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TEKNIIKAN JA LIIKENTEEN ALA

# TECHNOLOGY OF FURNITURE PRODUCTION

**Author:** Kseniia Danilova

**SAVONIA UNIVERSITY OF APPLIED SCIENCES**  
**THESIS**

**Abstract**

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| Author(s)<br>Kseniia Danilova   |          |                  |    |
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| Supervisor(s)<br>Heikki Salkinoja (Savonia UAS); Olli-Pekka Kähkönen (Savonia UAS)  |          |                  |    |
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| Abstract<br><br><p>Manufacturing of furniture is one of the main processes of timber utilization. Furniture of Timberica Oy brand is made by special technology which does not allow use aggressive chemicals that can be harmful to humans, in wood processing. The furniture is made of Karelian "white" pine. Company's headquarters are located in Finland, its specialists improve and carefully controlled manufacturing process at the furniture factory in Karelia.</p> <p>Timberica Oy has produced furniture since 1998. They have their own sales chain in Russian market, from Eastern regions to Barents Sea.</p> <p>At the same time Timberica Oy works in the field of supplying soft wood sawn timber (pine, spruce, and larch), different types of wood products, interior and garden furniture, glue laminated products and panels to the European market. Timberica is an agency, which delivers timber, other wood products produced at Russian big, and small sawmills, to Europe.</p> <p>This thesis was aimed to research the process of furniture production using Timberica Oy as an example. Furniture production is one of the traditional directions of the woodworking industry of the northern countries of the European continent. It is related to several moments - great quality of local timber and the popularity of Scandinavian style in interior design.</p> |          |                  |    |
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## 1 INTRODUCTION

This thesis was aimed to research the process of furniture production using Timberica Oy as an example. Furniture production is one of the traditional directions of the woodworking industry of the northern countries of the European continent. It has related to several moments - great quality of local timber and the popularity of Scandinavian style in interior design.

The furniture of Timberica Oy brand is made by special technology which does not allow use of aggressive chemicals that can be harmful to humans in wood processing. The furniture is made of Karelian "white" pine. The company's headquarters are located in Finland, its specialists improve and carefully controlled manufacturing process at the furniture factory in Karelia.

Timberica Oy has produced furniture since 1998. They have their own sales chain in Russian market, reaching from Eastern regions to Barents Sea.

At the same time Timberica Oy works in the field of supplying soft wood sawn timber (pine, spruce, and larch), different types of wood products, interior and garden furniture, glue laminated products and panels to the European market. Timberica is an agency, which delivers timber, other wood products produced at Russian big, and small sawmills, to Europe.

### 1.1 Characteristics of wood

Vast expanses of our planet are covered by forests, they occupy about one-third of the land. Wood is the main product of the forest. According to the type of forest vegetation forests are categorised into coniferous forests of the warm temperate climate, equatorial rain forest, tropical moist deciduous forest, dry forest areas. Wood has very long been used for the construction of dwellings, manufacturing of household goods, transport and different kind of ware. Over the time, along with the wood in construction it was start to use steel metal, cement, tiles, glass, and plastics. Despite this fact, the volume of wood processing grows and increases production and processing of lumber. Consumption of sawn timber will increase in housing construction, for industrial and domestic use, in the construction of structures of varying complexity and size, to the repair and maintenance works in the furniture manufacturing and packaging

Due to the rare combination of many valuable properties, wood is the most usable material. Wood is very durable and at the same time lightweight material. It has good thermal insulation properties and vibration dampening. Wood is easily handled with cutting tools, glued, keeps metal mounting. Wear resistance is the ability to resist gradual destruction of its surface. In endurance test, timber has shown that the wear with side surfaces is significantly larger than the surface of the end section. With an increase of density and hardness of the wood wear has decreased. The wear of wet wood is bigger than the wear of dry wood.

Wood has a unique ability to keep bracing such as nails, screws, brackets, crutches, etc. During the nail hammering to wood, elastic deformation occurs, it provides sufficient frictional force that prevents unplugging of nails. After processing, wood is used as lumber, pulp, plywood, paper, cardboard, wood fiber and particleboard. Wood is a great construction material, and it is used in mechanical engineering. Railway sleepers, furniture and matches, musical instruments, sports equipment and packaging are manufactured from wood. A significant role in the assessment of wood as a material of the future is its unique aesthetics. Even the waste wood has an advantage over other materials, it is biodegradable and does not pollute the environment.

However wood has several disadvantages such as variability of properties along and across the axis of the barrel; it is hygroscopic, which leads to an increase in its mass and strength decrease, during drying wood is reduced in size (shrinkage occurs); it crack and warps, and is affected by fungi and putrefaction as a result; wood can burn. These disadvantages removed by chemical processing into sheet and board materials such as paper, cardboard, chipboard and fiberboard, plywood and others. In order to improve the appearance and to protect products from the negative impact of the surrounding environment, various ways of surface treatment are used. Surface finishing types include carving, inlay, finishing film pasting, and coating with paint materials and so on. The development of the history of wood finishing has great and long history. Wood was one of the first materials which humans started to use for the creation of hunting and labor tools. The desire to decorate and protect these tools from the destruction originated at the earliest development stages of human culture. However, the technique of the wood finishing progressed slowly until the XX century while finishing materials (resins, pigments, dyes) originated naturally. Furniture production is one of the major processes where wood is used. In order to select the proper type of wood, it is necessary to explore their main characteristics and distinguishing features

## 2 RESEARCH OF WOOD TYPES

### 2.1 Mechanical characteristics of wood

To fully understand and appreciate wood as a structural material, one must first understand wood anatomy and structure. This can be considered at two levels: the microstructure, which can be examined only with the aid of a microscope, and the macrostructure, which is normally visible to the unaided eye.

#### 2.1.1 Microstructure

The primary structural building block of wood is the wood cell, or tracheid. When closely packed, these wood cells form a strong composite system that is often compared to a bundle of drinking straws (Figure 1). As a unit, the straws (wood cells) weigh very little, but if restrained from lateral buckling, they will support a substantial load in compression parallel to their longitudinal axis. If the straws are loaded in compression perpendicular to their longitudinal axis, they will yield under relatively light loads. Using this analogy, it is easy to visualize the superior strength-to-weight ratio of a cellular composite such as wood. Yet, each individual wood cell is even more structurally advanced because it is actually a multilayered, filament-reinforced, closed-end tube rather than just a homogeneous, nonreinforced straw (FIGURE 2). (Timber Bridges, ei pvm)

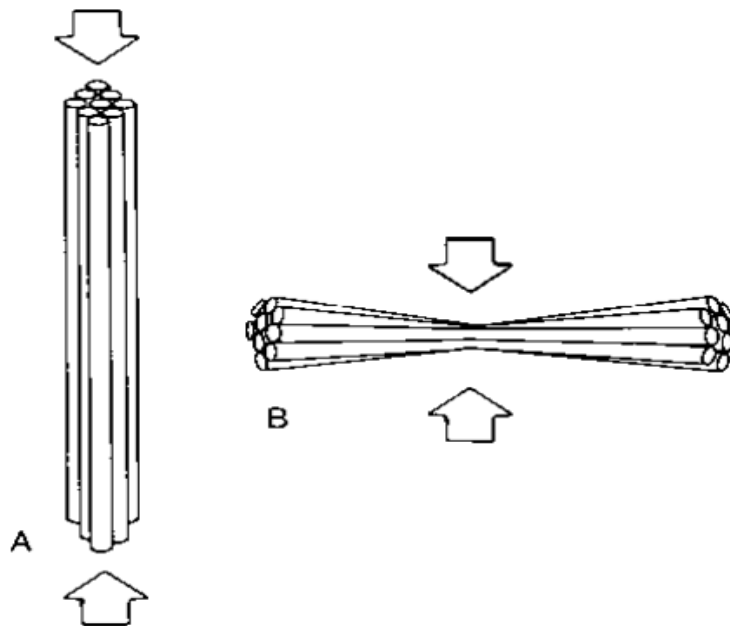


Figure 1. (A) Parallel to their longitudinal axis, the straws (wood cells) can support loads substantially greater than their weight. (B) When loaded perpendicular to their longitudinal axis, the straws yield under much lower loads (Timber Bridges, ei pvm)

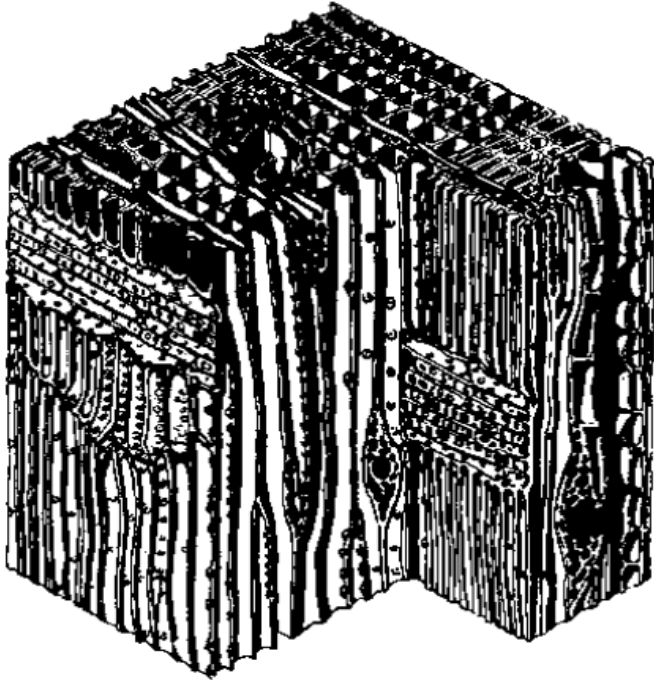


Figure 2. Drawing of the magnified structure of a softwood (Timber Bridges, ei pvm)

### 2.1.2 Macrostructure

Macrostructure is the structure of the timber, which can be investigated by the naked eye or using the magnifying glass. There are three basic parts in a cross-section of tree: bark, cambium, and wood (Figure 3). Bark is composed of an external layer (outer) of corky material with a thin internal (inner) layer of living cells. The main purpose is to protect the tree and to conduct nutrients. The cambium is a thin, continuous ring of reproductive tissue located between the wood and the bark. New wood and bark cells are formed in this part of tree, usually one to ten cells thick, it depends on the season of the year. Wood is located inside the cambium, it conducts and stores nutrients and provides the tree with structural support. Pith is a central part of wood, tree growth began from the heart center.

Wood is divided into two general classes, sapwood and heartwood. The sapwood consists of both active and inactive cells and is located on the outside of the tree, next to the cambium. It functions primarily in food storage and the transport of sap. Heartwood, which was once sapwood, is composed mostly of inactive cells that differ both chemically and physically from sapwood cells. The heartwood cells do not function in either food storage or sap transportation. In most species, the heartwood contains extractive substances that are deposited in the cell during the conversion from sapwood to heartwood. These deposits frequently give the heartwood a much darker



color than sapwood; however, in several species the heartwood is not dark and looks virtually the same as sapwood. The extractives also serve to make the heartwood of several species more resistant to attack by decay fungi and insects. Because all heartwood was once sapwood, there is generally little difference in their dry weight or strength.

Growth in wood cells varies between cells that are formed early in the growing season, early wood cells, and those formed late in the growing season, latewood cells. Early wood cells are usually formed during the first or second month of the growing season and have relatively large cell cavities and thin walls. Latewood cells are formed later in the growing season and have smaller cell cavities and thicker walls. The contrast between the early wood and latewood cells forms the characteristic growth rings common to most species (Figure 4). These growth rings vary in width, depending on species and site conditions. In many species of softwood, such as Douglas-fir and Southern Pine, there is a marked contrast between the early wood and latewood, and growth rings are plainly visible. In other species, such as spruces and true firs, the change from early wood to latewood is less obvious, and rings are more difficult to see. Environmental conditions can also affect growth rings. Rings formed during short or dry seasons are narrower than those formed under more favorable growing conditions. (Timber Bridges, ei pvm)

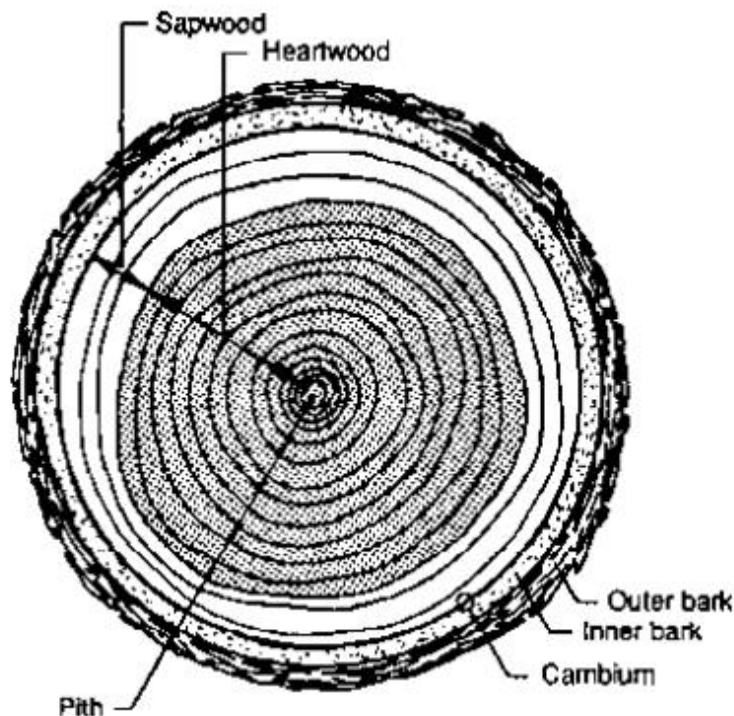


Figure 3. Cross section of tree, showing macrostructure (Timber Bridges, ei pvm)

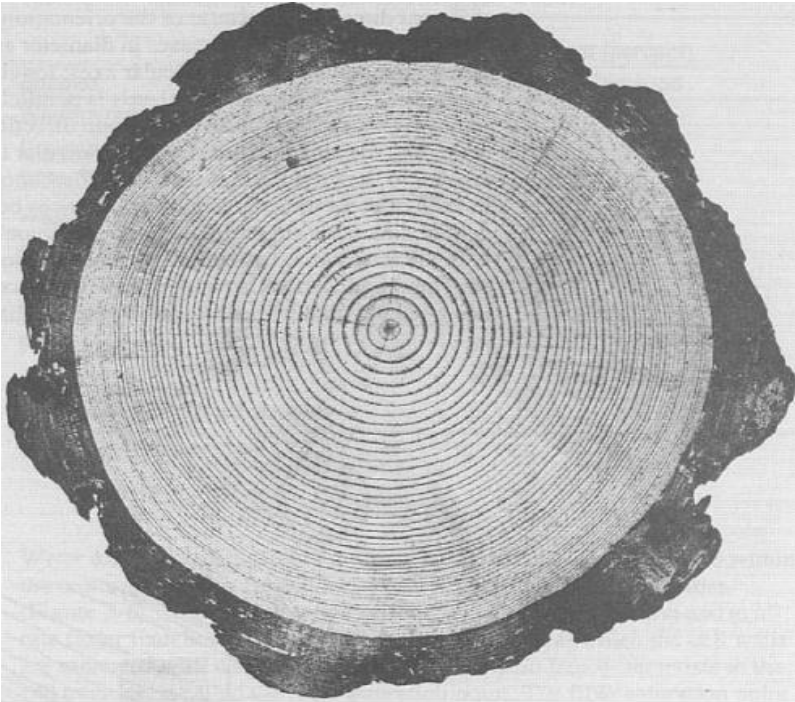


Figure 4. Growth rings of pine log. A growth ring is composed of the earlywood ring and the latewood ring outside it (Timber Bridges, ei pvm)

## 2.2 Wood Types

Wood has been one of the best materials used for making furniture since ages. Due to the centuries-old experience of using different tree species and studying their properties, people have found the most appropriate methods of production, processing and operation of wooden furniture. Some species are not suitable for manufacturing or using in those or other conditions because of physical characteristic. One of the main factors when choosing wooden furniture is the appearance of the wood from which the furniture has made. Main characteristics of wood appearance are color, texture and shine (gloss).

- Wood has a variety of colors from light to dark (Figure6). It depends on breeds and the location. Wood breeds native to southern and tropical areas are brighter than the color of northern breeds. Some breeds after the contact with light and air lose its brightness and become of greyish tone. Alder wood right after cutting has a light-pink color, but after a while it gets yellowish-red color. Oak wood exposed to moisture for long periods becomes dark brown or

black (stained oak). Moreover, wood color depends on the age. Young trees are brighter than the old trees.

- Wood gloss is the ability to reflect light. It depends on wood size, density and location of medullary rays.
- Wood texture is the image, which is obtained on sections of wood by cutting its fibers, growth rings and medullary rays. Texture is a peculiar pattern formed by the medullary rays, fibers, and yearly layers of wood. The texture determines the decorative value of the wood, which is particularly important in the manufacture of artistic furniture, various artefacts, while the decoration of musical instruments and others.

According to the degree of density, wood is divided into three main groups:

- Soft wood: fir, cedar, pine, fir, juniper, linden, aspen, poplar, willow, alder, chestnut.
- Hard wood: larch, beech, birch, oak, elm, elm, sycamore, maple, mountain ash, walnut, ash, apple tree.
- Very hard wood: Acacia white, box, hornbeam, dogwood, steel birch, pistachio tree, yew.

In the northern countries of the European continent, furniture is produced from the most popular species like pine wood, spruce, birch and aspen.

### 2.2.1 Birch

Birch is white with a yellowish tinge. Wood is homogeneous by density, well cut and colored. It is simulate mahogany, walnut, gray maple. Thanks to elastic structure of wood, birch is not deformed and there are no cracks. Birch lends itself to carving that allows making very beautiful products. Birch timber looks very nice in cross-section; surface of the product does not require additional decoration (Figure 5). In some cases you can simply cover the transparent varnish. It is durable type of wood and its

products are able to serve for many years. Birch is easy to glue, grind, finish and impregnate.



Figure 5. Cross Section of birch (Novosibdom, n.d.)

### 2.2.2 Karelian Birch

Karelian birch is quite a rare and valuable tree. Unlike conventional birch, Karelian is not exposed to rot. Specific advantages of Karelian birch are its strength and very beautiful structure (Figure 6). Birch timber has a strong curly grain (twist). The fibers are located at different angles to the cutting plane creating the impression of curl and waviness. Common wood color is light brown or brownish with numerous inclusions in the form of brackets, dashes, check marks. The most robust of all types of birch wood is Schmidt's birch. In addition to its high strength, it is not subjected to rot. Processing of Karelian birch is hard, but furniture made of it will be almost eternal.



Figure 6. Unique structure of Karelian Birch (Yulia, 2009)

### 2.2.3 Aspen

Aspen is sapwood. Aspen prefers cool temperate climate. Usually it grows in mixed forests and wet soils adjacent to coniferous forests. It is white color wood with greenish tint. Growth rings are not clearly expressed, medullary rays are not visible. One of the advantages is that aspen does not turn into yellow color, when indoors for a long time. One more advantage is an ability not to rot if it is in the water for a long time.



Figure 7. Cross section of Aspen (Karelian forests, n.d.)

#### 2.2.4 Spruce

Spruce is related to coniferous trees (Figure 8). This is one of the most widespread species of conifer in both Europe and North Asia. The peculiarity of the wood is that it does not have clearly expressed core. Color of spruce is homogeneous, yellowish-white; some breeds have a little pinkish tinge. Late layers are darker than the young. Annual rings are well distinguished in any section. Spruce wood is characterized by small density and low gummosity. The trunk has a large number of knots that complicate the wood processing in the production of furniture veneer. Spruce wood is characterized by low thermal conductivity and good mechanical strength. Compared to pine, spruce absorbs moisture better and begins to rot faster. That is why it should be treated with antiseptic.



Figure 8. Cross section of spruce (Dostoinstva i nedostatki drevesiny raznyh porod, n.d.)

#### 2.2.5 Pine

Pine is the best type of wood used for furniture production. Colors of pine wood might be yellowish or whitish with brown stains. Pine is light in weight but very strong. Manufacturers usually use pine grown up on the hills with sandy or dry soils. Difficult conditions of its existence increase hardness of the wood in comparison with a simple East European pine. That kind of wood has distinct and narrow growth rings closely spaced to each other (Figure 9). Due to the fact that pine has good hardness, it is

easy to work along fibers. Pine is also a very productive material, it is easy to process. Pine coating responds well to grinding and tinting, without losing its natural texture. Pine material is also able to destroy the parasites and prevent rotting.



Figure 9. Old pine in a corner of a log house (Banyamsk, 2016)  
(Stule de France, n.d.)

To sum up we can say that the most popular wood breeds for furniture manufacturing is a pine.

For production in Karelia (Russia), usually silvery pine is used. Karelian pine has the highest consumer properties, which is valued throughout the European continent. Harsh and cold winters, typical for the local climate, significantly slow the growth of pine, therefore the strength and density increase. Tree, grown in unpolluted area, keeps the purity of wood. There is no radioactive metals, traces of sulfur, sulfur dioxide, and other substances.

### 3 MATERIALS FOR FURNITURE MANUFACTURING

#### 3.1 Raw materials

At the longitudinal division (sawing) of saw log parts and at the longitudinal or transverse cutting of obtained parts we get sawn timber, which includes lumber, veneer, blanks, sleepers, etc.

There are many variations to cutting patterns, which depend on the log and the end use of the lumber. There are three common methods of sawing logs: rift sawing, plain sawing, and quarter sawing. (Wood and natural fibres, 2007)

- Rift Sawing

Rift sawing is a technique of radially sawing logs in a purpose to obtain boards, so the annual rings are located nearly 90° to the faces. This method produces the most quantity of waste, increasing the cost of this lumber.



Figure 10. Cut pattern for rift sawn lumber (Sawing Options , n.d.)



- Plain Sawing

Plain sawing is the most common and affordable method to mill a log into planks. Moreover, it is the fastest way to slice the boards. Plain sawn has really attractive (cathedral) appearance.



Figure 11. Plain method of sawing (Sawing Options , n.d.)

- Quarter Sawing

Quarter sawing is more complicated than plain sawing. It is produced by cutting a log lengthwise into quarters, then creating a series of parallel cuts, with the middle cut being perpendicular to the tree's rings. One disadvantage of this method is that it leaves some scrap.



Figure 12. A quarter method of sawing (Sawing Options , n.d.)

### 3.2 Types of materials

Different kinds of materials used in furniture manufacturing such us:

Fiberboard, Particleboard, HDF, MDF, Veneer, plywood.

- Fiberboard

This term includes hardboard and medium-density fiberboard. Fiberboard is a wood product that is manufactured from wood fibers by compressing.



Figure 13. Wood Fiber Board Texture (Wood Fiber Board Texture, n.d.)

- Medium-density fiberboard (MDF)

This kind of plate is made of very small sawdust. Wood particles are held together by lignin and paraffin, so that the MDF is very eco-friendly material.



Figure 14. MDF Fiberboard (Medium Density Fiberboard MDF, 2016)

- HDF (high density fiberboard)

The production process of the material made by compressing shredded conifer fibers. In fact, the plate HDF is a modified analogue of MDF with improved properties. Its density parameters are higher than the same parameters of classical MDF.



Figure 15. HDF fiberboard (Grinvich, n.d.)

- Particleboard (chipboard)

Particleboard is a wood plate manufactured from wood chips, sawmill shavings, or even sawdust, made by hot pressing. Particleboard is manufactured with one-, three-, five- and multilayers, coated and uncoated; grinded and unpolished; flat molded and extruded; painted and laminated (film, paper). The plates vary in properties and purpose: they may be antiseptic and reinforced, water-repellent, with high resistant to fire and water.



Figure 16. Particleboard (Robert Bury , n.d.)

- OSB (Oriented strand board)

OSB (Oriented strand board) is a panel manufactured from flaked wood strands are bonded together with water-resistant resin.



Figure 17. OSB sheet (PuuProffa, 2004)

- Plywood

Plywood is a layered glued wood veneer of sheets of birch, alder, ash, elm, oak, beech, linden, aspen, poplar, maple, spruce, pine, fir, cedar and larch. Plywood consists of three or more sheets of veneer, with the grain direction of adjacent layers oriented perpendicular to one another.



Figure 18. Plywood (Plywood , n.d.)

- Veneer

Veneers are very thin layers made from the logs by mounting on a lathe machine, and are rotated about their longitudinal axis, while a cutter peels off thin layers. To produce veneer of better quality slice-cutting method instead of rotary-cutting method is used. It is usually glued over lesser quality wood surfaces to enhance their beauty and richness.



Figure 19. Veneer (Hardwood Veneer, n.d.)

(Materials used in the manufacture, 2013)

(Wood-Based Composite Materials, n.d.)

## 4 THE TECHNOLOGICAL PROCESS OF FURNITURE MANUFACTURING

### 4.1 Manufacturing process

The manufacture of furniture includes the following steps: designing, obtaining workpieces and parts, joining of parts in assemblies, veneer process, product assembly, finishing. The order of performance of some operations may vary, for example veneering can be performed before joining, and finishing before the assemblies.

#### 1. Designing

Manufacture of furniture starts with the designing (technical project development) and production of a prototype. After project approval by the respective authorities, the product is recommended to production. During the designing stage of furniture, utilitarian and aesthetic features of products (comfort, reliability, aesthetic appearance), architectural and planning decisions of rooms are taken into account. An important condition for the designing is to observe the requirements of existing standards and other normative and technical documentation.

#### 2. Obtaining of workpieces and parts

To avoid deformation and warpage, wood materials are dried in a kiln dry. Kiln dry process usually takes 2 to 4 weeks; it depends on the wood species, thickness and capacity of dry kiln. As a result of sawing of dry materials, workpieces are obtained. Workpieces are processed to needed sizes by different machines (depends on needed shape).

#### 3. Joining the parts in assemblies

Components' assembling is the joining of parts by dint of halving joint of parts, glue and metal fasteners. To increase the strength of the connection, the mating surfaces are glued together.

#### 4. Veneer process

Individual parts and panels are subjected to veneering, for giving more beautiful appearance to furniture made of low-value wood species. The process of veneer consists of preparing surface of base, veneer preparing and applying veneer to the base.

During the preparation of the surface, wood knots are removed and seal obtained holes. Imperfections and cracks of the surface are eliminated by using fillers. For the veneering of big surfaces, veneer sheets are cut to size and selected according to species, texture and color. These sheets are glued together for getting the needed set.

#### 5. Product assembly

The order of assembly is determined by the type of the product and its design. The assembly of the finished product is the joining of elements and parts with the help of halving joint, bolts and different screeds. The most common product for creating assemblies is dowels.

#### 6. Wood finishing

Modern furniture is characterized by the simple form and the lack of decoration, so finishing is a very important phase. The main directions in furniture decoration are texture detection (natural pattern), or imitation of value wood species, and giving the certain color and texture.

There are many ways of wood finishing. The main purpose is the preservation of the beauty of natural wood grain. It might be in form of protective and decorative coatings (varnishing, polishing, applying transparencies, opaque painting), simulation (printing, airbrush, textured paper) and decoration (carving, inlaying, intarsia).

(Manufacturing Process of Furniture, n.d.) (Furniture Manufacturing Process Flow, 2010)

## 5 MACHINES AND EQUIPMENT

Machine tools are used to shape wood. Most machine tools are now electrically driven. Machine tools with electrical drive are faster and more accurate than hand tools.

Woodworking machines, which are widely used in furniture enterprises, are classified according to the different characteristics. As intended there are two different types of woodworking machines - universal and for general purposes. Equipment for general purpose implies the machinery with which it is possible to implement particular procedures associated with the treatment of billets, for example sawing –with help of circular saw machine or drilling with drillers. The universal type of woodworking machines implies the machinery with which the operations are held on purpose, for instance cutting, shaping, drilling, etc. Universal equipment is used on the enterprises with individual manufacturing or workshops.

Woodworking machines can be cyclic - with intermittent movement of the part or cutting tool and bushing - with continuous movement of parts. By the technological principle of performed work, machine tools divided into working with formation of chip and working without chip formation. To machines tools, which works with chip formation, relates sawing (circular, bandsaw, and jigsaws), milling machines, drilling, grooving, lathe and grinding.

Interaction is between the workpiece and the working body of the machine. Working bodies are divided into major and auxiliary. Major (machining) bodies perform filing and processing (cutting) workpieces. Auxiliary bodies carry out basing operations, settings, loading and unloading (hopper, shops), control. Besides the working bodies, machine tool has motional and transmission gears and support elements. The motional mechanism makes cutting movement and feeding. These include electric, hydraulic and pneumatic actuators. Transmission gears are used to transmit motion from the driving mechanism. These include different types of transmissions (gear, belt, and chain), gearboxes and so on.

Carpenter's work place is equipped with cutting, marking (rulers, folding meters, calipers, and compasses) and auxiliary tools. Auxiliary tools include spanners, screwdrivers, pliers, tongs, hammers etc.

Applications of powered tools can improve the productivity compared to hand tools, during the execution of woodworking. In the manufacturing of furniture hand-held



circular saw, electric planer, hand drilling and grinding machines are used. Circular-saw is a cutting tool with a toothed or abrasive disc or blade; Electric planer is a tool for wood shaping. Planers are used to impart needed roughness, straightness, flatness to surface of wooden parts.

Jobs related to woodworking industry are very dangerous. The risk of harm or injury is very high in workshops. Most machine tools have moving parts. That is why employees should be provided with information, instruction, training and supervision. They have to have special knowledge, skills and experience to allow them to work safely.

Moreover, to reduce problems and injuries, maintenance of all machinery should be made in time.

## 6 ECONOMICAL SIDE

Selling is the main source of income for the enterprises. Sales determine all other aspects of the company's activities, so the compilation of the financial plan begins with forecasting sales. The basis for this prediction is the marketing plan. It should also be borne in mind that the volume of sales of new businesses usually grows slowly, and cost of sales may "jumping" and in some months be disproportionately high or low.

All will depend on the situation prevailing at any given time on the market. Income and expenditure plan should also contain assessment of all the articles of indirect expenses by month of the first year.

It is necessary to foresee in a plan various items of expenditure and to plan their dynamics by the months. Payroll costs will depend on the number of employees, their specialties and qualifications. Information about how much and what kind of specialists are required are taken from the organizational plan. Expansion of business may require increasing the number of employees in the first months of existence of the enterprise. Labor costs must be provided in advance and included in the plan of income and expenses. In terms of income and expenses, the costs of higher wages to employees should be also envisaged.

With the growth of the company costs for insurance, advertising, participation in exhibitions, renting additional storage increase. It should be reflected in terms of income and expenditure. Terms of insurance can be found directly in the insurance company in which the company is insured. The amount of payouts might be determined by the type of insurance and the state of affairs in the company to a certain point. Adding new areas will increase the rental costs.

For the purposes of analysis and evaluation of the activity of enterprises, profitability indicators characterizing the relative magnitude of the profit are widely used. For these purposes, use the indicators such as product profitability and return on production assets (sometimes referred to as return on capital).

The indicator of profitability of production reflects the relationship between the profit from the sale of a product and its cost price; it shows the relative (in %) amount of profit per ruble of current expenses. Profitability of the product might be calculated to

all amounts of released products or just by individual groups of products. Profitability (Gross Margin Ratio, GPM) might be calculated in this way:

**GPM = Gross profit / Revenue**

**GPM = (Revenue - cost of goods sold) / Revenue**

Increasing of the profitability level is very important characteristic of improving enterprise's operation and increasing its effectiveness. The main ways of raising the level of profitability are: on the one hand increase in the absolute size of profits, on the other hand - improvement of the use material and labor resources of the enterprise, fixed assets and working capital.

(Profitability Ratios, 2013)

## 7 CONCLUSION

To conclude the modern manufacture of furniture is a highly mechanized industry. Furniture manufacturing is one of the main directions of timber utilizing. Year to year this sphere actively is developed and many new companies are created.

Each company has to be responsible in choosing of raw materials and ingredients for coating. Using of chemicals that can be harmful for humans is forbidden. In a furniture production, Timberica Oy use only natural substances such as tinting and water-based paints. For the consumers, wood covered by water paints and tinting, has the following advantages:

- Environmental friendliness. Does not contain toxic compounds, it does not cause any allergic reactions for humans, maintains useful quality of the processed material.
- Aesthetics. The tree structure appears more clearly, which creates a very beautiful color transitions and effects. Furthermore, lacquers do not turn to yellow color and do not change its characteristics, due to this fact, treated surfaces keep aesthetic appearance for many years.
- Touch pleasant. Wood stays as a living material, that is why it is nice to contact with it.
- Durability. These materials protect the wood from the action of unfavorable factors and significantly prolong the life of the product.
- Fire safety. The composition of the lacquer does not support the combustion process.

In this work, the author considered and researched the process of furniture manufacturing; choosing of suitable raw materials and its methods of processing.



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(Furniture Manufacturing Process Flow, 2010)

