A New Approach to Identifying Top-Priority Step for Increasing the Building Materials Competitiveness

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Abstract. The problem of development the competitiveness of building products in the condition of limited financial resources is discussed. It has been proposed a new methodological approach that allows manufacturers to determine the priority direction of development of product quality while they maintains or slightly increases the selling price of products. The new methodological approach is based on a few steps including assessment of the properties significance for the consumers through an individual survey of experts and calculation of a consumer property significance ratio; the formation of the virtual standard-product parameters; calculation of the relative Single Quality Score for every property which based on comparison the actual property of product with property of virtual standard-product. The identification of this priority direction of the product’s development should be carried out on the basis of an internal audit of the industrial company. The results of the audit would determine the reserves of improving technology parameters and product quality. As a result of the identified internal reserves, top management of an industrial company can operate a plan to improve product’s quality, the implementation a schedule of this plan should be built on a parallel-sequential principle.

1. Introduction
The market stability depends on the competitiveness rate of the products as the ratio of their quality and price. The competitiveness of building materials is determined by the ability of industrial companies to achieve the minimum costs for obtaining the required functional properties such as compressive strength, density, durability, and so on. At the same time, the competitive building materials must have price-competitiveness and high quality [1]. According to this point of view, the building industrial companies will be able to raise the competitiveness of their products by reducing the price, or by improving the consumer properties of the products.

However, reducing the price of the products is not an effective strategy for increasing their competitiveness according to the following reasons. Firstly, the building materials market is a very competitive market, in which none of the manufacturers can influence the market price. Secondly, industrial companies have to ensure a low prime cost of products in order to lower sell price that is very difficult for many of them [2 - 5].

Obviously, the improvement of consumer properties of products demands an additional capital and current outlays. So, in the conditions of an own financial resource’s deficit, the top management of an industrial company needs to determine the priority direction for financing the system of steps that improve the product’s quality. To determine an effective strategy of improving the product’s quality,
the most problematic and most significant property should be distinguished in the set of consumer properties of building materials which have a low level of competitiveness. In this case, increasing of this problematic and significant property will allow an industrial company to jump the competitiveness of manufactured building materials [6-8].

The study aimed to formulate a new methodological approach which allows manufacturers to determine the priority direction increasing the competitiveness of products in the condition of limited financial resources.

2. Methods

All of the known methods of competitiveness estimation are based on a comparison between the quality and price of compared products. This principle is the basis of the new methodology which determines the relative indicator of the building material’s competitiveness, produced by different manufacturers. This methodology has been developed in the Voronezh State Technical University. The competitiveness computation algorithm within a single nomenclature group of building materials includes nine interconnected steps [9]:

- **step 1** – formation of a list of consumer’s properties based on expert judgment;
- **step 2** – comparison of actual product’s properties with standard properties of these products;
- **step 3** – assessment of the properties significance for the consumer through an individual survey of experts;
- **step 4** – calculation of the concordance coefficient characterizing the degree of expert opinions agreement;
- **step 5** – the formation of the virtual standard-product parameters having the best values of the properties and minimum price among the compared products;
- **step 6** – calculation of the relative Single Quality Score for every property which based on comparison the actual property of product with property of virtual standard-product;
- **step 7** – calculation of a customer property significance ratio;
- **step 8** – calculation of the Comprehensive Quality Score for products, produced by different manufactures, taking into account the customer property significance ratio;
- **step 9** – calculation of the relative price of product, produced by different manufacturers, through dividing the price of this product into the price of the virtual standard-product;
- **step 10** – calculation of the Relative indicator of product’s competitiveness through dividing the Comprehensive Quality Score of every product into its relative price

**Table 1.** Results of competitiveness estimation of cellular concrete wall-blocks, produced by different regional manufacturers (Central Russian Region).

| Customer properties                     | Single Quality Score of customer property for competing products |
|----------------------------------------|---------------------------------------------------------------|
|                                        | factory 1 | factory 2 | factory 3 |
| thermal conductivity                   | 1.00      | 0.86      | 1.00      |
| density                                | 0.98      | 0.83      | 1.00      |
| compressive strength                   | 0.57      | 1.00      | 0.79      |
| size variation                         | 0.50      | 0.20      | 1.00      |
| frost resistance                       | 1.00      | 0.25      | 1.00      |
| compressive strength/density – ratio   | 0.64      | 1.00      | 0.90      |
| Comprehensive Quality Score            | 0.83      | 0.75      | 0.96      |
| Relative indicator of product’s competitiveness | 0.76 | 0.75 | 0.73 |
The data, obtained as a result of the implementation of the presented algorithm, might be a basis to make decisions to solve the problem of increasing competitiveness of building products through improving their consumer properties. However, the definition only the Comprehensive Quality Score (see step 7) and the Single Quality Score of every properties of products (see step 6) doesn’t allow to identify key property improvement of which might solve the problem of increasing the product competitiveness (Table). This is due to the fact that the properties have different significance for consumers. So, the key property, what has to be improved, is the property with the highest significance ratio for consumers.

Thus, for defining the first steps improving the product’s quality authors recommend using a new methodological approach, which proposes the comparison of a customer’s property significance ratio and the Single Quality Score of this customer property.

3. Result and discussion
The Quality diagram of cellular concrete wall-block’s properties, produced by different manufacturers (Figure), is illustrated opportunities of the proposal methodological approach that allows manufacturers to determine the priority direction, which can increase the competitiveness of products. The information, presented in the Quality diagram, reflects the situation in which the level of the Single Quality Score of customer products properties of competing factories is significantly different. One of the competing factories produces the best cellular concrete wall-blocks due to the fact that the value of its customer products properties is very close to the virtual standard-product parameters (factory 3). The variation degree of some product’s properties, produced by other factories, from the virtual standard-product parameters is significantly higher. The Quality diagram allows manufactories to rank a number of unresolved problems in the product quality. According to this range the top management of an industrial company will be able to identify the priority step of the technological development that can improve the product’s quality. For example, for the factory 1 key issue of development of the cellular concrete wall-block’s quality will have to increase their compressive strength. For the factory 3 (as a market-leader) development of competitiveness of its product might be ensured by increasing of the compressive strength too. The factory 2 has obvious problems with the size variation of the wall-blocks and frost resistance of the cellular concrete. However, for this factory the most important problem is the problem to low density of the cellular concrete, because of the low density of the cellular concrete has the highest significance ratio among all customer properties.

![Figure 1. Quality diagram of cellular concrete wall-block’s properties, produced by different manufacturers.](image-url)
It should be necessary to take into account that the technology parameters contemporaneously affect the formation of the complex of building material’s properties as soon as the top management of a company wants to develop problematic properties of any product. It is possible that the technology parameters, which are responsible for providing various properties, contradict each other. For this reason, there are possible situations:

- increase of level of one property would lead to an obvious deterioration of other ones;
- increase of level of one property would affect positively on the level of most other ones;
- increase of level of one property would not affect obviously on the level of other ones.

It is clearly that technology parameters should be optimized in a compromise way. The way of the optimization depends on technical conditions at a factory. Analysis of the technical conditions will determine the best balance between costs and the level of product quality [9, 10].

4. Conclusion

Proposal new methodological approach allows manufacturers to determine the priority direction to develop the customer products properties what ensure the competitiveness of their products in the condition of limited financial resources.

The identification of this priority direction of the product’s development should be carried out on the basis of an internal audit of the industrial company. The results of the audit would determine the reserves of improving technology parameters and product quality. As a result of the identified internal reserves, top management of an industrial company can operate a plan to improve product’s quality, the implementable schedule of this plan should be built on a parallel-sequential principle.

5. References

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