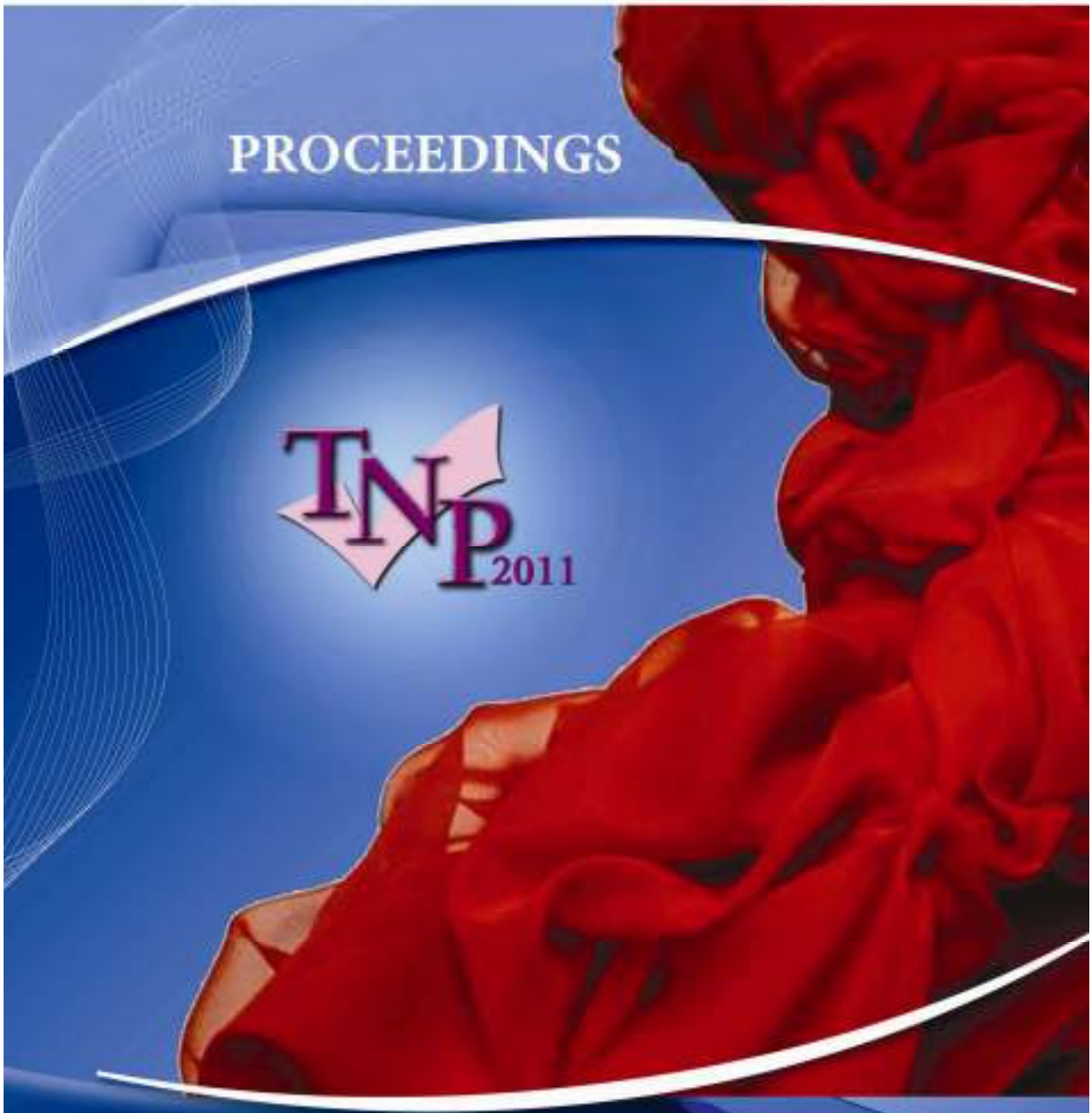
UNIVERSITY OF NOVI SAD
Technical faculty "Mihajlo Pupin"
Zrenjanin, Serbia



PROCEEDINGS

TNP 2011

TEXTILE SCIENCE & ECONOMY III

Zrenjanin, November 10-11, 2011
Serbia

UNIVERSITY OF NOVI SAD

TECHNICAL FACULTY "MIHAJLO PUPIN"

ZRENJANIN, REPUBLIC OF SERBIA

3rd scientific-professional conference

TEXTILE SCIENCE AND ECONOMY

Proceedings

Zrenjanin, 10-11th November 2011

Organiser of the Conference:
University of Novi Sad, Technical faculty "Mihajlo Pupin", Zrenjanin, Republic of Serbia.

Publisher:
University of Novi Sad, Technical faculty "Mihajlo Pupin", Zrenjanin, Djure Djakovic bb, 23000 Zrenjanin, Republic of Serbia.

For publisher:
Milan Pavlović, Ph. D, Professor, Dean of the Technical faculty "Mihajlo Pupin"

Technical treatment and design:
Vasilije Petrović, Ph. D, Professor
Jelena Stojanov, M. Sc, Assistant
Stanislava Sindjelić, M. Des, Assistant

Design:
Stanislava Sindjelić, M. Des, Assistant

Printed by:
Printing office "Diginet – Pro studio", Cara Lazara 16, Zrenjanin.

Circulation: **150**

ISBN: 978-86-7672-150-4

By the resolution no. 451 – 03- 02640/2010-02 from May 9th, 2011 Ministry of Education and Science Republic of Serbia donated financial means for printing this Simposium Proceedings.

CIP - Каталогизација у публикацији
Библиотека Матице српске, Нови Сад

677(082)

SCIENTIFIC – Professional Conference Textile Science and Economy (3 ; 2011 ; Zrenjanin)
Proceedings / 3rd Scientific-Professional Conference Textile Science and Economy, Zrenjanin, 10-11th November 2011 ; [organiser Technical Faculty "Mihajlo Pupin", Zrenjanin]. – Zrenjanin : Technical Faculty "Mihajlo Pupin", 2011 (Zrenjanin : Diginet). – XI, 366 str. : ilustr. ; 30cm

Tiraž 150. – Bibliografija uz svaki rad.

ISBN 978-86-7672-150-4
1. Technical Faculty "Mihajlo Pupin" (Zrenjanin)
a) Текстилна индустрија - Зборници
COBISS.SR-ID 267249927

NOTE

All the papers presented in this publication have been reviewed. However the editor's and organizer are not responsible for the contents presented within the paper.

THE SCIENCE COMMITTEE:

Chairman: Jovan Stepanović, Ph. D, Professor- Dean, Faculty of Technology in Leskovac, *Serbia*
Darko Ujević, Ph. D, Professor- Dean, Faculty of Textile Technology, Zagreb, *Croatia*
Budimir Mijović, Ph. D, Professor, Faculty of Textile Technology, Zagreb, *Croatia*
Zenun Skenderi, Ph. D, Professor, Faculty of Textile Technology, Zagreb, *Croatia*
Marius Sangeorzan, DFA, Professor, Faculty of Arts and Design, *Romania*
Florea Hariton, DFA, Professor, Faculty of Arts and Design, *Romania*
Danilo Jakšić, Ph. D, Professor, Faculty of Sciences and Engineering, Ljubljana, *Slovenia*
Jelka Geršak, Ph. D, Professor, Faculty of Mechanical Engineering, Maribor, *Slovenia*
Dijana Macura, DFA, Professor, Fashion Design Faculty, Sharjah, Dubai, UAE
Nadiia Bukhonka, Ph. D, Assistant Professor, Kiev National University of Technologies and Design, Department of Knitting Technology, Kiev, *Ukraine*
Dušan Ristić, Ph. D, Professor, Faculty of Technology, Banja Luka, *The Republic of Serbian*
Dragana Grujić, Ph. D, Professor, Faculty of Technology, Banja Luka, *The Republic of Serbian*
Goran Demboski, Ph. D, Professor, Faculty of Technology and Metallurgy, Skopje, *Macedonia*
Milan Pavlović, Ph. D, Professor – Dean, Technical Faculty "Mihajlo Pupin", Zrenjanin, *Serbia*
Vasilije Petrović, Ph. D, Professor, Technical Faculty "Mihajlo Pupin", Zrenjanin, *Serbia*
Momčilo Bjelica, Ph. D, Professor, Technical Faculty "Mihajlo Pupin", Zrenjanin, *Serbia*
Želimir Branović, Ph. D, Professor, Technical Faculty "Mihajlo Pupin", Zrenjanin, *Serbia*
Miodrag Stamenković, Ph. D, Professor, Faculty of Technology in Leskovac, *Serbia*
Milan Gašović, Ph. D, Professor, Faculty of Economic, Subotica, *Serbia*
Dušan Trajković, Ph. D, Assistant Professor, Faculty of Technology in Leskovac, *Serbia*
Srđan Cakić, DFA Professor, Faculty of Technology in Leskovac, *Serbia*

THE ORGANIZING COMMITTEE:

Chairman committee: Vasilije Petrović, Ph. D, Professor, Technical Faculty "Mihajlo Pupin", Zrenjanin, *Serbia*
Milan Pavlović, Ph. D, Professor – Dean, Technical Faculty "Mihajlo Pupin", Zrenjanin, *Serbia*
Milan Gašović, Ph. D, Professor, Faculty of Economic, Subotica, *Serbia*
Milan Radovanović M. Sc. Regional Chamber of Commerce Zrenjanin, *Srbija*
Slađana Milojević, FACTS / Klaster fashion and textile industry
Mirjana Reljić, M. Sc. President of CIS Institute
Milan Radovanović, Miteks, Arilje,
Zoran Arsenijević, **Seventy Five**, Kragujevac
Slavoljub Miljković, BRAMY, Aleksandrovac
Momčilo Bjelica, Ph. D, Professor, Technical Faculty "Mihajlo Pupin", Zrenjanin, *Serbia*
Vasilije Kovačev, M. Des. Assistent Professor, Technical Faculty "Mihajlo Pupin", Zrenjanin, *Serbia*
Nadežda Ljubojev, Ph. D. Assistent Professor, Technical Faculty "Mihajlo Pupin", Zrenjanin, *Serbia*
Stanislava Sinđelić, M. Des, Assistant, Technical Faculty "Mihajlo Pupin", Zrenjanin, *Serbia*
Marija Savić, M. Sc. Assistant, Technical Faculty "Mihajlo Pupin", Zrenjanin, *Serbia*
Jelena Stojanov, M. Sc. Assistant, Technical Faculty "Mihajlo Pupin", Zrenjanin, *Serbia*
Dragana Bugarčić Rošu, Technical Faculty "Mihajlo Pupin", Zrenjanin, *Serbia*
Đukić Jasmina, LL. M, Technical Faculty "Mihajlo Pupin", Zrenjanin, *Serbia*
Aćin Slavica, Technical Faculty "Mihajlo Pupin", Zrenjanin, *Serbia*
Nada Peško, Technical Faculty "Mihajlo Pupin", Zrenjanin, *Serbia*

INTRODUCTION

It is necessary and justified, nowadays, more than ever, to assemble the scientists and entrepreneurs in the field of textile and clothing industry. The Scientific-professional Conference "Textile Science and Economy III" (TNP2011) is organized with the goal to promote connection between Serbian entrepreneurs and scientists and experts to jointly contribute the development based on knowledge and innovations. We are aware that by establishing these development research institutions and institutions of academic education, very active participants in this process must be included.

It is necessary to keep connections and cooperation based on knowledge and experience because that leads us to sustainability and development of our textile and fashion industry. Therefore, this conference TNP2011 meets the Strategy of Scientific and Technological Development of Serbia for the period from 2010 to 2015. Through the papers of the Conference TNP2011 participants current situation in the textile and fashion industry is to be analyzed, as well as the vision of this industry in Europe up to 2020 from the standpoint of the European Technology Platform (ETP). The European Union has entered the new millennium, setting the strategic goal of achieving extremely competitive and dynamic economic development based on the innovations and technological development. Therefore, this Conference TNP2011 wants to contribute to the development strategy of the Serbian textile and fashion industry in the direction of the dynamic cooperation of science and economy.

The aim of this Conference TNP2011 is to foster the regional cooperation with the scientists, experts, businessmen from the neighboring countries as well as from the other countries, what gives this event international significance and its scientific and professional level. Therefore, it is a great pleasure that such a remarkable number of the scientists and businessmen, mainly from the region and the other countries, responded to our invitation. The submitted papers of our colleagues were published in The Conference Proceedings. Because of economic focus of this event, the business and professional papers and the papers of our graduates, now employed in many companies, have found their place in The Conference Proceedings.

At the plenary lecture we have tried to show you the European experiences related to technology transfer from the University to Economy.

In the part of inviting lectures, we have tried to assemble the leading scientists, experts and professionals from the industry whose working experiences can contribute to the Strategy of Scientific and Technological Development of the Republic of Serbia 2010-2015 (SSTDRS).

In the poster section we wanted to present scientific and professional work at our Faculty.

Technical Faculty "Mihajlo Pupin" is the only scientific institution in Vojvodina in the field of textiles and clothing. The intention of this Conference TNP2011 is to present to the entrepreneurs the Faculty's previous experiences and competences in the field of education and science. During the Conference TNP2011 and after, the Technical Faculty will promote its openness and acceptance of new ideas of improving cooperation with entrepreneurs and solving their everyday technological issues as well as those in the field of research - development projects.

The Chairman of the Organizing Committee:

Vasilije Petrovic, Ph. D., Professor

FLAGS OF PARTICIPATING COUNTRIES

Serbia

Germany

Italy

Turkey

England

USA

Luxembourg

Macedonia

Romania

Croatia

Sweden

Portugal

Montenegro

Israel

Bosnia and Herzegovina

Ukraine

Slovenia

WORD OF THANKS

Special thanks to:

- **Ministry of Education and Science Republic of Serbia,** for donated financial means for Igor Kresoja donating funds for presentation at the conference TNP 2011.
- **Ministry of Economy and Regional Development**
- **Regional Chamber of Commerce Zrenjanin**
- **JP "Tourism Center of the City of Zrenjanin"**

CONTENTS

CONTENTS

DETERMINATION OF GENERATED TEXTILE WASTE IN CLOTHING COMPANIES OF DIFFERENT TECHNOLOGICAL LEVEL

Silvana KRSTEVA & Goran DEMBOSKI

Abstract: *During the last decade, the clothing manufacturing companies have being exposed to high competition from the low labor countries and to constant increasing of production costs. This in turn, for the manufacturing companies aiming to increase competitiveness and profitability, imposes the issue of better utilization of the existing resources. The material costs in clothing manufacturing represent more than 50% of the price of the garment. The technique of processing cutting orders and planning economic cutting lays are of utmost importance for better utilization of materials and for increasing the efficiency of cutting process.*

In this paper, the influence of the level of applied technology on the percentage of generated textile waste has been analyzed in two representative clothing manufacturing companies. The aim of this work is to provide additional information regarding the planning of cutting orders, generated textile waste and existing condition of utilization of textile materials in Macedonian apparel industry.

Key words: clothing manufacturing companies, textile waste, cut order planning, CAD system, material costs and labor costs.

Introduction

In today‘s highly competitive global market, manufacturers are faced with a constant pressure to reduce costs, offer greater product selection, and faster product delivery. By maintaining lower labor cost and factory automation tools, many companies have successfully reduced operating costs.

The focus of efficiency in the apparel industry is to reduce the cost of raw materials (material costs), which often reach up to 75% of total production costs. In the recent years we witness continuous increasing of the price of textile materials, so any higher percentage of utilization of materials achieved directly affects the overall production costs (Jacobs - Blecha C. et al., 1998).

CAD/CAM systems for nesting/marking and CNC automated cutting equipment have proven effective in increasing the efficiency of the individual cutting operation. But the greatest opportunity for savings in overall time and material costs remains more effectively optimizing the overall cutting process – from order through cutting (Beazley A., et al., 2003). The cut order planning process, spreading and cutting process in the cutting department, determine the utilization of textile materials. Great importance in increasing the efficient use of materials is the planning the conversion work orders in cutting plans.

The purpose of this research is to investigate the influence on the level of applied technology on the percentage of generated textile waste in clothing manufacturing companies.

Theory

Cut order planning is an important linkage in the workflow control system. Cut order planning is the activity of planning the order for cutting, as an input into the marker making stage so that the cutting room receives complete spreading and cutting instructions (Wallace T. F. et al. 2003). The cut

order planning process is a dynamic function that must respond to the ever - changing status of many critical factors such as sales, inventory levels, raw materials, and availability of labor and equipment. The variety of sizes, styles, fabrics and colors induces significant complexity into the problem. Adding to the complexity, and thus potentially increasing total production costs, are setup the changeover costs, the question of appropriate sizes, and the necessity to meet customers‘ demands competitively (Cooklin G. et al., 2006).

Current industry approaches for performing cut order planning range from manual ad hoc procedures to customized proprietary software. Many apparel manufacturing facilities are still using very unsophisticated methods, depending on the expertise of one individual who has the necessary data and decision making tools only in his or her memory. Profit margins in this industry severely limit capital investment, resulting in few resources for computing equipment. Commercial software for cut order planning has been developed, but effective application requires extensive customization and the necessary hardware for implementation (Hands C. et al., 1997).

The cutting room has a greater effect on excessive manufacturing costs than any other department concerned with the actual production of garments. The revolution in the garment industry took place as a result of the introduction of CAD/CAM techniques. CAD/CAM systems are becoming more affordable during the whole time (D. J. Tyler, 2008).

Today it is advisable to use CAD/CAM systems wherever it is economically justified (Knox A., 1994, Gradiar M. et al., 1997). Handmade markers are time consuming, and if you change your mind about the layout you have to start over from the beginning. Making patterns on a CAD system allows very precise drafting and measurements. But the real advantage is that each pattern is stored on the computer and adjustments can be made very quickly and easily. CAD systems allow the marker maker to play with the pieces until it gets a good layout that minimizes waste. Reduced labor costs and faster production are the benefits. The better the layout is, the less fabric we have to buy on the first place, and much less textile waste is generated (Tincher W. C. et al., 1993).

Experiment

In two representative clothing manufacturing companies, designated A and B, which differ in terms of organization, number of employers, production capacity, the level of applied technology in the cutting process etc., the function of processing work orders has been analyzed and the real percentage of generated textile waste has been identified.

Production company A is formed in 2007 and only offers CMT services to different foreign partners. It employs about 45 productive workers in two production lines. The main activity of this company is production of pants. Here it is very important to mention that, the production company A, still uses manual production of markers for the greatest part of the work orders, because it has not got a CAD system. The cutting department is fitted with 1 cutting table for spreading with a length of 8,5 m, 1 band knife and 2 straight knife cutting machines. The production capacity ranges between 240 - 250 product units daily, which depend on the style and model.

Production company B is a modern and dynamic company with main activity in the field of textile and logistic on the European and world level. The company founders are occupied with this work since 2001. Their production palette includes men, women and children's denim collections and they monthly export between 20000 and 30000 units. The production company B has got a computer design system CAD. The cutting department is fitted with 4 cutting tables for spreading with a length of 8,5 m, 1 spreading machine, 3 band knife and 5 straight knife cutting machines.

In each production company the function of cut order planning and processing of three variants of work orders, was analyzed. In table 1 and 2 the structure of analyzed work orders at both companies is

presented. The tables clearly show that the work orders have different structure and differ in terms of the model, sizes, quantity etc. Besides the difference in the structure of the analyzed work orders, the difference in level of applied technology also affects on planning markers and economic cutting lays for analyzed work orders.

Table 1. Structure of the analyzed work orders in the production company A

Work order	Production company A									
1 (women's pants)	Size	**46**	**48**	**50**	**52**	**54**				**Total**
	quantity	85	25	230	25	65				430
2 (women's pants)	Size	**44**	**46**	**48**	**50**	**52**	**54**			**Total**
	quantity	110	132	204	183	110	96			835
3 (women's pants)	Size	**44**	**46**	**48**	**50**	**52**	**54**			**Total**
	quantity	63	85	136	103	93	85			565

Table 2. Structure of the analyzed work orders in the production company B

Work order	Production company B									
4 (children's pants)	Size	**4**	**6**	**8**	**10**	**11**	**12**	**14**	**16**	**Total**
	quantity	34	23	23	36	23	36	36	21	232
5 (men's pants)	Size	**38**	**40**	**42**	**44**	**46**	**48**	**48B**		**Total**
	quantity	23	54	62	60	53	18	4		274
6 (men's pants)	Size	**30**	**31**	**32**	**33**	**34**	**35**	**36**	**38**	**Total**
	quantity	80	100	160	140	200	100	120	60	960

The analyses of work orders in production companies were performed in several steps and there are some differences in the investigation performed at both companies:

- monitoring of the development of cut order plan according to the structure of analyzed work order (company A and B);
- monitoring of manual preparation of necessary markers (company A);
- manually measuring the length and width of the markers, m (company A);
- monitoring of the computer marker making using Gerber Accumark system (company B);
- analysis of the basic data required for cut markers (company B);
- monitoring the process of spreading plies and forming cut layers (company A and B);
- following the order of spreading fabric rolls (company A and B);
- measuring lengths and mass of the remnants of used fabric rolls, (company A and B)
- determination of the actual percentage of textile waste generated in the cutting process from each cut layer, by manual measurement using technical scale, (company A);
- measurement areal weight of the textile material with dimensions (10 x 10) cm, using a laboratory scale, (company B);
- calculating the actual percentage of generated textile waste in the cutting process from each layer, m^2, and its expression in mass units (company B);
- determination of the total time required for processing of the work order and calculating the total labor costs, (company A and B)

Findings

Table 3 and 4 presents the summary of obtained results from a research conducted in clothing manufacturing companies A and B.

Table 3. Total production costs and quantities of generated textile waste in the production company A

Production company A	Work order 1	Work order 2	Work order 3
Number of clothing pieces	430	835	565
Total number of layers	212	425	284
Cutting clothing pieces	424	835	568
Total material costs, €	2887,60	5867,45	4784,42
Total labor costs, €	43,95	60,99	50,38
Total production costs, €	2931,55	5928,44	4834,80
Total quantity of textlie waste, kg	66,70	228,42	94,66
Total quantity of textile waste from cut layers, %	28,2	35,00	26,5
Total quantity of textile waste from remnants, %	2,2	0,6	2,5
Total quantity of textlie waste, %	30,4	35,6	29,0

Table 4. Total production costs and quantities of generated textile waste in the production company B

Production company B	Work order 4	Work order 5	Work order 6
Number of clothing pieces	232	274	960
Total number of layers	114	147	421
Cutting clothing pieces	232	277	963
Total material costs, €	932,09	1755,45	6893,48
Total labour costs, €	39,08	32,06	84,02
Total production costs, €	971,17	1787,51	6977,5
Total quanty of textile waste, kg	17,6	50,50	112,82
Total quanty of textile waste from cut layers, %	19,8	26,5	18
Total quantity of textile waste from remnants, %	1,2	1,1	1,7
Total quantity of textile waste, %	21	27,6	19,7

To evaluate the impact of the level of applied technology on total production costs, quantities of generated textile waste in the production companies A is compared with the quantities of generated waste in the company B.

The results from comparison of total quantities of textile waste and waste from remnants, % are shown as a diagram (Figure 1 and 2).

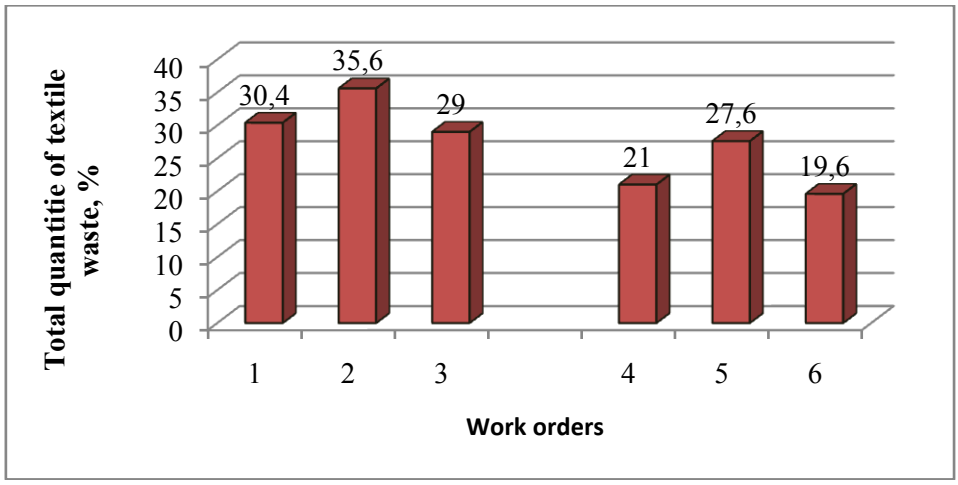


Figure 1. Total quantities of generated textlie waste in the production companies A and B, %

Figure 2. Total quantities of textile waste from remnants in production companies A and B, %

Discussion

Based on the analysis conducted in the representative companies (Figure 1 and 2), it can be concluded that the greatest quantities of textile waste (29 to 35,6)% created the production company A. One of the main reasons for this is certainly the difference in their technological capabilities. The production company A does not have a CAD system, and as a result of the inefficient planning and utilization of textile materials, a significant amount of textile waste is created and consequently the total production costs are increased. Despite the high percentage of waste as a result of the ply losses, in this production company there is a high percentage of waste due to fabric faults and remnants from fabrics rolls (0,6 to 2,5)%.

In the second production company B the quantities of generated textile waste are smaller and this is mostly due to the efficient interactive planning of cut markers using CAD system and its extensive experience in the manufacturing of pants.

The quantities of generated textile waste in the production company B ranges from (19,6 to 27,6)% and these differences are due to the difference in the structure of processed work orders and the effective width of the used textile materials. From Table 4 it is clear that the greatest amount of textile waste (27,6%) are generated with processing of work order 5. The higher percentage of waste is a result of the structure of the work order and the application of markers with low utilization.
In none of the analyzed production companies, planning the fabric rolls for spreading is not used, which contributes to the percentage of waste due to fabric faults and remnants from fabrics roll (figure 2) which move from (0,6 to 2,5)%.

Conclusion

The analyzed production companies produce different quantities of textile waste. One of the main reasons for variation in the percentage of generated waste, in companies that produce similar products, is the difference in the level of applied technological equipment.

In the production company A, as a result of inefficient planning and lack of a CAD system, the quantities of textile waste ranges from 29 to 35,6 %. On the contrary in the company B as a result of the extensive experience in the production of standard products and efficient interactive planning of marker using CAD system, the quantities of textile waste ranges from 19,6 to 27,6%.

In the analyzed companies, material costs dominate over labor costs, which clearly indicate that when planning cut orders the priority should be given to the material costs. An efficient utilization of textile materials will help to reduce the production costs and quantities of generated textile waste. Planning the order of spreading fabric rolls can further affect the utilization of textile materials and reduce the total quantities of generated textile waste.

Literature:

[1] Jacobs - Blecha C., Ammons J. C., Schutte A., Smith T., (1998), *Cut order planning for apparel manufacturing*, IIE Transactions, Springer 30 (1), 79 - 90;
[2] Beazley A., Bond T., (2003), *Computer aided pattern design and product development,* Blackwell Science Ltd., 1 - 20;
[3] Wallace T. F., Stahl R. A., (2003), *Master scheduling in the 21st century: for simplicity, speed, and success,* T. F. Wallace & Company, USA, 85 - 98;
[4] Cooklin G., Hayes S. G., McLoughlin J., (2006), *Introduction To Clothing Manufacture,* Blackwell Publishing Ltd, 85 - 99; [5] http://chinahollymanager.en.made-in-china.com/offer/HofnxQIVVihM/Sell-Most-Popular- Laundry-Ball.html
[5] Hands C., Hergeth H. H. A., Hudson P., (1997), *Marker making in small clothing companies – Part 1*, International Journal of Clothing Science and Technology, 9 (2), 154 - 165;
[6] Tyler D. J., (2008, Carr and Latham's Technology of Clothing Manufacture, 4nd edition, Blackwell Publishing Ltd,), 6 - 51;
[7] Knox A., (1994), *CAD/CAM in the clothing industry***,** World Clothing Manufacturer, 20 - 22;
[8] Gradiar M., Jesenko J., Resinov G., (1997), *Optimization of roll cutting in clothing industry*, Computers & Operations Research, 24 (10), 945 - 953;
[9] Tincher W. C., Daley W., Holcomb W., (1993), *Detection and Removal of Fabric Defects in Apparel Production*, International Journal of Clothing Science and Technology, 54 - 65;

AUTHORS ADDRESSES

MARTA ABRAM ZVER
Faculty of Mechanical Engineering
Slovenia

OZAN AVINC
Pamukkale University
Textile Engineering Department
Denizli, Turkey

BAJRO BOLIĆ, Ph.D.
Technical faculty
Universisty in Bihać
Bihać, Bosnia and Hercegovina
e-mail: bajro_bolic@yahoo.com

BJELICA MOMČILO, Ph. D.
Professor
Technical faculty "Mihajlo Pupin"
Zrenjanin, Serbia

BRDARIĆ M.
Faculty of Economics, Subotica
University of Novi Sad
Subotica, Serbia

BLAŢENKA BRLOBAŠIĆ ŠAJATOVIĆ
Tekstilno-tehnološki fakultet,
Zagreb, Hrvatska
e-mail: blazenka.brlobasic@ttf.hr

BRNADA S.
Department of Textile Design and Management
Faculty of Textile Technology
University of Zagreb
Zagreb, Croatia

NADIIA BUKHONKA, Ph.D.
Assistant Professor
Department of Knitting Technology
National University of Technologies and Designul
Kiev, Ukraine
e-mail: nbukhonka@ukr.net,
nbukhonka@gmail.com

LISA COWEY
EU IPA project Improved SME Competitiveness
and Innovation, Serbia
e-mail: lisa.cowey@icip.serbia.org

NENAD ĆIRKOVIĆ, Msc
Assistant Professor
Faculty of Technology
Leskovac, Serbia

DRAGAN ĆOĆKALO, Ph.D.
Assistant Professor
Technical faculty "Mihajlo Pupin"
Zrenjanin, Serbia

GORAN DEMBOSKI, Ph. D.
Faculty of Technology and Metallurgy
Sts. Cyril & Methodius University
Skopje, Republic of Macedonia
e-mail: goran@tmf.ukim.edu.mk

PETRONELA DRAMBEI
INMA Bucharest, Romania

VERA ĐEKIĆ
Technical faculty "Mihajlo Pupin"
Zrenjanin, Serbia

DEJAN ĐORĐEVIĆ, Ph.D.
Professor
Technical faculty "Mihajlo Pupin"
Zrenjanin, Serbia

DRAGAN ĐORĐIĆ
MIRJANA RELJIC
Cis Institute Belgrade
Belgrad, Serbia

SLAVIŠA ĐURĐEVIĆ
"SINGIDUNUM SVERIGE", Storgatan 25
Uddevalla, SWEDEN

MIGUEL ÂNGELO FERNANDES CARVALHO
University of Minho
Textile Engineering Department
Guimaraes, Portugal

GASOVIĆ MILAN, Ph. D.
Professor
Faculty of Economics, Subotica
University of Novi Sad
Subotica, Serbia

SAŠKA GOLOMEOVA, Msc
University —Goce Delčev"
Stip, Macedonia
e-mail: saska.golomeova@ugd.edu.mk

GORKEM GEDIK
Pamukkale University
Textile Engineering Department
Denizli, Turkey

VOJISLAV R. GLIGORIJEVIĆ, Ph. D
Professor
Faculty of Technology
Leskovac, Serbia

SUZANA GREGORČIČ
Faculty of Mechanical Engineering
Slovenia

ANA GRGUROVIĆ, student
Technical faculty "Mihajlo Pupin"
Zrenjanin, Serbia
e-mail: new_fetish@yahoo.com

DRAGANA GRUJIĆ, Ph. D
Assistant Professor
University of Banja Luka, Faculty of Technology,
Banja Luka, Bosna i Hercegovina
e-mail: dragana.grujic@tfbl.org

SVJETLANA JANJIĆ
University of Banja Luka,
Faculty of Technology,
Banja Luka, Bosna i Hercegovina

ISAK KARABEGOVIĆ, Ph. D
Professor
University of Bihac, Technical Faculty
Bihac, BiH

LJUBICA KAZI, M.Sc.
Assistant
University of Novi Sad
Technical faculty —Mihajlo Pupin"
Zrenjanin, Serbia

LESJA KOROLJOVA, M.Sc.
Department of Knitting Technology National
University of Technologies and Designul.
Kiev, Ukraine

SONJA KORTOSHEVA, Ph.D.
—St. Cyril and Methodius"
Skopje, Macedonia
e-mail: sonja@tmf.ukim.edu.mk

KOVAČEVIĆ S. , Ph.D.
Department of Textile Design and Management
Faculty of Textile Technology
University of Zagreb
Zagreb, Croatia
e-mail: stana.kovacevic@ttf.hr

IGOR KRESOJA
IKIII S.À.R.L., Creative Solutions For Retail,
Marketing & Product Management
Bettel Luxembourg,
e-mail: igor.kresoja@ik-3.com

BOJANA KRSMANOVIĆ
visual retail merchandising consultant
XAOSolutions,
Management consulting and
entrepreneurship development firm
Belgrade, Serbia
e–mail: bkrsmanovic@xaosolutions.com

SNEŢANA MILOŠEVIĆ
S. M. STYLE
Beograd, Serbia
e-mail: snezanamil13@open.telekom.rs

SILVANA KRSTEVA
Faculty of Technology
Goce Delĉev University
Štip, Republic of Macedonia
e-mail: silvana.krsteva@ugd.edu.mk

SERENA LANJI – KRSTIĆ
Textiliorg agency for fashion consulting
Jerusalem, Israel
e-mail: serenalanji@yahoo.com

KOSTADINKA LAPCHEVA, Ph.D.
Technology and Metallurgy Faculty
Skopje, Macedonia

MIRJAM LESKOVŠEK, Ph.D.
University of Ljubljana
Faculty of Natural Sciences and Engineering
Department of Textiles
Ljubljana, Slovenia

NADEŢDA LJUBOJEV, Ph.D.
Assistant Professor
Technical Faculty "Mihajlo Pupin"
Zrenjanin, Serbia

NEBOJŠA MARTINOVIĆ B.Sc.tech.
VM Protect
Šabac, Serbia

LJUBOMIR MAŠIREVIĆ, Ph. D.
Assistant Professor
Akademija lepih umetnosti
Beograd, Serbia

SLADJANA MILOJEVIC
Director of the Cluster of clothing fashion industry of Serbia,
Novi Beograd, Serbia
Email: fashioncluster@gmail.com

IVANA MILOŠEVIĆ
University of Banja Luka,
Faculty of Technology,
Banja Luka, Bosna i Hercegovina

MAJA NOFITOSKA
Ss. Cyril and Methodius University
Textile Engineering Department
Skopje, Macedonia

STANISLAV PRAĈEK, Ph.D.
Department of textile, NTF
University of Ljubljana
Ljubljana, Slovenija
e-mail: stane.pracek@ntf.uni-lj.si

VASILIJE PETROVIĆ, Ph.D.
Tehniĉki fakultet „Mihajlo Pupin—
Zrenjanin, Srbija

PREDRAG PETROVIĆ Ph.D.
Institute „Kirilo Savić—
Belgrade, Serbia

MARIJA PETROVIĆ B.Sc.agr.
Institute „Kirilo Savić—
Belgrade, Serbia

MIHAI POPA
SC Novatextile Pitesti
Pitesti, Romania

ALINA POPESCU
National Institute of R&D
for Textile and Leather-INCDTP
Bucharest, Romania

FLOAREA PRICOP, Ph. D
National Institute of R&D
for Textile and Leather-INCDTP
Bucharest, Romania

JELENA RADOSAVLJEVIĆ
Faculty of Technology
Leskovac, Srbija

MIRJANA RELJIC
Cis Institute Belgrade
Belgrad, Serbia
e-mail: reljicmira@gmail.com

ANDREJA RUDOLF
Faculty of Mechanical Engineering
Slovenia

IVANA SALOPEK ĈUBRIĆ, Ph.D.
University of Zagreb
Faculty of Textile Technology
Department of Textile Design and Management
Zagreb, Croatia
e-mail:ivana.salopek@ttf.hr

SELIM SAHIN
Kar – As Tekstil Yatak Yay San Ltd. Co.
Kayseri, Turkey

TATJANA ŠARAC, M.Sc.
Assistent
Faculty of Technology
Leskovac, Serbia
e-mail: tangerine_art@hotmail.com

MARIJA SAVIĆ
Technical Faculty "Mihajlo Pupin"
University of Novi Sad
Zrenjanin, Serbia

STANISLAVA SINĐELIĆ
Technical Faculty "Mihajlo Pupin"
University of Novi Sad
Zrenjanin, Serbia
e-mail: l_stanislava@yahoo.com

ZENUN SKENDERI, Ph. D.
University of Zagreb
Faculty of Textile Technology
Department of Textile Design and Management
Zagreb, Croatia
e-mail: zenun.skenderi@ttf.hr

SANJA STANISAVLJEV, M.Sc.
University of Novi Sad
Technical faculty —Mihajlo Pupin"
Zrenjanin, Serbia

MARIJA STANKOVIĆ
University of Novi Sad
Technical faculty —Mihajlo Pupin"
Zrenjanin, Serbia

URŠKA STANKOVIĈ ELESINI, Ph. D
Assistant Professor
Faculty of natural sciences and engineering
University of Ljubljana
Ljubljana, Slovenia
e-mail: urska.stankovic@ntf.uni-lj.si

JOVAN STEPANOVIĆ, Ph. D Professor
Faculty of Technology
Leskovac, Srbija

DRAGAN T. STOJILJKOVIĆ, Ph.D
Professor
Faculty of Technology
Leskovac, Srbija

STANIŠA STOJILJKOVIĆ, Ph. D
Professor
Faculty of Technology
Leskovac, Srbija

IVAN TASIC, Ph. D
Assistant Professor
Technical Faculty "Mihajlo Pupin"
University of Novi Sad
Zrenjanin, Serbia
e-mail: tasici@tfzr.uns.ac.rs

JELENA TASIC, M.Sc.
Primary School "Mihajlo Pupin"
Veternik, Serbia

MERVYN TAUB, Ph. D
Professor
Southern New Hampshire University
Manchester, New Hampshire, USA

DOINA TOMA
National Institute of R&D
for Textile and Leather-INCDTP
Bucharest, Romania

DAJANA TUBIC, Bsc ecc
Economic – Businees School
Odzaci, Serbia

DARKO UJEVIĆ**,** Ph. D, Professor
Faculty of Textile Technology
Zagreb, Croatia
e-mail: darko.ujevic@ttf.hr

Dr SINIŠA VARGA, Ph.D
Law Faculty
Kragujevac, Serbia

ARZU YAVAS
Pamukkale University
Textile Engineering Department
Denizli, Turkey

SRĐAN CAKIĆ, M.Sc.
Professor
Faculty of Technology
Leskovac, Srbija