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INTEGRATED ASSESSMENT OF FLOOR COVERING QUALITY, COSTS OF ITS LAYING AND MAINTENANCE

The method of complex assessment of qualitative and cost characteristics of different species of modern flooring is given in the article. In the course of research was made assessment of flooring quality by 7 most important quantities, were made complex and integral indices of flooring quality. Findings of investigation indicate that natural floorings has the best qualitative and cost quantities.

Introduction. Great variety of existing variants for production of floor coverings involving the use of different types of material brought about the need for their assessment from the perspective of consumer choice. Such an assessment is possible on the basis of sound criteria or the system of criteria (indices) enabling to cover the complex of the main product properties characterizing its quality and competitiveness. Thus the objective of the investigation is to develop the approach for comparative assessment of floor covering types on the basis of an integrated index which covers qualitative and quantitative characteristics of the products.

Main part. On the construction products market of the RB there are different types of modern floor coverings, such as a natural parquet which is issued in the form of small levels, parquet boards; pith covering; the laminated parquet covering (an artificial material); floor ceramic tile; linoleum; carpet, etc.

All floor coverings presented in the market can be divided into two extensive groups: coverings on the basis of natural materials and artificial.

Natural floor coverings include: parquet products and floor board, pith covering, natural linoleum and ceramic tile.

Now for manufacturing of floor coverings from wood about twenty types of a tree from a classical oak to olive or an ebony are used.

The characteristic and esthetic properties of floor coverings from natural wood are defined by quality and a wood grade of which the obverse surface of a floor is made. The main indicator of the qualitative characteristic is hardness (density) of wood which depends on wood species, conditions of growth and humidity of a tree.

Floor covering from a cork tree (a bark of a pith oak) – a natural elastic, elastic material with high insulating properties and density about 150–200 kg/m³.

Natural linoleum is a covering made of non-polluting materials: cork tree, wood flour, vegetative pitches and jute. Natural linoleum differs by existence of bactericidal properties, anti-static character, fire safety and strong resistance to chemical reactants.

The ceramic tile of various types of production and appointment represents the products made of a

mix of clay of different grades with addition of other natural components, previously pressed under the pressure of about 500 kg/cm² and then burned in furnaces at temperature from 1,040 to 1,300°C depending on tile type.

Artificial floor coverings include: the laminated parquet, linoleum and a carpet.

The laminated parquet – the panels of a floor covering received in the course of a veneering a layer of a wood plate (HDF) by a paper-resin film with incomplete poly-condensation of pitch (lamination).

Linoleum – a polymeric rolled material. Depending on the main raw materials linoleum can be polyvinylchloride, alkyd, rubber, kolloksilin, on the basis of synthetic fibers.

Carpet – a carpet, a rolled material. Depending on a basis it can be nylon, acrylic and polyether.

On a way of production the carpet is subdivided into three main types: woven, taffetine, needle-punched.

The presented list of floor coverings is characterized by set of the diverse properties defining their quality, conditions and ways of consumption.

Quality of production is the set of characteristics causing suitability to satisfy certain requirements according to appointment. Estimation of quality of production assumes quantitative (high-quality) definition of a measure (degree) of compliance of characteristics and quality to shown requirements. A problem of estimation of production (floor coverings) is the checking as far as they are capable to fulfill the requirements established by normative documents or the consumer.

In this regard there is a need to prove and choose system of the most important qualitative characteristics of floor coverings, such as environmental disposal, wear resistance, moisture resistance, chemical and mechanical stability, heat dissipation and durability.

For an assessment of these properties the expert method of definition of indicators of quality was used. The expert method of an assessment of a level of quality of production is used when it is impossible or it is very inconvenient to apply methods of objective determination of values of individual or complex indicators of quality such

methods, as tool, empirical or settlement. It finds wide application in scientific and technical forecasting and planning of conditions of development of a national economy and its separate branches, in development of large scientific and technical, economic and social programs.

The assessment of system of reasonable qualitative characteristics of floor coverings was carried out on a 10-mark scale, for each of considered properties where higher point corresponds to higher level of quality of production.

Total results of an expert assessment of set of consumer properties of different types of floor coverings are given in Table 1.

The data presented in Table 1 characterize individual indicators of quality of production which isolated use doesn't allow to give unequivocal preference to one or other type of coverings.

In this regard there is a need to define a complex (generalizing) indicator of quality of production.

The complex indicator of quality is characterized by set of the interconnected properties (difficult property) from all set of the properties forming quality of production, and expressed by one number that allows to compare in practice a large number of indicators of quality of production to the same quantity of base indicators. It reflects such set of properties of production on which the decision to estimate quality of production is made.

Value of a complex indicator of quality (PKK) is offered to be counted on a formula;

$$PKK = \sum_{i=1}^n B_i \quad (1)$$

Where n – quantity of estimated qualitative properties; B_i – a quantitative assessment (point) of i -go of property.

Values of a complex indicator of quality are also presented in Table 1.

Except quality indicators, priority value at a choice of a floor covering cumulative costs of its device (have purchase, transportation and installation) and operation. Floor coverings should be estimated taking into account full expenses at all

stages: productions, laying and operation of floors. Replacement of one material with another involves change of a part or all design of a floor therefore at an assessment of different types of coverings it is necessary to compare not a material to a material but floor designs.

Production efficiency and applications of various materials for a covering can be received for the account of bigger durability of floors as from the economic point of view it is equivalent to reduction in the long term volumes of their production at the expense of reduction of expenses by dismantle of the become unfit for use covering of a floor, its production, transport and installation.

Influence of this factor decides on the help of factor of durability of floor covering (μ) which considers distinctions in service life of materials and time factor. By means of this factor materials with various service life are given to the same value of durability.

Unlimited durability is considered. Practically for coverings of floors this covering makes 50 years and more, in this case factor $\mu = 1$.

All materials for coverings of the floors which service life less than 50 years, are led to a standard, i.e. to initial expenses are added costs of future renovation taking into account a time factor.

The structure of operational expenses includes maintenance costs and care of floor coverings. Also it is necessary to refer periodic repairs to operational expenses. Floor coverings from wood demand periodic repair for updating of a protective and decorative covering. Now parquet products with a factory covering a varnish which is more wear-resistant, firm, homogeneous are widespread. In research the piece parquet and a parquet board with factory furnish were considered. The protective and decorative covering is put on a board of a floor after laying. Also it is necessary to consider repairs which demand partial replacement of the covering. To carry out such repair it is possible only for a laminate, timber floors, a tile and a cork covering. Rolled materials aren't subject to partial repair. Costs of materials and work of the expert include the cost of repair.

Table 1

Results of an estimation of quality of coverings

Type of floor covering	Options of an expert assessment							QI
	Ecological compatibility	Durability	Moisture resistance	Chemical resistance	Mechanical resistance	Heat transfer	Service lifetime	
Parquet	10	8	5	6	6	8	9	52
Wood flooring	10	6	4	4	6	8	7	52
Laminate	8	8	5	7	6	7	7	48
Ceramic tiles	10	9	10	10	8	3	9	59
Carpet	5	3	0	4	4	10	3	29
Linoleum (PVC)	2	1	4	2	1	5	1	18
Natural linoleum	10	8	7	5	6	8	9	53
Cork	10	8	7	7	9	9	9	59

Operational costs include reference durability of a material and lead them to initial level, considering the sum for every year, i.e. is discrete in time. For simplification of calculations operational costs are accepted not changed on years at level of the mid-annual.

Knowing covering cost, factor of durability, costs of its laying, the contents, leaving and repair, it is possible to calculate cumulative costs of creation and operation of a design of 1 sq. m floor.

$$Z_{\text{cum}} = \mu \cdot Z_p + \sum_{t=T_n}^{T_k} \frac{Z_e}{(1+E)^t} \quad (2)$$

where Z_p – costs of purchase, transportation and installation of a covering, c.u.; μ – factor of durability; Z_e – costs of operation of a covering, c.u.; T_n and T_k – respectively initial and final year of operation of a covering; K_t – factor of discounting; t – year, expenses and which results are led to settlement year.

Expenses of all years of the period of operation of coverings occurring at different times are led to settlement year by multiplication of their size for every year on factor of reduction (discounting) of K_t :

$$K_t = (1 + E_n)^{t_p - t}, \quad (3)$$

where E_n – the standard of reduction of expenses and results by the uniform moment of time, or norm of discount (discount rate of percent or other rate); t_p – settlement year.

The norm of discount is accepted to an equal actual rate of percent on the long-term credits of banks.

Having received cumulative costs of creation and operation of a design of a floor, we count their size on 1 year of operation of a covering.

For a resultant assessment of quality and cost indexes of a floor covering, we enter an integrated indicator of quality of production which is the relation of a complex indicator of quality and the given cumulative expenses. It is obvious that this indicator of quality characterizes numerical expression of quality of a covering (expressed in points), falling on 1 c.u. of cumulative expenses.

Results of research are given in Table 2.

Analyzing the obtained data, we can divide floor coverings into three groups depending on value of an integrated indicator of quality.

1. Coverings with a high integrated indicator of quality (26.1–56.9). Such natural coverings concern them as, a ceramic tile (56.9), natural linoleum (34.0) and a cork covering (26.1). The high indicator of quality of these coverings is caused by their naturalness, environmental friendliness, high wear resistance and durability.

2. Coverings with an average integrated value of quality (8.2–24.8). Floor coverings include wood floor board (24.8), parquet board (13.4), piece parquet (8.2). The low indicator of coverings from natural wood is caused by considerable costs of the device and operation.

3. Coverings with a low integrated indicator of quality (3.5–7.3). These are artificial floor coverings: linoleum (7.3), laminate (7.1), carpet (3.5–5.2). These coverings are short-lived, with low moisture resistance and stability to damages.

Table 2

Estimation of a degree of quality of various kinds of floor coverings

Tupe of floor coverings	Cost of a design of a floor	Term services floor	Factor durability of a material (μ)	total expenses of manufacture and consumption	Total expenses for 1 year of operation	integrated quality indicator coverings
Natural linoleum	35	30	1.06	46.8	1.6	34.0
Linoleum (on the basis of PVC)	22.5	15	1.51	37.2	2.5	7.3
Laminate	28.8	10	1.63	67.8	6.8	7.1
Carpet:						
Nylon	54.3	15	1.31	88.7	5.9	4.9
Acryle	36.8	10	1.63	60	6.0	5.2
Polyester	18	5	2.63	47.3	9.5	3.5
Wooden coverings:						
Piece parquet	122.3	30	1.06	190.2	6.3	8.2
Parquet board	109.8	30	1.06	116.4	3.9	13.4
Floor board	31	20	1.17	36.3	1.8	24.8
Cork floors	53.8	30	1.06	67.9	2.3	26.1
Ceramic tile	35	50	1	51.8	1	56.9

Conclusion. The integrated indicator of quality allows us to compare diverse types of production and to make a reasonable choice on its value.

Natural linoleum and cork covering are import materials that causes their high cost in comparison with materials of a domestic production. The ceramic tile is limited in application for all types of rooms.

Wood possesses indisputable consumer advantages, such as harmlessness for health, durability, high insulating qualities, beautiful unique drawing of a structure, and also traditional attachment of the person to wood that puts wood materials for floors in more advantageous position in comparison with artificial materials. For production of parquet products and a board of a floor the domestic

raw materials are widely used. For extension of service life and depreciation of repair of wooden coverings it is necessary to improve their operational characteristics. Decrease in initial expenses is provided with application of new materials and designs.

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