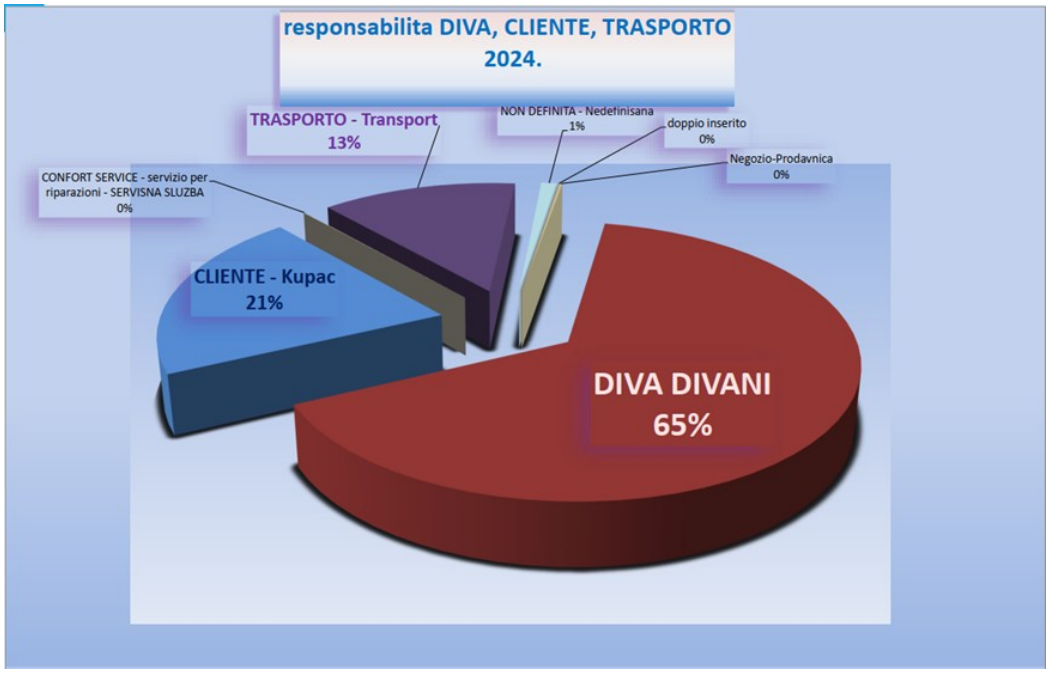


Figure 9. *Graphical representation of total complaints in percentages.*

CONCLUSIONS

Once the proposals have been reviewed and approved, a report needs to be prepared and distributed to all stakeholders in the factory, including management, production, and quality control teams. This report clearly outlines all the findings of the analysis, the proposed improvement measures, and the implementation deadlines.

An annual analysis of recorded operator errors not only helps to resolve problems from the previous year but also plays a key role in preventing future errors. Correcting the identified errors leads to improved processes and the quality of finished products, as well as higher factory productivity.

Investing in continuous improvement of work processes, operator training, and equipment maintenance is the key to the success of any factory that wants to achieve high-quality standards.

Quality control is one of the key elements in the production management system in a furniture factory. Its role is to ensure that each product meets defined technical, aesthetic, and functional requirements, as well as the expectations of end users. By establishing systematic quality control (from incoming raw material control through process control in all stages of production to final control of finished products), it is possible to detect and eliminate defects at an early stage, which significantly reduces the costs of repairs and complaints.

By applying standardized procedures and using adequate measuring tools and methods, uniformity of production and reliability of delivery are achieved. The quality of finished furniture directly affects the image of the company, the level of customer satisfaction, and its competitiveness in the market. Therefore, continuous improvement of the quality control system is a prerequisite for sustainable growth and development of the production system.

In conclusion, quality control in furniture production is not just an operational function but a strategic component of the business that ensures product compliance with technical specifications, safety standards, and customer expectations.

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Author's address

Dr Damjan Stanojevic, PhD, lecturer.
Academy of Technical and educational Vocational Studies,
Department of Vranje,
Beogradska 18,
18000 Niš, Republic of Serbia.

Dr Anastasija Temelkova, PhD, assistant professor.
Dr Elena Jevtoska, PhD, assistant professor.
Dr Zoran Trposki, PhD, full professor.
Ss. Cyril and Methodius University in Skopje,
Faculty of Design and Technologies of Furniture and Interior – Skopje,
16ta Makedonska brigada 3,
1000, Skopje, Republic of North Macedonia.