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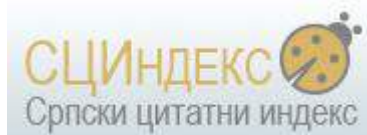
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IMPRESUM

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CONTENTS

PAGE 1 - 5

Paper 1: MANCHESTER DECODER WITH HIGH ROBUSTNESS

Authors: Zoran T Lovreković, Republic of Serbia

PAGE 6 - 12

Paper 2: WOOD AS A PRIMARY SELECTION OF MATERIAL FOR FURNITURE PRODUCTION

Authors: Petar Namichev, Mihail Petrovski, Republic of North Macedonia

PAGE 13 - 23

Paper 3: FACTORS INFLUENCING THE ADOPTION OF INFORMATION COMMUNICATION TECHNOLOGY (ICT): IN SELECTED, RATED, HOTELS IN ADDIS ABABA, ETHIOPIA

Authors: Menen Agegnehu, Kenenisa Lemi, Firew Mulatu, Ethiopia

PAGE 24 - 34

Paper 4: THE ADVANTAGES OF PUBLIC AUCTIONS FOR COMPANIES IN FORESTRY

Authors: Slađana Đurić, Republic of Serbia

PAGE 35 - 45

Paper 5: ASSESSMENT OF MOVEMENT OF THE BELEX15 INDEX USING LINEAR REGRESSION AND NEURAL NETWORK

Authors: Marijana Petrović, Republic of Serbia

PAGE 46 - 56

Paper 6: WHICH MODEL OF ECONOMIC DEVELOPMENT IS THE BEST FOR SERBIA

Authors: Jugoslav Aničić, Dušan Aničić, Republic of Serbia

PAGE 57

- INSTRUCTIONS TO AUTHORS

WOOD AS A PRIMARY SELECTION OF MATERIAL FOR FURNITURE PRODUCTION

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Abstract: This paper analyzes the influence of wood as the primary choice of material for furniture production. The wood, with its physical, chemical and mechanical properties, stands out from other materials when making a selection of material for furniture production. The wood possesses excellent physical properties, hardness, strength and density, chemical properties, wood does not rust and mechanical properties, elasticity, bending strength and tensile strength. Each type of wood has its own specific properties that make it unique, even the same kind of wood grown in a different place has different properties, the oak has great strength and is therefore difficult to work while the beech has less firmness than the oak and therefore it is easier for machining. Proper choice of material also exerts a great influence on the very design of the piece of furniture. The choice of material depends on which design will be used in the manufacture of furniture. A well thought-out design can be adapted to the choice of material sometimes, but with wood as the primary choice of material for furniture production the design itself gets on quality.

Key words: *furniture, wood, choice of material, design*

INTRODUCTION

The wood as a raw material has offered services to man from its existence on the earth, and has significantly contributed to the human survival and development of civilizations.

It is also true that wood, although not respected today due to the development of synthetic substances, is the most common basic material of countless products.

The value of this natural material is retained and expanded through use of modern methods of research in studying its growth, structure, chemical composition and utilization.

The list of contemporary use of wood is long. From the production of structures and furniture, pillars and other everyday products, the wood is processed in a veneer, which is glued – usually with waterproof adhesives, plywood, constructions (beams, arches, helicopter propellers), etc.

Although use of wood for products in which its natural structure is preserved appears to be declining, there is a definite increase of products in which wood is mechanically or chemically modified. Such wood-base products are expected to constitute the major outlets of wood utilization in the future. (G. Thoumis, 1968:1)

One of the fundamental joys in creating tempting wood furniture is working with these materials, and getting to know the unique qualities of every kind of wood, which is actually a very important step towards the way of becoming a furniture manufacturer. Every wood has its own character. Some types of wood in machining are processed more easily compared to other types of wood.

The selection of the materials used for the preparation of the final products is planned after a project is prepared for the preparation of a particular finished product. The materials can be divided into basic materials, which will be used during production. For this purpose, a standard for basic and auxiliary material is developed as part of the technical and technological documentation. With the development of the norm it is known exactly which materials will be used during production, i.e. the type, dimensions and quantities. (E. Andonova, T. Andonovski, 2013:20)

1. CHARACTERISTICS OF THE WOODEN FURNITURE

Wooden furniture is extremely elastic and requires very little maintenance. The wood is a long-lasting natural material that can withstand a constant burden and persist for generations. Attention should be paid to the absence of water or dust settled on your table, chair or armchair for a long period of time.

List of choices of the best ratio of material for furniture production				
Type of material for furniture	Furniture made from stainless steel	Furniture made from plastic	Furniture made from aluminium	Furniture made of wood
Easy for rearrangement	-	+	+	+
Material for all weather conditions	+	-	+	+
Wind Resistant	+	+	-	+
Resistant to fading	+	+	+	+
Resistant to rust	+	+	+	+
Water Resistant	+	+	+	-
Total	5/6	5/6	5/6	5/6

(The data has been downloaded from <https://www.patioproductions.com/blog/patio-furniture/best-material-for-outdoor-furniture/>)

Table1. List of choices of the best ratio of material for furniture production

Wooden furniture with its elegance, charm and sophistication fits into every interior. The beauty of wooden furniture is that it can be changed over time, for second, third or fourth use. This is done by sanding, painting or repainting the furniture, making the furniture completely new.

2. ADVANTAGES AND DISADVANTAGES OF WOODEN FURNITURE

The wood offers a unique combination of aesthetic appeal and integral structural integrity that other materials can not reflect.

Wood is a long-lasting and hard material and is the perfect choice for anyone looking for durability in the furniture. Whether it's hardwood (oak, walnut, cherry) or softwood (pine, spruce), there is inherent stability and reliability for a well-prepared chair or desk. Endurance also provides easy maintenance. It is occasionally required to perform the functions of varnishing, polishing and coating, which is understood as a process that does not require much work while at the same time protecting the wood for long-term use.

The wood comes in a lightly colored wood or a wood with rich dark shades. And when it is done by a skilled carpenter, the potential for innovation of the design of the wood grows, which means that the aesthetic value of the furniture increases.

Wood is the most important energy source for about three billion people. Over 50% of the world's harvest of wood is used as fuel (firewood and charcoal). More than 80% of this consumption, an increased trend, takes place in developed countries.

It is estimated that some 80% of the world’s population does not have access to the minimum amount of paper considered necessary to fulfill basic needs in reading and communication. (U. Kues, 2007:77)

List of the selection of material for furniture production through criteria				
Type of material for furniture	Furniture made from stainless steel	Furniture made from plastic	Furniture made from aluminium	Furniture made of wood
Aesthetically appealing	● ●	●	● ●	● ● ●
Comfort	●	● ●	● ●	● ●
Endurance	● ●	● ●	● ● ●	● ● ●
Maintenance	● ●	●	● ●	●
Total Score	12/18	11/18	14/18	15/18
Price	Middle	Low	Low	High

(The data has been downloaded from <https://www.patioproducts.com/blog/patio-furniture/best-material-for-outdoor-furniture/>)

Table 2. List of the selection of materials for furniture production through criteria for aesthetic appearance, comfort, durability and maintenance

When the wood is of good source and checked, the wood is an excellent option for sustainability, thus representing an environmental sound way of securing the home.

The wood that comes from a good source is actually the only renewable building material – from the forest from which it is collected because the wood can be supplemented with new growth. In addition, carbon resulting from the production and processing of wood products is drastically lower than that of other building materials.

Another way that the wood is a viable option is that it gives you the opportunity to buy “locally” from specialized craftsmen across the country. This gives you the opportunity not only to support the local wood industry, but also the local economy.

The wide variety of colors and tones of wood in many different types of wood represent the availability of appearance and style. And this should not mention the subtle but noticeable differences between the grains and textures of different species and incisions.

There is another diversity available in that every furniture manufacturer – especially if you buy from an individual craftsmen – offers a different arrangement of the design according to which type of furniture is being built, along with personal tastes (yours and theirs).

When making decisions on structural requirements for furniture, considerations of tension, compression, and bending are the product of an intuitive process. (J. Clark, 1980:2)

Unlike many other materials, the wood looks good in almost all conditions. Wooden furniture can be part of any design pattern, be it modern or rustic design, and, of course, makes it more versatile with every interior arrangement.

Factor	Included variable
Management role	(1) Management involvement
	(2) Providing secure working procedure of the employee
	(3) Setting signs on potential danger
	(4) Accident Information and their regulation
	(5) Keep up to date with the causes of consequences
Factor	Included variable
Danger Predictions	(1) Risk analysis of accidents Exploring a near accident
	(2) Maintaining Regular Security Inspection
Factor	Included variable
Training	(3) Security training
	(4) Management training on Accident Prevention
	(5) System for introduction of new employees with security

(The data has been downloaded from <https://www.furninfo.com/furniture-world-articles/3705>)

Table 3. The role of the management in a furniture manufacturing company associated with reducing accidents at work

Reasons for decomposition of wood

Decomposition of the wood is a biological process that is especially important for maintaining the life of the Earth. There are many causes of wood decay, among which the most common are abiotic and biotic factors.

Abiotic factors that destroy the wood:

- Mechanical influences (force of pressure, friction, impact, etc.)
- Physical influences (atmospheric – sun, rain, wind, low and high temperature, electricity, etc.) – these factors change the physical and chemical properties of the wood.
- Chemical influences (strong inorganic acids, bases, salts and gases) that cause physical and chemical changes of the wood.

Biotic factors include:

- Microorganisms (epoxy fungi and bacteria) and
- Xylophagous insects.

3. PREPARATION OF MATERIALS FOR FURNITURE PRODUCTION

Nomenclature of materials is a systematic list (overview) of all types of materials used in production.

The need for nomenclature arises in that the wrong names of the materials are not used by persons coming into contact with them – physically or documented.

The nomenclature for each type of material should contain: the exact name of the material, the technical and commercial characteristics of the material, the quality of the material, the dimensions of the material and the cipher (mark) of the material.

The norm of the materials is a certain number of materials needed for the manufacture of a one unit product.

Accordingly, for each product and for each type of materials that will be used for making certain types of products it is necessary to establish norms. The norms in themselves contain the amount of genuine inbuilt materials and the waste that occurs inevitably in the processing of the materials. (З. Ангеловски, Ѓ. Груевски, 2014:43)

Type of product	The norm of the material (m ³ /product)	Planned quantity of products	Normative of the material m ³
1	2	3	4
A	0,025	2000	50
E	0,018	3000	54
K	0,090	500	45
M	0,045	1200	54
П	0,050	1500	75

Total material norm: 278 m³

(Image taken from *Техничка подготовка на производството за IV год*)

Table 4. An example of the norm of a particular material made on the basis of the norms of several products that will be produced in a certain period of time

Based on the function they have in the construction of the products, and according to their technological characteristics, the production materials are divided into three groups:

- **Basic materials** that are processed or produced in the appropriate production, that is, the raw material for production, which are also most represented in their quantity. These include: lumber, various wooden panels, veneers and sometimes metals or plastics.
- **Auxiliary materials**, which are not processed or produced in the appropriate production, but are incorporated into their composition. These include: adhesives, varnishes, hinges and other fittings.
- **Consumables** that are not part of the production, but are used or decomposed during use.

Also materials that participate in the execution of certain technological operations during the formation of the finished product. These include: solvents, bleaches, fuels, paper, electric current, etc. (З. Ангеловски, Ѓ. Груевски, 2014:44)

Order #	452	Date	4/4/2009
Customer Name	Radford public library		
Product Description	Solid wood bookshelves		
Number of Units	100		

Materials	Bf/unit	Cost/bf	Total cost
Cherry 1 1/4	30	7	\$ 21,000.00

Type of finish	Lacquer
----------------	---------

Labor requirements	Cost/h	\$ 11.5
--------------------	--------	---------

Cross cutting	# hours/u	Total hours	Total cost
Ripping	0.75	75	\$ 862.50
Machining	0.25	25	\$ 287.50
Sanding	0.2	20	\$ 230.00
Assembly	1.25	125	\$ 1,437.50
Finishing	0.2	20	\$ 230.00
Packaging	0.1	10	\$ 115.00
Total hours		275	\$ 3,162.50
Estimated overhead			\$ 5,250.00
Total cost order			\$ 29,412.50
Total unit cost			\$ 294.13

(The data has been downloaded from <http://ephesustour.cc/cost-sheet-format-in-excel/>)

Table 5. Example of ordering solid wood for the production of shelves in the library, together with working hours

4. THE INFLUENCE OF WOOD ON THE DESIGN PROCESS FOR FURNITURE MANUFACTURE

For the wood furniture industry, the designer or product manager must try to understand the nature of the raw materials, the wood with its mechanical properties as swelling or shrinking depending on the atmospheric moisture. In addition, each type of wood has different properties, even the same wood in a different location also have different properties. Therefore, the

designer should also be further concerned about the user as a factor, its dimensions, reliability, and the user's sense because the furniture is a product that is in direct or indirect contact with the users.

In general, the furniture can be divided into the following: appearance (legs, cabinet type, upholstery), function (home, office, special-purpose), placement (external or internal), assembly (built-in, or free standing), and materials (pure wood, panels, metal, plastic, natural materials, etc.) (S. Choodoung, U. Smutkupt, 2012:2)

This research represents the processes of designing furniture and factors that need to be addressed both in the function and in the aesthetics for further benefits in the furniture industry.

- Process design (design planning; is the first step in the design of wood furniture. The designer must identify the needs of consumers and then plan how the expected product will meet the needs of the market.
- Product Specifications; it starts with specific research related to wooden furniture and targeting a group of consumers.
- Concept design; is a presentation of the concept of wooden furniture which consists of basic information, experience, and skills of the designer through which the selection and testing of the product will be carried out.
- Product Architecture; includes various parts such as development of design, costs, prototype design and testing of it.

- Industrial design; in the real wood furniture industry, the designer must begin with the process of revision. The designer and the manufacturer must approve the design and then the designer can start with the production of said design. Then the product is assembled.
- Production; for the production process, the designer must cooperate with the manufacturer and also to inspect the product in each of its processes together with the engineer. (S. Choudoung, U. Smutkupt, 2012:4)

1) Evaluation of the design

A good design must respond to the main goal of effective creative design in several ways, such as ease to use, easy production, etc. and easy distribution using the following criteria.

- 1.1) Good function and aesthetics
- 1.2) Durability
- 1.3) Economy
- 1.4) Right choice of material
- 1.5) Correct structure
- 1.6) Character / identity
- 1.7) Beauty caused by the positive reaction of buyers

2) Factors influencing the design of wooden furniture

2.1) Style; History of furniture. The design of furniture historically follows: Gothic (early 16th century), Renaissance (16th century), Louis XIII (1590 – 1661), Louis XIV (1661 – late 17th century), Rigence (early 18th century), Louis XV (1795 – 1804), Transition (1760 – 1780), Directorate and Consulate (1795 – 1804) – after

the French Revolution, Imperial (1804 – 1815), Art Nouveau (late 19th century – early 20th century), Art Deco (Early 20th century – to date), Modern (early 20th century – to date), this design is based on population increase, industry development, etc.

3) Form

Compatibility; the overall shape of the product must be united. The best design of wood furniture consists of geometric shapes due to the consistency of shapes and easy production of such shapes using machines.

4) Function

Strength and durability; the structural conceptual forms which depend on the functionality of the wooden furniture. Appropriate molding of the furniture according to the specific environment and the environment of the product when in use. Ergonomics of the human body.

5) Material

According to the function; the hardness of the wood must be related to the function of the furniture. The designer also needs to know the specific density of each type of wood. This is very important because the hardness of the wood will affect the process of joining furniture, textures and color. The designer that is familiar with the steps and goals in designing a piece of furniture can use variations in certain parts of the designing process.

5. CONCLUSION

Wood as a natural material is a priority when choosing material for furniture production. The characteristics of the wooden furniture consist of its durability, hardness and resistance to climatic conditions. Because the wood is a natural material, it brings freshness to the interior designs, but you need to be cautious about exposing the wooden furniture to moisture, water, or dust because they are his biggest enemies.

Almost 90% of the things made of wood, the wood must first be reformed, usually by removing parts of it until the desired shape and size is obtained.(R. Bruce Hoadley 2000:158)

The wood is composed of a complex mixture of substances, but the main ingredient of each wood is carbohydrates also known as cellulose. This material serves as the primary source of energy and nutrition to many forms of life. People also use this energy source, not as food, but as a source of heat. Which mean that, accordingly, cellulose is responsible for the extraordinary hardness of the wood that makes it desirable in the manufacture of furniture. (G. Thomasson2015:2)

Wood is the most prevalent when choosing materials for furniture production, because it is a renewable natural material, has great durability and possesses a higher quality compared to other materials (plastic, iron, glass, etc.).

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