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Use of 8D Method in Nonconformity Resolution – a Case Study of Production of Spliced Veeners in Slovakia

Primjena metode 8D u rješavanju nesukladnosti – studija slučaja u proizvodnji lijepljenog furnira u Slovačkoj

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ABSTRACT • *A turbulent and competitive environment currently imposes high demands on flexible adaptation to the changing qualitative and quantitative conditions at the European and global stage. One of the criteria used as an expression/declaration of the high level of management of all organisation's activities is to adhere to the principles of total quality management (TQM). In this way, it is possible to achieve high quality outputs. One of the TQM principles is constant improvement. It is one of the main objectives of each organisation. It is focused on constant improvement of the total performance. The aim of this case study is to analyse and improve selected processes in a specific company engaged in production of veneer – IKEA Industry Slovakia, Ltd., enterprise branch - Majcichov, by using combined instruments the way they are used in the quality management system. In this study, 8D method is applied for nonconformity resolution. The applied method showed to be optimal for nonconformity resolution because employees are educated and experienced in this area. However, in future, it will be necessary to adopt further quality instruments for increasing a company's competitiveness.*

Keywords: *improvement instruments, production of spliced veneers, TQM, 8D method*

SAŽETAK • *Današnje turbulentno i konkurentno okruženje postavlja visoke zahtjeve glede fleksibilne prilagodbe poduzeća promjenjivim kvalitativnim i kvantitativnim uvjetima na europskome i svjetskom tržištu. Jedan od kriterija koji se primjenjuju za izražavanje i potvrdu visoke razine upravljanja svim organizacijskim aktivnostima jest primjena načela potpunog upravljanja kvalitetom (TQM). Samo je na taj način moguće postići visokokvalitetne izlazne rezultate poduzeća. Jedno od načela TQM-a jest stalno unapređenje kvalitete proizvodnje. To je ujedno i jedna od glavnih zadaća svakog proizvođača, a temelji se na stalnom unapređenju cjelokupnog rada poduzeća. Cilj ovog istraživanja bio je analizirati i poboljšati određene procese u poduzeću uključenome u proizvodnju furnira – IKEA Industry Slovakia, Ltd., Majcichov, i usredotočiti se na primjenu kombiniranih instrumenata unapređenja na način na koji se oni primjenjuju u modelu potpunog upravljanja kvalitetom. U ovom je radu za rješavanje nesukladnosti primijenjena metoda 8D. Za promatrano poduzeće ta se metoda pokazala optimalnom u*

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rješavanju takvih problema jer su zaposlenici dodatno educirani i imaju iskustva s njezinom primjenom. Međutim, u budućnosti će biti potrebno uključiti i druge instrumente za postizanje kvalitete kako bi se povećala konkurentnost poduzeća.

Ključne riječi: *instrumenti poboljšanja, proizvodnja lijepljenog furnira, TQM, metoda 8D*

1 INTRODUCTION
1. UVOD

IKEA is a well-known company. It has been established in various European countries in the recent period and it is known as a world's producer in furniture industry. IKEA created its branches in more than 12 countries worldwide. One of them is IKEA Industry Branch Majcichov with the seat in the Slovak Republic. The main product specialisation of IKEA Industry Slovakia, Ltd,, Majcichov, is the production of spliced veneers used for producing veneer furniture. The factory in Majcichov was created when it was separated from the original company with the seat in Trnava. In 2014, a branch named IKEA Industry Slovakia, Ltd; Trnava, the branch of the enterprise – Majchichov, was founded, (Holovič, 2016). The main vision of the company is to focus on the production of high quality spliced veneers, and thus help to improve daily life through furniture sold in the trade network of IKEA (Handbook IMS, 2015).

The organisation is managed by the integrated management systems, which is certified under international standards ISO 9001:2008, ISO 14001:2004, ISO 50001:2011 and OHSAS 18001:2007. For its production, the company uses legally logged wood that comes from the areas where civil and traditional rights are not violated. Wood from forests transformed in plantations or for non-forest use and wood from forests planted from genetically modified woody plants are not used for production. No convention of the World Labour Organisation is breached and the Forest Stewardship Council (FSC) is supported, and the suppliers are required to manage forests according to the principles and criteria of FSC.

IKEA Industry has short-term objectives with the implementation period of 1 year and long-term objectives (Handbook IMS, 2015). Ambitions for 2020 are to become a leader in the industry of "green" production of furniture. IKEA Industry wants to deliver large wooden materials and furniture produced with the use of recycled wood or wood coming exclusively from well-managed forests to the IKEA supply chain. The long term objectives for 2020 go from the above considerations to professional experiences of co-operators (IKEA Industry Vision, 2013).

The long term objectives are described below as follows:

(a) For an objective focus – collaborators, it is possible to achieve objectives: The top priority is to keep workplace safe and healthy for all people working in the company or visiting its premises. Collaborators are involved in improving the working environment for their own benefit.

(b) For an objective focus – suppliers, it is possible to achieve objectives: Our factories are considered "well-developed" and exceeding requirements of IWAY. (IWAY is the IKEA code of conduct, first introduced in 2000. It specifies the requirements placed on suppliers of products and services, and details what they can expect in return from IKEA. IWAY Standard - Minimum Requirements for Environment and Social & Working Conditions when Purchasing Products, Materials and Services). Fair and good conditions, which are always in the best interest of children, workers and environment, are ensured. IKEA customers buy, at low prices, good quality furniture produced according to acceptable working conditions of suppliers, who take care of people and environment, as supported by other relevant documents (Rudy, 2015; Prístavka, 2010).

(c) For an objective focus – community, it is possible to achieve objectives: It is focused on adopting measures ensuring that entrepreneurship will comply with the needs of the local community, in compliance with environmental protection regulations as well as other relevant documents (Chovancová, 2014).

(d) For an objective focus – wood and forestry, it is possible to achieve objectives: The share of wood coming from FSC certified forests largely prevails and the nutrients are delivered back to wooded land to maintain the forest growth. Measures were developed for preserving biodiversity. The use of our wood and by-products is optimised and used by the IKEA supply chain as much as possible, as supported by other relevant documents (Šebo, 2008; Zákon č. 326/2005; Oznámenie č. 17/2005)

(e) For an objective focus – chemicals, it is possible to achieve objectives: Chemical management is implemented and efficient and safe uses of chemicals in our production were elaborated. Pollutants were excluded from the supply chain to ensure the lowest possible impact on the environment, as supported by other relevant documents (Nariadenie č. 416/2011)

(f) For an objective focus – water, it is possible to achieve objectives: The local water cycle is supported by re-usage of rainwater at a greater extent than usage of surface and tap water, as supported by other relevant documents (Vyhláška 636/2004).

(g) For an objective focus – waste. it is possible to achieve objectives: Using resources effectively and re-using them, recycling waste instead of waste incineration and sending waste at landfills (90 % of material for recycling and zero waste for landfills in 2020), as supported by other relevant documents (Zákon č. 79/2015).

(h) For an objective focus – energy, it is possible to achieve objectives: Using renewable energy sourc-

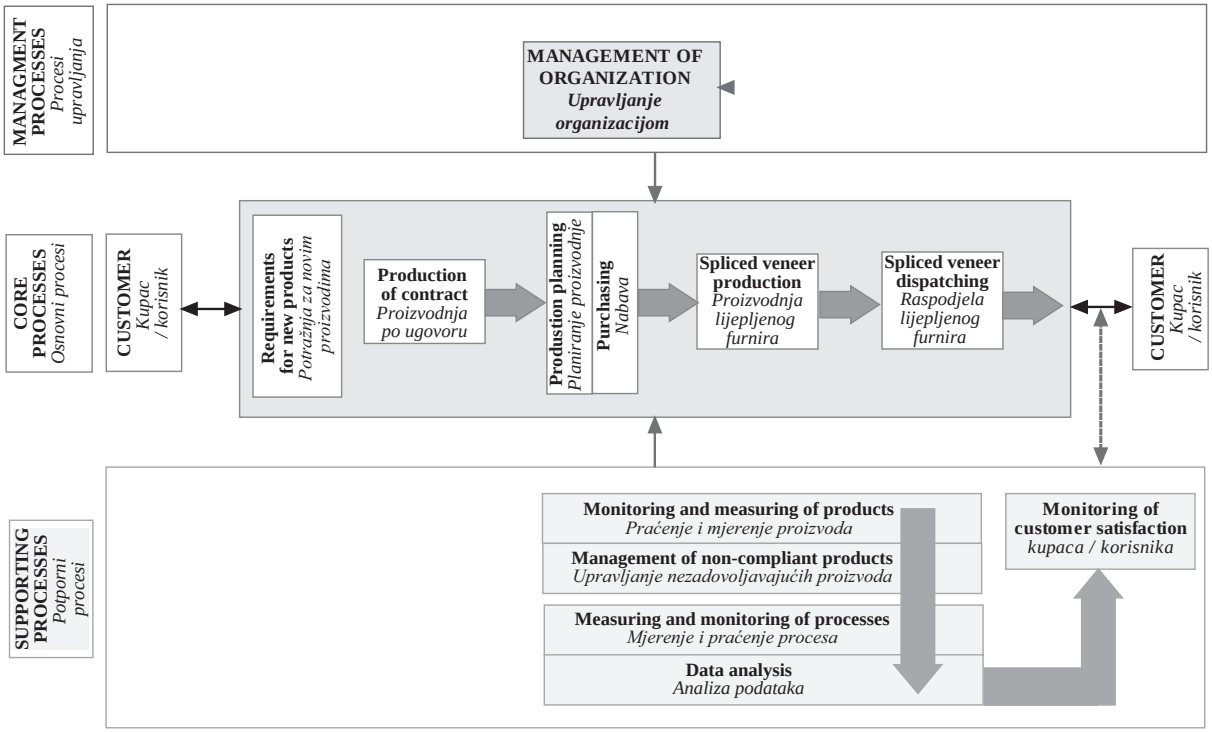


Figure 1 Interaction between managing, core and supporting processes (Source: Handbook IMS, p.63, 2015)
Slika 1. Odnos između upravljanja te osnovnoga i pratećih procesa (izvor: *Handbook IMS*, str. 63, 2015.)

es, according to other relevant documents (Zákon č. 309/2009). Emissions of carbon dioxide (CO_2) to be decreased, according to other relevant documents (Vyhláška č. 271/2011).

(i) For an objective focus – smart logistics, it is possible to achieve objectives: The optimal itinerary of suppliers to manufacturing plants. The extent of filling goods in trucks increased thanks to better package solutions and use of bigger facilities, as supported by other relevant documents (Straka, 2013).

(j) For an objective focus – sustainable development, it is possible to achieve objectives: The programmes of educational sustainability are available for all collaborators. Collaborators are inspired and they exchange their ideas, knowledge and smart solutions with each other, as supported by other relevant documents (Hurná, 1999).

Short-term objectives related to quality are set at (Handbook IMS, p. 54, 2015): (1) the value of percentage of complaints is max. 0.55 %, and (2) maximum percentage of discarded spliced veneers is 3.14 %.

The processes in the company are divided into core, managing and supporting processes (Handbook IMS, 2015). Fig. 1 shows the interaction between managing, core and supporting processes in the company. Fig. 1 presents purchasing as a core process in spite of the fact that most professional handbooks on company production consider the purchasing as a supporting process. However, there is also a fourth type of business processes: the process of measurement, analysis and improvement, partially presented (green colour) in Fig.1, but authors of this case study did not want to modify the original figure description in Handbook IMS. The authors studied and analysed the actual state and used the actual company's documents in this case study and suggested several corrections in the figures based on the company's documentation.

Manufacturing of products, which belongs to the core processes, consists of sub-processes shown in Fig. 2.

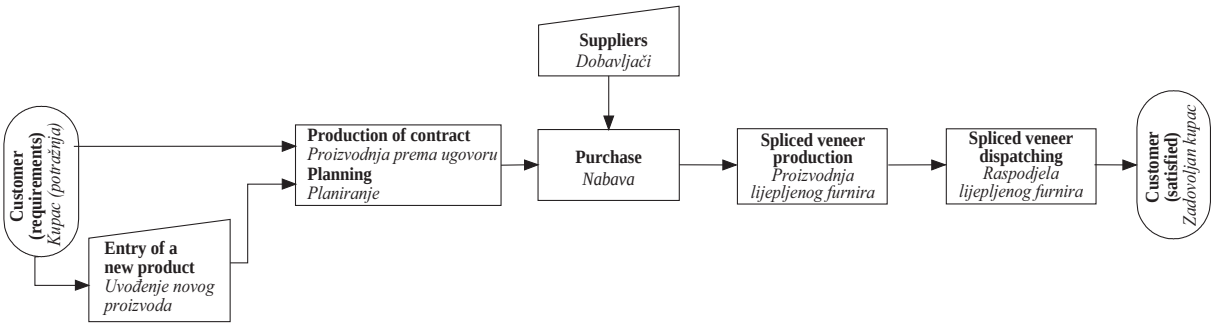


Figure 2 Sequence of processes in manufacturing products (Source: Handbook IMS, p. 65, 2015)
Slika 2. Faze procesa proizvodnje (izvor: *Handbook IMS*, str. 65, 2015.)

2 TECHNOLOGICAL PROCESS OF THE PRODUCTION OF SPLICED VENEERS AND USED METHODOLOGY

2. TEHNOLOŠKI PROCES PROIZVODNJE LIJEPLJENOG FURNIRA I PRIMIJENJENA METODOLOGIJA

The main purpose of the case study, in IKEA Industry, is detailed analysis and development of selected technological processes during spliced veneer production. In this study, 8D method is applied for nonconformity resolution. The applied method showed to be optimal for nonconformity resolution because employees are educated and experienced with the application of Pareto analysis, Ishikawa chart; Poka-Yoke, etc. The main steps of production of spliced veneers (Technological Technique of the Production of Spliced Veneers, p. 85-87, 2012) are divided into two sections.

1. Choice and preparation of material (STN EN 14279+A1)

Environment - there are recommended requirements for the production of spliced veneers: humidity of air: 50±10 % and ambient temperature 25±5°C;

Input material - there are veneers of various woody plants and their thickness: beech h = 0.55 mm, oak, ash h = 0.63 mm, birch h = 0.55 mm with the tolerance ±0.04 mm; veneer humidity 8-12 %; fusion fibre; glue;

Choice of material is carried out in the warehouse of raw veneer;

Preparation of material starts with unpacking a pallet and the preparation of material for the transversal cutting workplace is carried out in the warehouse of input material at a designated place. The generated waste is sorted in accordance with the regulations related to sorting of wastes.

2. Processing of material (STN 22 5205)

Transversal cutting

- According to the type and quantity of defects, veneer is divided into the quality groups Q1, Q2, Q3, in accordance with the specifications in force.
- Cut veneer marked by accompanying cards is placed on pallets. Bundles of veneers that are not suitable and do not meet quality requirements are placed on a special pallet.
- During the shift, the discarded packets of veneers are checked and reassessed.
- At the end of the shift, non-compliant veneers are marked with a veneer separator and information is added in the pallet card. A filled pallet is transported to the place dedicated to complaints.

Longitudinal cutting

- Veneer bundles are arranged in the spliced veneer at the longitudinal cutting workplace.
- The cut bundles are placed on the bases, which results in the look, structure and exact dimension of finished spliced veneer. The spliced veneers are wider than 600 mm, or the compound formats are cut from two halves. The cut spliced veneers are marked with the accompanying cards.
- Veneers that do not meet requirements are put aside on the dedicated place and these discarded veneers are collected by the worker responsible for the transversal cutting during the shift for reprocessing.

Connecting by means of a fusion fibre

- The spliced veneers are connected by means of a fusion fibre into the integrated format at the sewing workplace. A fusion fibre must be fused correctly and must adhere along the whole length of a joint, and veneer sheets must not overlap.
- Veneer sheets are sewed in a way to be spliced and before sewing they must be reversed. Quality is observed visually and when the mechanical or technical defect is detected, the bundle is discarded and substituted by another one.
- A worker has to sew the remaining veneer stripes into a current format of the spliced veneer or he can achieve this format by cutting the spliced veneer by longitudinal scissors. The emphasis is put on the maximum usage of material, i.e. on the minimum accumulation of waste.

Connecting by means of liquid glue

- The correct preparation of the glue is the responsibility of a worker at the gluing workplace.
- The glue must be applied correctly along the whole edge of a bundle and must adhere along the whole length of a joint. If a joint does not have these properties, the worker must check the application of glue or adjust the machine. Quality is observed visually and when the mechanical or technical defect is detected, the bundle is discarded and substituted by another one.

Formatting

- Formatting of the ends of spliced veneers is carried out at the formatting workplace.
- Mechanically damaged spliced veneers are placed on the trolley to be repaired. When technically lower quality is detected, a spliced veneer must be moved to the corresponding category of quality requirements. (In-process and Production Control, 2012)
- Formatted spliced veneers are placed on pallets. Information about pallet quantity, pallet dimensions and direction of spliced veneer fibres are given in a list on an accompanying card. After formatting is finished, all formatted and discarded spliced veneers shall be written off the system.

Exit check and repair of spliced veneers

- Each layer of a spliced veneer is checked before the check and repair step and the correctness of information in the accompanying card specifying quality and dimensions of a spliced veneer is compared.
- Mechanical and technical quality is checked. Checking is carried out in two ways –statistical checking or piece by piece checking.

Packaging

- The packaging workplace prepares pallets for dispatching. Each pallet must be checked before starting packaging and information on an accompanying card needs to be compared.
- Veneers are divided into quality classes and mechanical and technical quality is checked visually. A worker is responsible for correct identification of defects and for the subsequent repair.

- Packed pallets are ready for dispatching. Then, they are written off the system.

Pallets are packed according to instructions for specific buyers and there are 8 different quality specifications in IKEA Industry Branch– Majcichov → 5 for Šoproň (oak, 3D oak, white ash, brown ash, birch) and 3 for Trnava (oak, ash, peeled birch). Quality requirements for spliced veneers were designed in 2013 and are shown in the tables below. Quality signs in individual types of spliced veneers show certain quality requirements of individual types of spliced veneers (STN 49 2301 and STN 49 2316). Description of what is allowed and prohibited in production are shown in Tab. 1, 2 and 3 (Quality requirements for spliced veneers, p. 71÷77, 2013). These tables illustrate the approach to the analysed problems according to the technical standards applicable in the

Table 1 Quality requirements for spliced veneers I
Tablica 1. Zahtijevana kvaliteta lijepljenog furnira I.

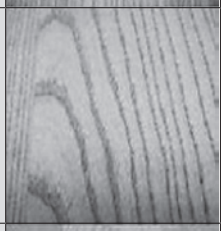
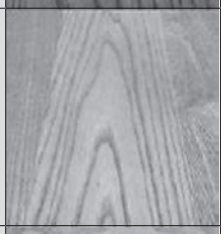
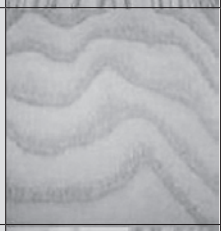
Name *Svojstvo*	**Quality** / *Kvaliteta*					**Picture** *Slika*
	Q3	Q4++	Q4+	Q4	Q5	
Flat fibre (radial) *radijalna tekstura*	✓	✓	✓	✓	✓	
Half grain pattern *polutangentna tekstura*	✓	✓	✓	✓	✓	
Full grain pattern (tangential) *tangentna tekstura*	✓	✓	✓	✓	✓	
Horizontal drawing *horizontalne linije*	×	✓	✓	✓	✓	
Colour *boja*	Spliced veneer can contain min. 35 % and max. 65 % of white ash in total. Distribution of white and brown ash on the surface must be homogenous. *Lijepljeni furnir može sadržavati min. 35 % i maks. 65 % bijelog jasena. Raspodjela bijeloga i smeđeg jasena na površini mora biti podjednaka.*	Distribution of white and brown ash on the surface must be homogenous. *Raspodjela bijeloga i smeđeg jasena na površini mora biti podjednaka.*	Distribution of white and brown ash on the surface must be homogenous. *Raspodjela bijeloga i smeđeg jasena na površini mora biti podjednaka.*	Without limitation *bez ograničenja*	Without limitation *bez ograničenja*	

Table 2 Quality requirements for spliced veneers II
Tablica 2. Zahtijevana kvaliteta lijepljenog furnira II.

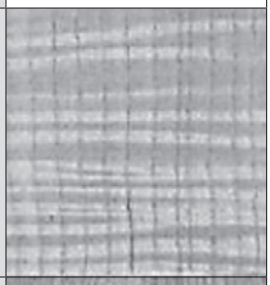
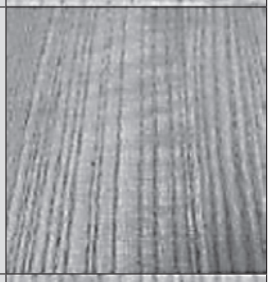
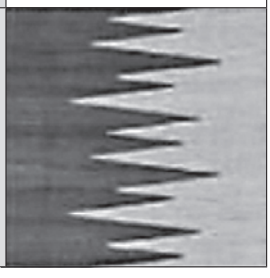
Name *Svojstvo*	**Quality** */ Kvaliteta*					**Picture** *Slika*
	Q3	Q4++	Q4+	Q4	Q5	
Strong swirl grain *jako kovrčava žica drva*	×	✓ max. 1 stripe/ spliced veneer *maks. 1 linija po listu furnira*	✓ max. 1 stripe/ spliced veneer *maks. 1 linija po listu furnira*	✓ max. 1 stripe/ spliced veneer *maks. 1 linija po listu furnira*	✓ max. 2 stripes/ spliced veneer *maks. 2 linije po listu furnira*	
Moderate swirl grain *umjereno kovrčava žica drva*	✓	✓	✓	✓	✓	
Healthy Knots *zdrave kvrge*	✓	✓	✓	✓	✓	
Rigid black knots *oštre crne kvrge*	✓ max. Ø 5mm max.10 pc/m² *maks. 10 kom./m²*	✓ max. Ø 5mm max.15 pc/m² *maks. 15 kom./m²*	✓ max. Ø 5mm max.15 pc/m² *maks. 15 kom./m²*	✓ max. Ø 5mm max.15 pc/m² *maks. 15 kom./m²*	✓ max. Ø 5mm	
Dark stripes, mineral lines *tamne linije, mineralne linije*	✓ max. dimension 3 x 90 mm: max. 20 pc/m² dispersed throughout surface *maks. dimenzija 3 x 90 mm; maks. 20 kom./m² po cijeloj površini*	✓ max. dimension 3 x 90 mm: max. 20 pc/m² dispersed throughout surface *maks. dimenzija 3 x 90 mm; maks. 20 kom./m² po cijeloj površini*	✓ max. dimension 3 x 90 mm: max. 20 pc/m² dispersed throughout surface *maks. dimenzija 3 x 90 mm; maks. 20 kom./m² po cijeloj površini*	✓	✓	
Finger Joint *zupčasti spoj*	×	×	×	×	✓ Type 3	

Table 3 Quality requirements for spliced veneers III
Tablica 3. Zahtijevana kvaliteta lijepljenog furnira III.

Name *Svojstvo*	**Quality** / *Kvaliteta*					**Picture** *Slika*
	Q3	Q4++	Q4+	Q4	Q5	
Stripe Width *širina linija*	40÷220 mm Edge stripes can be narrower *rubne linije mogu biti uže*	40÷300 mm Edge stripes can be narrower *rubne linije mogu biti uže*	40÷300 mm Edge stripes can be narrower *rubne linije mogu biti uže*	40÷300 mm Edge stripes can be narrower *rubne linije mogu biti uže*	40÷300 mm Edge stripes can be narrower *rubne linije mogu biti uže*	
Dimension tolerance *tolerancija dimenzija*	Width / *širina*: -0 mm +1mm per 100 mm of width Length/*dužina*: -0/+5 mm	Width / *širina*: -0 mm +1mm per 100 mm of width Length/*dužina*: -0/+5 mm	Width / *širina*: -0 mm +1mm per 100 mm of width Length/*dužina*: -0/+5 mm	Width / *širina*: -0 mm +1mm per 100 mm of width Length/ *dužina*: -0/+5 mm	Width / *širina*: -0 mm +1mm per 100 mm of width Length/*dužina*: -0/+5 mm	+/-
Connecting method *metoda spajanja*	Glued *lijepljeno*	Glued *lijepljeno*	Glued *lijepljeno*	Glued *lijepljeno*	Glued *lijepljeno*	/
Splicing method (overall look) *metoda lijepljenja (ukupni izgled)*	Balanced random splicing. Spliced veneer cannot be made of the same halves! *Ujednačeno lijepljenje. Lijepljeni furnir ne smije biti izrađen od iste polovice!*	Balanced random splicing. Spliced veneer cannot be made of the same halves! *Ujednačeno lijepljenje. Lijepljeni furnir ne smije biti izrađen od iste polovice.*	Balanced random splicing. *ujednačeno nasumično lijepljenje*	Balanced random splicing. *ujednačeno nasumično lijepljenje*	Balanced random splicing. *ujednačeno nasumično lijepljenje*	

Explanatory notes / *Objašnjenje simbola*					
×	Forbidden *zabranjeno*	✓	Allowed *dopušteno*	✓ xyz	Allowed to a certain extent *dopušteno uz dodatni uvjet*

Note: The basic document of this case study, concerning TQM as well as improvement methods, which are used in production of spliced veneers, is the Handbook IMS, 110 p; 2015 and the book by Hrubec (2009). However, Handbook IMS is continuously modified and improved, so that it would be too much extended to review all the modifications and improvements from the previous handbook issues.

Slovak Republic, which could be similar or different with regard to the foreign technical standards.

3 USE OF INSTRUMENTS FOR IMPROVEMENT – RESOLUTION OF NONCONFORMITIES BY 8D METHOD
3. PRIMJENA INSTRUMENATA POBOLJŠANJA – RJEŠAVANJE NESUKLADNOSTI PREMA METODI 8D

The 8D method is used for a systematic solution of problems in the production process, technical issues, health and safety at work and in the workplace of IKEA Company. The most frequent nonconformities resolved by the 8D method are as follows (Handbook IMS, p. 90, 2015):

- Open ends
- Perpendicularity outside the tolerance
- Formatting
- Blocking of safety sensors
- Rifts.

Description of the 8D method:

D1: Setting up the team - Setting up the team is very important for resolving a defined problem. To solve the problem, the team of 5 members was set up.

D2: Describing the problem – For correct specification and description of the problem, the results of a statistical quality control were considered. The occurrence of various nonconformities in the months of a given financial year FY15 were analysed, and subsequently, showed in a cumulative way in Tab. 4. Tables 6 and 7 were compiled by research cooperation with Mr. Holovič, who summarised data from the real production in the company IKEA, Ltd. Data were supplied by the quality management team.

In order to determine the main group of causes of nonconformity, the instrument of quality, i.e. Pareto

Table 4 Incidence of defects in individual months in the fiscal year 2015 (Holovič, 2016)
Tablica 4. Greške po mjesecima za fiskalnu godinu 2015. (Holovič, 2016.)

Individual months in the fiscal year 2015 *Mjesec u fiskalnoj godini*	**Structural defects pcs** *Stukturne greške* kom.	**Visual defects pcs** *Vizualne greške* kom.	**Stains pcs** *Mrlje* kom.	**Defects in manufacture of veneer pcs** *Greške u proizvodnji furnira* kom.	**Defects in manufacture of spliced veneer pcs** *Greške u proizvodnji lijepljenog furnira* kom.	**Dimension defects pcs** *Greške u dimenzijama* kom.	**Mechanical damage pcs** *Mehanička oštećenja* kom.
September *rujan*	692	580	277	1,116	3,504	412	99
October *listopad*	116	897	178	1,418	4,291	1,034	184
November *studeni*	334	629	76	1,184	4,899	393	387
December *prosinac*	195	162	92	1,707	3,408	182	155
January *siječanj*	265	422	22	827	4,575	167	247
February *veljača*	48	160	475	581	4,868	23	195
March *ožujak*	0	12	0	13	343	0	8
Total *Ukupno*	1,650	2,862	1120	6,846	25,888	2,211	1,275

analysis, was used. The values of the total incidence of defects were used to elaborate a Pareto analysis. Individual defects were classified in groups from A to G. Each group of defects was assigned the total incidence for the period under investigation. They were arranged in a descending order and their absolute and relative cumulative values were calculated, as shown in Tab. 5.

The assessment of the Pareto chart and the Lorenz curve, in accordance with the 80:20 rule, shows that the main nonconformity group is the defect group E (defects in manufacture of spliced veneer) and D (defects in manufacture of veneer). To solve the above problem, it was necessary to deal with those defects and to decrease their occurrence, and thus decrease the number of nonconformities (Statistical Control of Spliced Veneers, 2015).

The data presented in the table were used to elaborate the Pareto chart and the Lorenz curve, as shown in Fig. 3.

D3: Proposing temporary corrective measures - As far as these problems are concerned, no temporary corrective measures were proposed because the nonconformities were dealt with considering their longer-term occurrence in spliced veneers.

D4: Analysing possible causes and analysing the principal cause - As a matter of priority, the 8D method will be applied to determine the principal cause of nonconformities. The results of the Pareto analysis, therefore, relied on the fact that the main category of defects was established in the manufacture of spliced veneers and veneers. In order to analyse possible causes, more quality instruments have been used. Given the scope of this paper, it is not possible to describe comprehensively all of them.

Two Ishikawa charts were created. The first one demonstrates the causes of the occurrence of defects in the manufacture of spliced veneers and the second one demonstrates the causes of the defects in the manufac-

Table 5 Arrangement according to the number of defects in pcs (Holovič, 2016)
Tablica 5. Kumulativni prikaz grešaka prema pojavnosti (Holovič, 2016.)

Group of defects / *Skupina grešaka*	**Incidence, pcs** *Pojavnost* kom.	**Cumulative number** *Kumulativna vrijednost*	
		Absolute, pcs *Apsolutni broj* kom.	**Relative, %** *Relativni broj*, %
E: Defects in manufacture of spliced veneer / *greške u proizvodnji lijepljenog furnira*	25,888	25,888	61.86
D: Defects in manufacture of veneer / *greške u proizvodnji furnira*	6,846	32,734	78.21
B: Visual defects / *vizualne greške*	2,862	35,596	85.05
F: Dimension defects / *greške u dimenzijama*	2,211	37,807	90.33
A: Structural defects / *strukturne greške*	1,650	39,457	94.28
G: Mechanical damage / *mehanička oštećenja*	1,275	40,732	97.32
C: Stains / *mrlje*	1,120	41,852	100.00

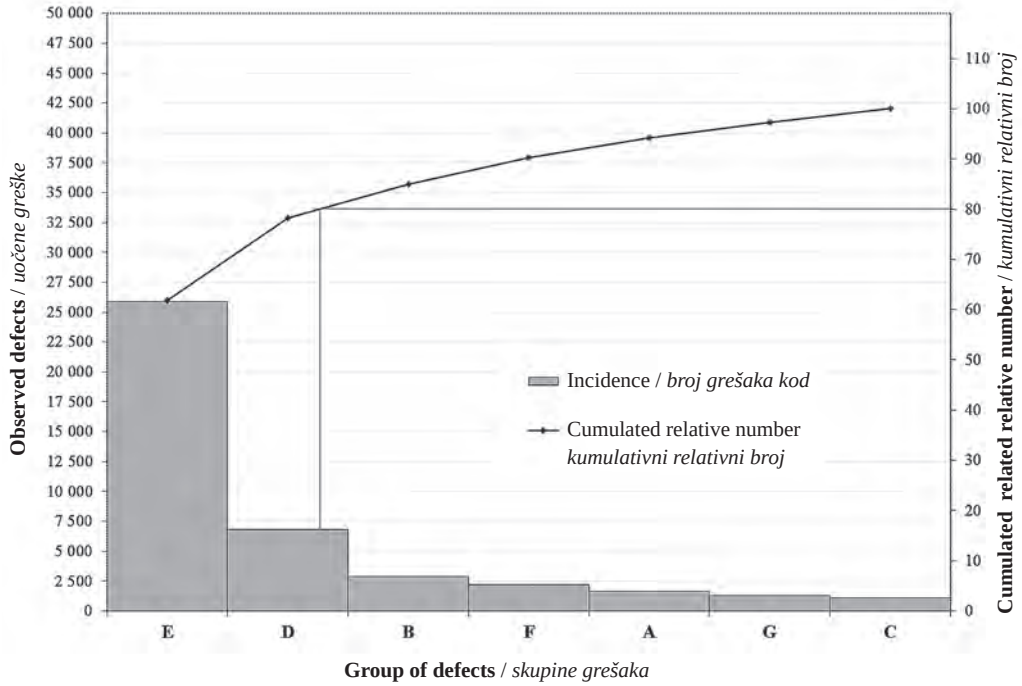


Figure 3 Graphical assessment of incidence of defects in spliced veneers in pcs according to the 80:20 rule (individual groups of defects A, B, …, F are described in detail in Tab.7)
Slika 3. Grafički prikaz broja grešaka na lijepljenom furniru prema pravilu 80 : 20 (pojedine skupine grešaka A, B, … F detaljno su opisane u tab. 7.)

ture of veneers. To assess the Ishikawa chart, the method of scores was used. Afterwards, together with a consultant in the company, the team members assigned the points to the causes, independently of one another. Each member had 3 points (2 points and 1 point), and then assigned the points to different causes. Ishikawa chart of defects in the manufacture is shown in Fig. 4.

Ishikawa chart of defects in the manufacture of veneers is shown in Fig. 5.

This resulted in 5 selected causes, i.e. roughness, folded sheets, rifts, unglued and open ends.

D5: Proposing the permanent corrective solution - In this point, it is necessary to choose and propose corrective measures for improvement. The aim is

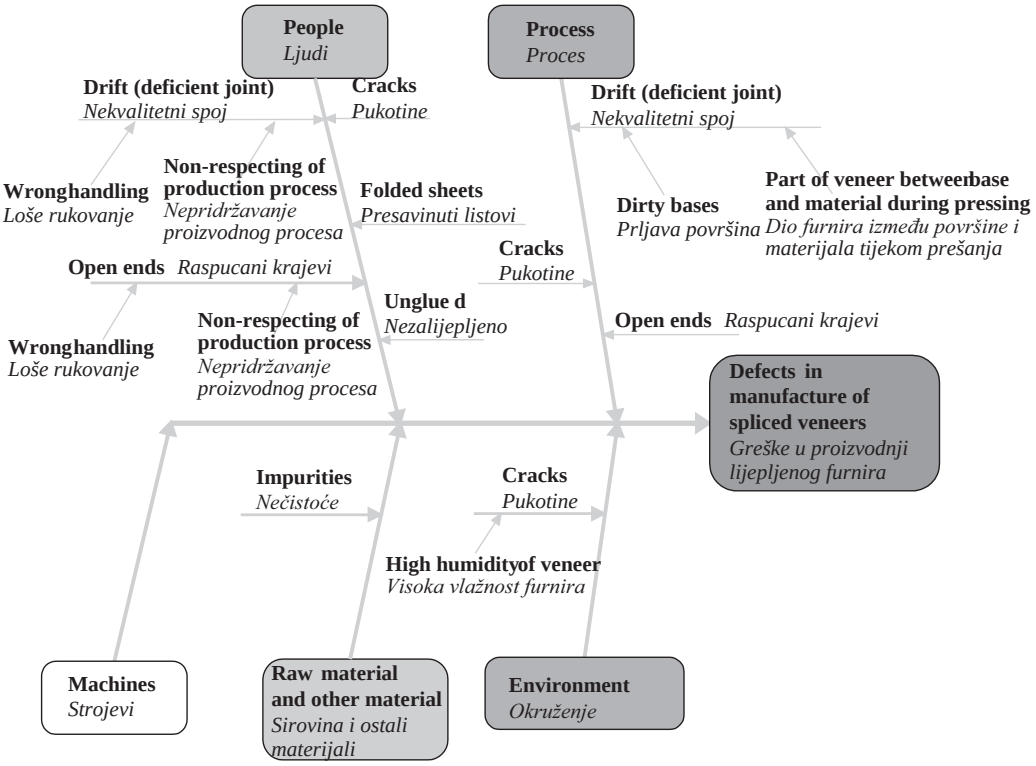


Figure 4 Ishikawa chart of defects in manufacture of spliced veneers
Slika 4. Ishikawa dijagram grešaka u proizvodnji lijepljenog furnira

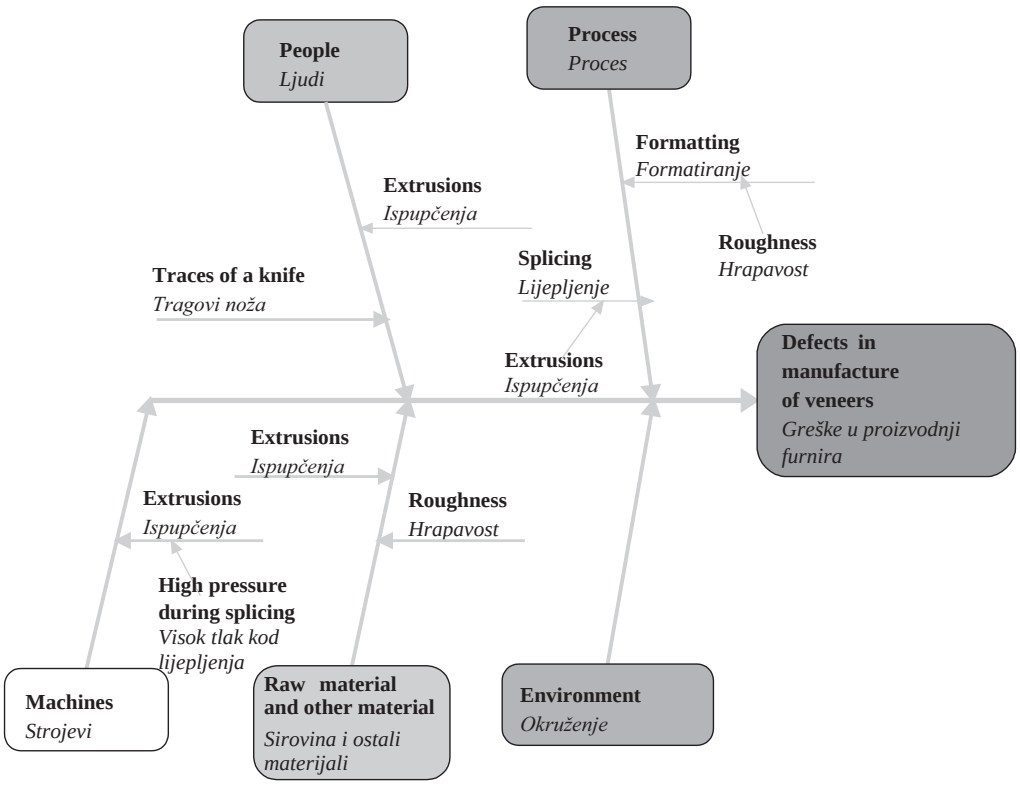


Figure 5 Ishikawa chart of defects in production of veneers
Slika 5. Ishikawa dijagram grešaka u proizvodnji furnira

to eliminate the main causes of a problem on a permanent basis. As mentioned in D4, in the 8D method, the causes of the the nonconformity "open end" are:

A) Formatting machine adjusted incorrectly,
B) Insufficient application of glue and the subsequent ungluing of spliced veneer,
C) Badly sheared package on a two-knife Josting machine.

D6: Implementation and verification of adopted corrective measures - For easier demonstration, a time graphic schedule (i.e. horizontal axis – x) – Gantt chart was developed as presented in Fig. 6. It shows the way of implementation of the proposed measures (i.e. vertical axis – y), which is not binding. It is used to recommend until when the proposed corrective measures should be implemented. A Poka-Yoke is a specific kind of methodology or mechanism applied in lean production processes, which provides support for service staff in order to avoid (yokeru) mistakes (poka), (Fantin, 2014). This method was applied in our study in order to prevent defects in production of spliced veneers. Causes of defects (D5 and D6) in veneer production were neglected in this case study.

D7: Preventive measures - In order to prevent the recurrence of defects, the corrective measures were elaborated in section D5. It is at a company's discretion, whether it will implement the determined proposals or not.

D8: Acknowledgements to the team – This part of the method is important to motivate employees who participate in the overall analyses and solutions.

4 CONCLUSION
4. ZAKLJUČAK

People in IKEA Industry Slovakia, Ltd., enterprise branch – Majcichov, Trnava, the Slovak Republic, focus on nonconformity solutions and thus try to

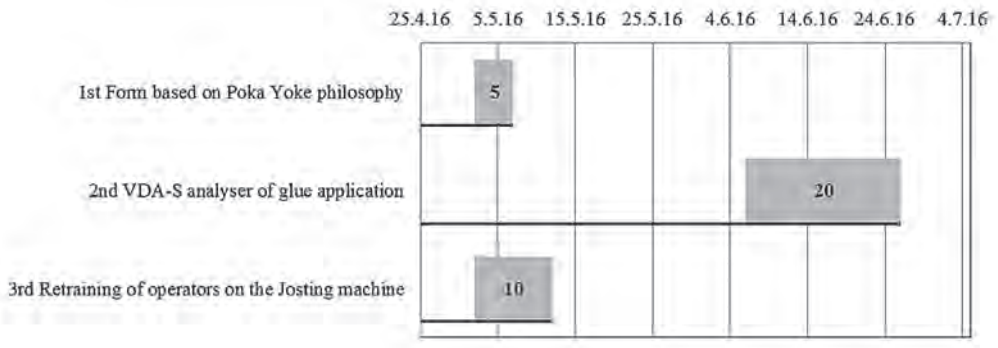


Figure 6 Gantt chart
Slika 6. Ganttov dijagram

satisfy the requirements of their customers and retain stable purchasers. The analysis was needed to reveal the incidence of nonconformities in spliced veneers in the period under investigation from 01/09/2015 to 02/03/2016. In quality management, there are several suitable methods, and we chose the 8D method. Chapter No. 3 describes individual items of the 8D method applied in IKEA Company. Benefits of the 8D method application are significant in the quantitative and qualitative sense and they create the initial base for future progress and improvement in spliced veneer production. The reason for this choice was the fact that the company used this method in the past to solve in-house problems. It is a structured process of problem solving that contributes to the early identification of a problem and to its complete elimination when used correctly.

The main task of the present case study in IKEA Ltd. Trnava, the Slovak Republic, was to make a detailed analysis and improve the future development concerning specific technological processes performed in the spliced veneer production. Emphasis should be put on the application of combined quality tools, which enable to make goal-directed decisions. In this study, 8D method is applied for nonconformity resolution. The method applied proved to be optimal for nonconformity resolution because employees were educated and experienced in the application of Pareto analysis, Ishikawa chart, Poka-Yoke, etc.

It is necessary to implement the One-Month-Team Building Training (scheduled for the third quarter of 2017) in order to obtain supplementary information about the influence of changing working shifts on production quality, as well as about the influence of employment duration on employees' skills.

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