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FOOTWEAR DIVERSIFICATION BY TYPIFICATION OF COMPONENT PARTS

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Abstract: *Diversification of a footwear product, constructively designed in a basic model, can be assured by putting into practice several diversification criteria. With this respect, the paper presents the results of the research on the diversification of a footwear product by typification of component parts. Thus, starting from a leisure time model of men shoe with vamp and whole quarters, diversification was made by detailing the basic patterns of the uppers. The detailing of the basic drawing of the uppers was made so that the outer contour of the two parts (the vamp and quarter) remains unchanged even in the case of patterns consisting of several components. Also, the vamp-quarter merging line will keep its position on the shoe last, its length, and its configuration unchanged. Under these circumstances, by detailing the vamp and the quarter, several variants of these fragmented parts resulted, which are considered typified parts. The use of typified parts for uppers will ensure the diversification of the basic model. The analysis of the resulting model variants led to highlighting the influence of the number of component parts of the uppers and of the set area on the usage index of the leather surface and the specific consumption at cutting.*

Key words: *diversification, footwear, waste, usage index, specific consumption*

1. INTRODUCTION

Nowadays, the continuous increase of the consumers' requirements and exigencies regarding the footwear products implies a demand of rapid diversification. In parallel with the diversification, the footwear manufacturers also aim at rationalizing the production in order to increase the economic efficiency.

Diversification of footwear is done mainly by changing the look and the composition of the uppers. This change is possible by adopting certain criteria of diversification, given that several criteria are possible, such as: the detailing of the basic drawing of the uppers, the detailing of the basic drawing of the outer linings, decorating the uppers, appearance and finishing of upper materials, the way of fixing footwear on the foot, etc. [1], [2]

As the detailing of the basic drawing of the uppers is an important criterion for diversification, in the present paper, this criterion is applied to a model of men's footwear, for leisure time, with vamp and whole quarters.

Thus, the following restrictive condition was imposed: the outer contour of the two parts (the vamp and quarter) remains unchanged, even in the case of a pattern composed of several pieces. Also, the vamncp-quarter merging line will keep the position on the shoe last, the length, and the configuration uhanged.

Under these circumstances, by detailing the vamp and the quarter several variants of these fragmented parts have resulted.

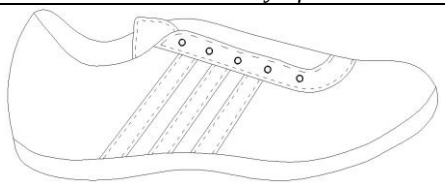
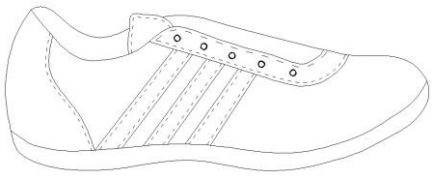
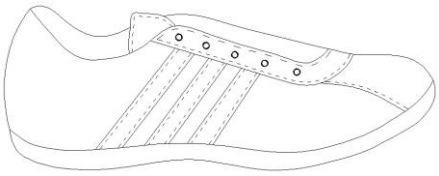
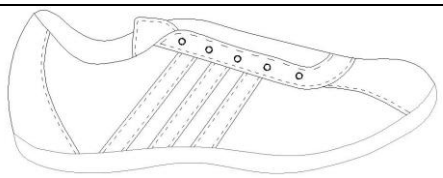
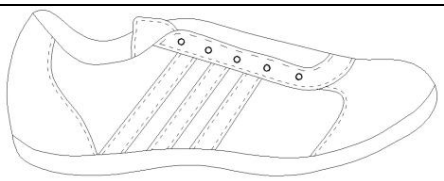
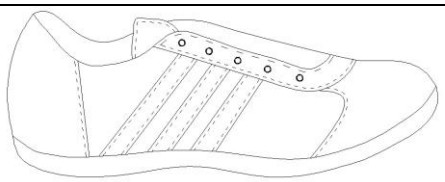
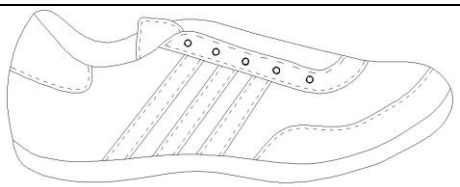
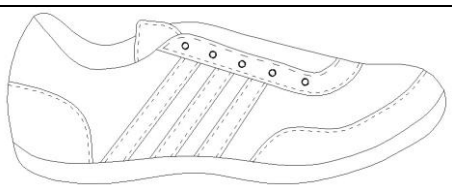
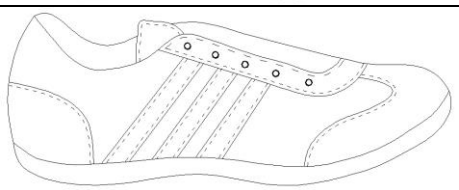
The association in a different way of the fragmented vamp and quarter has allowed a large number of variants of patterns to be grouped in a family [2], [3].

The component parts of the wamp and quarter were considered typified parts. Their use in the uppers will ensure the diversification of the basic model.

2.OBTAINING THE TYPIFIED COMPONENT PARTS

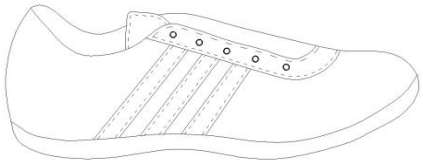
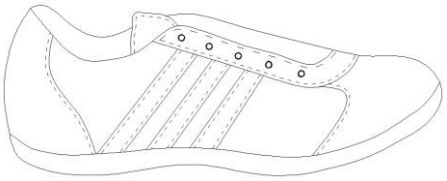
The vamp and the quarter were detailed, obtaining the family of models out of which were selected the models presented in Table 1.

Table 1. *Family of models*

<table>
<tr><td colspan="4"> 
Basic model M1</td></tr>
<tr><td>No.</td><td>Model variant</td><td>No.</td><td>Model variant</td></tr>
<tr><td>M2</td><td>  </td><td>M3</td><td>  </td></tr>
<tr><td>M4</td><td>  </td><td>M5</td><td>  </td></tr>
<tr><td>M6</td><td>  </td><td>M7</td><td>  </td></tr>
<tr><td>M8</td><td>  </td><td>M9</td><td>  </td></tr>
</table>

The parts: anchor, tongue, strap I, II and III are found in all model variants.
For example, for the M1 base model and the M5 model, the composition of the uppers is shown in table 2.

Table 2. *The patterns of the product*

Model variant		Pattern's name	Pattern Code	No. of patterns, ns
M1		anchor	01	2
		tongue	02	2
		strap I	03	4
		strap II	04	4
		strap III	05	4
		vamp	06	2
		quarter	07	4
		Total		22
M5		anchor	01	2
		tongue	02	2
		strap I	03	4
		strap II	04	4
		strap III	05	4
		toe cap	08	2
		vamp without toe cap	09	4
		quarter without heel counter stiffener	10	4
		heel counter stiffener	11	2
		Total		28

3. THEORETIC CALCULUS OF SPECIFIC CONSUMPTION

The hypothesis was that the models considered in this paper will be manufactured with 180 of dm^2 box calf leather. Knowing the surface areas and the perimeters of the patterns per model variant, theoretical variants of layout are done [4].

Once done the theoretical layout of patterns, the primary values necessary for calculating the leather consumption are obtained for each model variant, namely the area of the set, Aset, the area of the paralleogram of the set Aps, the perimeter of the set Ps and the theoretical factor F_A [5, 6].

The elements and calculus relationships necessary for establishing the specific consumption are presented in table 3.

Table 3*. Calculus relationships for estimating the specific consumption*

Calculus element	U.M.	Calculus relationship	Calculus element	U.M.	Calculus relationship
ns	-	-	a_{Dm+Dt}	%	$a_{Dm+Dt} = \frac{a}{\sqrt[4]{f_A}}$
$\overline{F_A}$	%	$\overline{F_A} = \frac{\sum A_s}{\sum A_{ps}} \cdot 1$	a_{Dp}	%	$a_{Dp} = \frac{pP_s}{2A_s} \cdot 1$
a_{Dn}	%	$a_{DN} = 100 - \overline{F_A}$	a_{DT}	%	aDT =aDN+ aDp + aDm+Dt

$\overline{A_S}$	dm^2	$\overline{A_S} = \frac{A_S}{n}$	IU	%	100-aDT=100-(aDn+aDm+t + aDp)
fa	-	$f_A = \frac{\overline{A_p}}{\overline{A_S}}$	CS	dm^2	$C_S = \frac{A_S}{I_U} \cdot I_C \cdot 10$

4. ANALYSIS OF MODEL VARIANTS

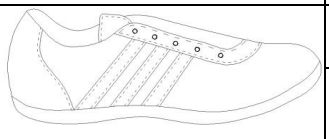
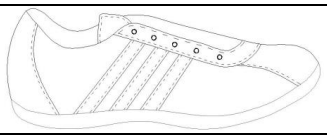
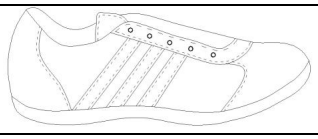
The number and configuration of the typified parts of the patterns of each model variant has led to different values of the average layout factor and of the size of the normal wastes (a_{Dn}), through bridges (a_{Dp}), marginal and pattern (a_{Dm+Dt}), table 4.

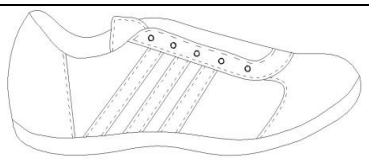
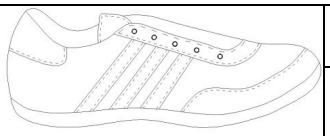
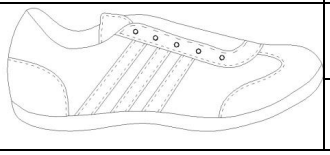
Table 3. *Average values for wastes*

	M1	M2	M3	M4	M5	M6	M7	M8	M9
ns	22	24	26	28	28	28	28	28	28
As	14.39	14.75	14.77	15.15	15.16	15.18	15.21	15.28	15.05
Aps	15.61	15.94	16.41	16.79	16.94	17.11	17.23	17.27	16.92
Ps	87.33	93.04	95.34	102.13	103.77	101.31	104.13	108.10	106.44
$\overline{F_A}$	92.18	92.53	90.01	90.23	89.49	88.72	88.27	88.47	88.94
a_{Dn}	7.82	7.47	9.99	9.77	10.51	11.28	11.73	11.53	11.17
$\overline{A_S}$	0.65	0.61	0.57	0.54	0.54	0.53	0.54	0.55	0.54
f_a	276.9	295.1	315.8	333.3	333.3	339.6	333.3	327.3	333.3
$\sqrt[4]{f_A}$	4.08	4.14	4.22	4.27	4.27	4.29	4.27	4.25	4.27
a_{Dn}	7.82	7.47	9.99	9.77	10.51	11.28	11.73	11.53	11.17
a_{Dp}	6.07	6.31	6.45	6.74	6.84	6.81	6.93	7.07	7.08
a_{Dm+Dt}	9.56	9.42	9.24	9.13	9.13	9.09	9.13	9.17	9.13
a_{Dt}	23.45	23.20	25.68	25.64	26.48	27.18	27.79	27.77	27.38
Iu	76.55	76.80	74.32	74.36	73.52	72.82	72.21	72.23	72.62
Cs	18.80	19.20	19.87	20.37	20.62	20.84	21.06	21.09	20.72

The values of usage indices and specific consumption, calculated on the basis of the theoretical layouts for model variants, are shown in Table 5.

Table 5. *Usage indices and specific consumption*

Model	Iu, %	Cs, dm^2/pair	Model	Iu, %	Cs, dm^2/pair
				M1	
				76.55	18.80
	M2			M3	
	76.8	19.2		74.32	19.87
	M4			M5	
	74.36	20.37		73.52	20.62

	M6			M7	
	75.55	19.68		21.72	69.08
	M8			M9	
	70.73	21.6		72.62	20.7

In the family of models created by the detailing differently the vamp and the quarter, there is registered an increase in the number of component parts of the uppers and implicitly of the area of the parts set. By detailing the vamp and quarter, the number of patterns in the set varies from 22 to 28 patterns in 6 model variants, having a significant influence on the average layout factor.
The highest average layout factor was obtained for the model M2, and the lowest for the model M7, figure 1.

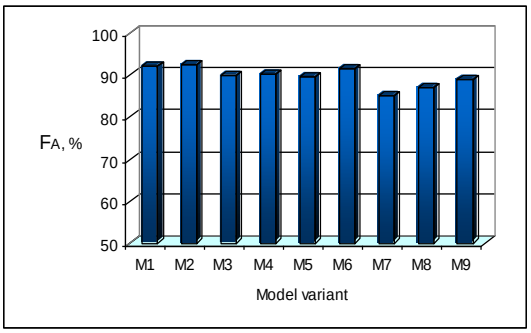


Fig.1 *Variation of average layout factor*

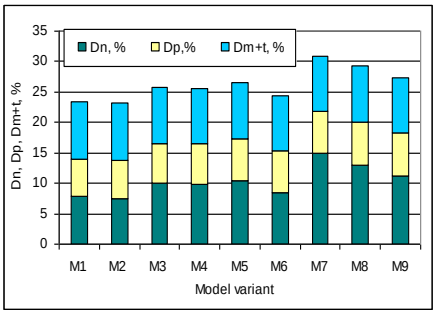


Fig.2. *Variation of total wastes*

The highest average layout factor was obtained for the model M2, and the lowest for the model M7, figure1. The variation of total wastes is illustrated in figure 2 as a sum of all wastes: normal, by bridges, marginal and pattern. The total waste varies in the range (23.75 - 27.77)%.

According to figure 2, within the three categories of waste, the highest differences are encountered for the normal waste.

The usage index of the leather varies for the model variants, between 72.21% and 76.80%. By detailing the component parts, Iu for M2 model is larger compared to the basic model.

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According to figure 2, within the three categories of waste, the highest differences are encountered for the normal waste. The usage index of the leather varies for the model variants, between 72.21% and 76.80%. By detailing the component parts, Iu for M2 model is larger compared to the basic model.

The number and shape of the component parts of each model variant influences the amount of specific consumption; the variation of the specific consumption is illustrated in figure 3.

Compared to the basic model M1, from the specific consumption point of view, the model variants can be grouped as it follows:

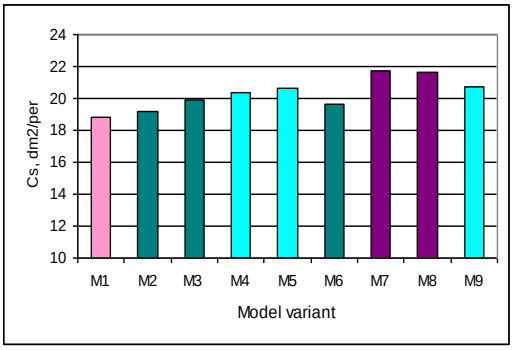

Fig.3 *Variation of specific consumption*

M2 and M3 : Cs= 19.20-19.87 dm^2/pair
M4 , M5, M6 and M9 : Cs=20.37-20.87 dm^2/pair
M7 and M8 : Cs=21.06-21.09 dm^2/pair

Variants of models with the same number of patterns in the set show higher values of specific consumption.

The graphical representations confirm the expectations regarding the estimate influence of the model variant on the efficient usage of the material while cutting-on.

4. CONCLUSIONS

In the case of the analyzed models, the following conclusions can be drawn:

- ✓ Different detailing of the uppers allows obtaining of typified patterns, and their use in the uppers is a manner of diversification of the footwear.
- ✓ The complexity of the uppers - given by the number of component parts - influences the size of the total wastes (23.75 - 27.77%), the biggest differences are found for normal wastes.
- ✓ The size of normal wastes is influenced by the size and the shape of the typified patterns, varying between 7.82 and 11.73%.
- ✓ The index of usage at leather cutting varies between 72.21% and 76.80% per model variant, being influenced by the configuration of the parts and the size of the set.
- ✓ The set area and usage index influence the specific consumption.
- ✓ Compared to the basic M1 model, from the point of view of specific consumption, the model variants can be grouped into three groups as it follows: M2 and M3 - Cs = 19.20-19.87 dm^2 / pair; M4, M5, M6 and M9 - Cs = 20.37-20.87 dm^2 / pair and M7 - M8 - Cs = 21.06-21.09 dm^2 / pair.

The conclusions are valid in the concrete case study and can be generalized for other types of footwear products through similar studies.

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