Comparative study on the wearing comfort of clothing items made by classic and unconventional technologies

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Abstract. The clothing made by classic or unconventional technologies has to respect the sanogenetic parameters, of wearing comfort and ease of maintenance. Also, resistance to stretching, bending, torsion and friction has to be respected, regardless of the technology of execution.

The paper proposes a study for the benchmarking of wearing comfort of clothing. The objectives of the study are: the influence of the type of textiles (natural, artificial or synthetic), the influence of the joint type (sewed or welded), for the synthetic materials, the analysis of certain comfort features (air and vapor permeability), all three objectives for identical articles made by different technologies (classic or unconventional).

The limits of the study, the objectives, and the sample will be established, and by the statistical processing of the results, conclusions will be drawn on the technologies that can be applied industrially for the production of the garments. Of course, unconventional assembling technologies will be preferred, as far as possible, because they are much faster than the classical ones and are suited to the current economic conditions characterized by an acute crisis of staff in general and qualified in particular.

1. Introduction

The present paper aims to conduct a study regarding the population's views on clothing products made of materials and by using conventional technologies compared to clothing products made from materials of new generations and unconventional technologies.

This study can serve as a base for collaboration between the economic and the academic world in terms of the manufacturing technologies applied to obtain high quality clothing with minimal production costs.

Clothing is an ingoing subject, always discussed, and is often given the importance it deserves. Clothes are not just materials that cover the body, the materials from which these clothes are made must have certain properties, and patterns can highlight a silhouette.

There is currently a real research work regarding the image. However, the image of a person is a complex issue that always has the clothing as a dominant component. The psychological impact of clothing, both as a technical execution and as materials, combinations of colours, and the correct adaptation of the materials to the models, can be possible research themes.
2. Problem description
Clothing, whether is made of classic materials and classical technology, or made from new generation textiles and unconventional technologies, will always be a research theme [1].

Classical materials from natural raw materials (cotton, flax, hemp, wool, natural silk) are the most known and quite used. These if are properly finished, cut and sewed, will meet the health care parameters and ensure the wearing comfort. The clothing made of natural raw materials is assembled by classic sewing technology [2]. The production time of classic clothing is relatively high and is determined by the sewing speed.

The artificial fabrics used for the clothing are based on natural polymers, and the comfort properties of wearing items from such raw materials are comparable to those of natural raw materials. However, the greatest inconvenient of artificial clothing is the high wrinkling rate, which is much higher than that the one of natural raw materials [3].

High technology fabrics made of synthetic fibres or microfibers (polyamides, polyesters, polyacrylonitrils and elastomers) are gaining more and more ground in the detriment of natural fibre materials. Materials which are using new generations [4], made of synthetic raw materials with superior finishes, can be assembled by gluing or welding process in order to obtain clothing, the production time of the products is being much smaller than those sewn together, and the wearing comfort parameters are often superior to clothing made from natural raw materials. New generation cloths provide air permeability, ensure the exchange of humidity between the body and the external environment which is superior to natural materials, ensuring comfort during wearing [5,6]. The most important point of clothing products made from materials and unconventional technology is the ease of maintenance; these items are washed at 30°C for a period that can start from 15 minutes. The big advantage is the non-wrinkling properties, knowing that the synthetic materials have a large angle of comeback from wrinkling. The big disadvantage is the high cost, because all the finishing processes applied are expensive, the technologies being still in the beginning. However, by comparing the lifetime of a clothing product made from classic materials and classical technology to the life of a clothing product with the same destination made from current materials and unconventional technologies, the cost of new generation products may no longer seem so great that the life of a “high tech” product of new generations is greater [7,8]. This can be continuously proven by the tensile strength and tear during usage which are much higher at synthetic materials than the natural ones.

3. Material and method
The paper proposes a case study for the comparative analysis of the wearing behaviour of the garments. The objectives of the study: the influence of the nature of textile materials (natural, artificial or synthetic), the influence of the type of joint (sewn or welded) on synthetic material, the analysis of some comfort characteristics (air and vapour permeability, all three objectives applied on identical garments made by different technologies (classic or unconventional).

It has been prepared a questionnaire with specific textile technology questions applied to clothing made from classic and natural raw materials, and clothing made through unconventional technologies and current raw materials.

For this study, closed questions were used which considerably reduce response effort, enable coding of responses, allow respondents to consider some variants of response that they would not otherwise have thought, are more readily accepted by respondents, limits the range of responses, etc. [9].

The questions were considered in terms of clarity, the uniqueness of a question in a wording was respected, the questions were appropriate to the purpose pursued, formulated in such a way as to be easy to understand, not to be too technical, in a clear, accessible language [10].

In the specialty literature it is mentioned that in order for a questionnaire to be acceptable as a size, the number of questions should be at most 50. The questionnaires were administered online, so they were very accessible from the point of view of the respondents, they did not require too much time for completion. It is also considered [11] to be more important than the number of questions, the duration and effort needed to give answers.
4. Sample volume determination
In order to determine the sample volume, three methods [12] are used: to "copy" the sample size used more frequently in certain types of study; starting from the number of analytical subgroups; and a statistical model was used for this study. According to the indications from the speciality literature [13], the following relationship, equation (1), was used:

\[ n = \frac{t^2 \cdot p(1-p)}{\varepsilon^2} \]  

(1)

where: \( n \) - sample size; \( t \) - theoretical value of the accepted probability (\( t=1.96 \) for a level of confidence of 95%); \( p \) - percentage in which the population has the sampling feature (\( p=0.50 \)); \( \varepsilon \) – permissible error of representativeness (values between 1% and 5% are accepted).

For a maximum permissible error of ± 5% and a volume of population surveyed, it appears that the volume of the sample should be at least 384. As at the time of stopping completion of the questionnaires, 396 valid answers were already recorded, it was decided to use only 389 answers, 7 of the initial ones were from respondents who answered twice.

The collected data was processed and the results were plotted, the images being suggestive.

For this study, we chose the sample so that it answers a series of questions: who is the survey (who will answer), what will be the volume of the sample and what are the criteria applied to the sample (the sampling criteria).

The chosen method is a statistical survey organized in order to identify the population's preferences for a certain type of clothing, classic or unconventional.

5. Experimental part
Here are some examples of answers to the public's views on technologies and some characteristics of garments.

1. Do you consider important the modern-unconventional technologies of clothing manufacturing? A. Yes, because modern technologies are focused on respecting the comfort parameters of wearing products; B. No, I prefer classical technologies because they are more certified; C. I have questioned the technology of clothing products, it's important just the look.

![Figure 1](image1.png)

**Figure 1.** The importance of modern unconventional technologies for the production of clothing products.

![Figure 2](image2.png)

**Figure 2.** The importance of air and vapour permeability of clothing items.

From the analysis of the graphical representation of answers, 54.5% of the respondents are interested in the unconventional technologies of clothing production. This justifies the development of research directions in this respect, products made with performing technologies being of interest, figure 1.

2. Do you consider important air and vapour permeability of a clothing item? A. Yes, these parameters are important for a clothing product; B. I only care about the vapour permeability of the product, so to have the feeling of dryness; C. I do not give importance to these technical data; I only care about the product being "good looking".
From the graphical representation analysis of figure 2 results in an overwhelming percentage, 76.9% of the respondents are interested in the air and vapour permeability of the garments. This is an opportunity for research into new technologies and materials with appropriate permeability properties, figure 2.

3. When you buy a clothing product, do you think about the comfort that it gives you during wearing? A. Yes, first of all I am interested in the comfort of wearing and afterwards the appearance of the product; B. I'm firstly interested in the look of the product; I think it is the duty of the manufacturer to provide articles that are comfortable to wear; C. If "looks good," the comfort of wearing does not interest me.

![Figure 3](image1.png)
**Figure 3.** The importance of wearing comfort of clothing items.

![Figure 4](image2.png)
**Figure 4.** Respondents' opinions on the purchase of articles made using unconventional technologies.

The comfort of wearing garments is important for 75% of respondents. Here interferes the role of advanced technology for the manufacture of comfortable clothing (materials, chemical finishing, fabrication, finishing of textiles) technologies that can lead to comfortable wearing products, figure 3.

4. If you are studying the joints of summer clothing item and you understand that they are made by welding, so the article is from synthetic raw materials, but the appearance is appropriate, do you buy it? A. Yes, if it “looks” good I buy it; B. No, in the summer I only wear articles from natural raw materials; C. I never study the joints carefully; I only care about the appearance of the product.

A percentage of 46% of respondents would buy products made through unconventional technologies, but most would buy classical articles from known materials and produced by known technologies, figure 4.

5. Taking in consideration the increasing trend in clothing production from recycled raw materials, would you purchase an article of such raw materials? A. No. I always read the product label and do not buy such items; B. Yes, if the materials are properly finished and have a nice look, if the product "looks good" I buy it, even if it is recycled raw materials; C. I do not read the product label; I only care if I like it. If I like it, I buy it. D. I do not read the product label, I only care about its appearance, if I do not like it, I do not buy it.

![Figure 5](image3.png)
**Figure 5.** Respondents’ opinions on the purchase of recycled raw materials.

It is well known that the emphasis is now on the recovery of raw materials and textiles. Once recycled, the garments can have an appropriate look and can respect all the comfort wearing parameters. 57.8%
of respondents would purchase such garments, so this area of recoverable textiles can still be researched, figure 5.

6. Conclusions
1. The garments made by modern-unconventional technologies are an area of interest for the studied population, which is an opportunity for university-economic environment collaboration on the development and application of performing technologies with lower costs for the production of clothing;
2. Ensuring air and vapour permeability is of interest to respondents, the production of new generation textiles with respect to these parameters can be a potential for scientific research;
3. Between the appearance and comfort of wearing a clothing item, the comfort is preferred, which is one of the particular importance’s for subsequent research, both in the chemical finishing of textile materials and in the area of cutting and fabrication. The comfort of wearing is always given by a whole set of technical parameters;
4. Interest in the purchase of articles made through unconventional technologies is close to 50%, launching articles made by current technologies on the market and checking them by buyers can lead to "high tech", "smart" articles, all made with unconventional technologies;
5. It is important to note the interest in recycled textile items. This contributes to the development of materials finishing techniques so that they achieve superior comfort and weariness;
6. The application of this study foresees the idea of developing scientific research in the textile area, both for the improvement of classical technologies and for the development of unconventional technologies for clothing products.

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