The basic algorithm for the design and construction of a monocultural innovation organization

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Abstract. Algorithmization of management activities in the transition to the digital economy is one of the most important tasks of modern management science. Sketch design is defined by the algorithm creation tool. This algorithmization method is applied to the processes of choosing the type of a homogeneous product, its quality and other consumer properties, utility for the consumer and manufacturer. Products are classified according to their purpose and the resources for their production. The quality of the product is defined as the ratio of the actual properties of the product to the normative ones, while it is necessary to take into account the influence of manufacturing defects, which entails a transition from linear to non-linear quality functions. The cumulative assessment of the product for the consumer is determined taking into account his subjective assessment of the properties of the product, expressed in the weight of the quality of individual utilities. For a manufacturer, the aggregate assessment of product quality directly depends on the main properties of the product, taking into account its other properties, and inversely depends on the cost of purchasing it, taking into account their functional elasticity. The algorithm is recommended for use by specialists dealing with algorithmic management activities.

1 Introduction

In the management of an organization, management decisions play a critical role. So, the development and production of innovative products is the result of the adopted management decisions. The process of developing the management decisions must be designed, i.e. developed in the form of a specific algorithm [1]. Algorithmization of management activities during the transition to the digital economy is one of the most important tasks of modern management science, increasing the competitiveness of the companies. According to M. Porter, the development of the national economy depends on the achievements of individual national companies in the foreign market [2-9].

The development of an algorithm for the design and construction of a monocultural innovation organization (hereinafter referred to as the creation of an organization) is one of the most difficult elements of this task. In our opinion, it is possible to construct a basic algorithm by simplifying the concept of an innovative organization and introducing several concepts:

- a single product produced by an organization.
- unit operation, manufacture of a product.

2 Materials and methods

The main proposed approach to algorithmic design and construction of management activities is the preliminary design. This is an analogue of the conceptual design of a product, the first conceptual stage of organizing the organization's activities.

The organization is created in the following sequence through selection and justification:

- type of homogeneous product for the organization of production activities;
- elements of technological equipment of a single product-operation;
- production capability of the product-operation;
- economic characteristics of the product-operation;
- indicators of the effectiveness and efficiency of the product-operation.
- types of resources for a single product-operation.
- technological elements of a single operation of supplying the homogeneous resources.
- parameters of the production capability of the delivery operation
- indicators of the effectiveness and efficiency of the delivery operation.

3 Results and Discussion

1 stage. Selection and justification of the type of homogeneous product for the organization of production activities.

Let us define a parametric range as a set of products that are similar in design and technology, with the same or similar functional purpose and differing in the quantitative level of the main consumer property.

The basis for choosing and justifying the type of a homogeneous product for organizing production activities is the classification of types of products.

The classification of types of homogeneous products is shown in Figure 1.

- Types of homogeneous products produced on a single product-

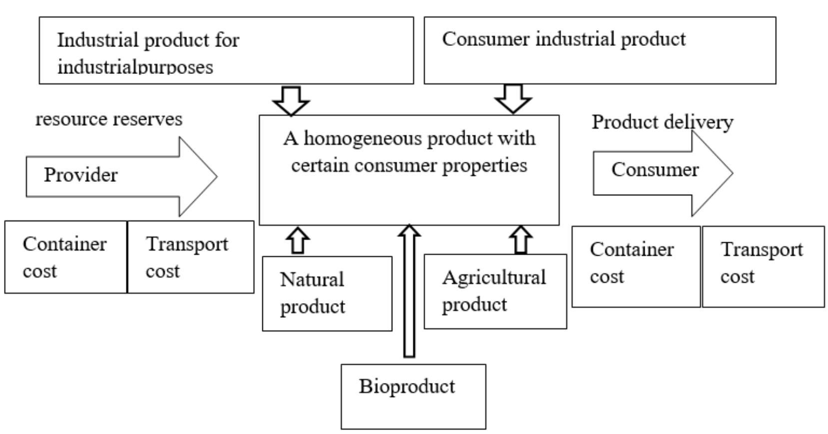

Fig. 1. Classification of product types

To select and justify the types of homogeneous products for production, a selection criterion is required. Such a criterion is the usefulness of the product for the consumer. The usefulness of the product depends primarily on the consumer properties of the product, on the consumer himself, his subjective attitude to individual properties and their totality. The utility of a homogeneous product for a particular consumer may be different, both, relatively high or relatively low. It is necessary to assess the usefulness of the product for the consumer.

Let us present the analysis of the usefulness of a homogeneous product for the consumer in the form of the following sequence:

Usefulness of a product (Cv) is a function of an indicator of product properties (P) useful for a consumer, consumer requirements (U), conditions of consumption (hc), etc.

$$Cv=\int(P,U,hc) \tag{1}$$

Useful properties of the products (Q) - a combination of organoleptic, physicochemical and other properties of a product that determine its quality.

2 stage. In most of the quality assessment methods, the property assessment is the ratio of the values of its indicator and the corresponding base indicator:

$$K_{ij} = \frac{P_{ij}}{P_{ij}^{\text{base}}} \tag{2}$$

The quality of the product property function (P) is quantified by metrological measurement i.e.:

$$P=\frac{\oint(X_k)}{\oint(X_o)} \tag{3}$$

Where: P - assessment of the quality indicator of the measured property of the product;

f(Xo) - reference characteristic of the property (base);

f(Xk) - actual characteristic of the property (measured property)

The objective feature, the properties of the product that are part of its quality, the achieved level of properties in relation to the standard are quantitatively measured. The property scoring model establishes a certain relationship between the property index value Pij and its Kij score.

Other methods for assessing the consumer properties of a product.

If we introduce an additional parameter - the defective index Pijdefect, which is taken as the lower permissible value of the indicator, the quality assessment formula takes the following form:

$$K_{ij} = \frac{P_{ij} - P_{ijdefect}}{P_{ij}^{\text{base}} - P_{ijdefect}} \tag{4}$$

This formula differs somewhat from the formula for linear dependence, but describes a different dependence - nonlinear one.

In Harrington's method [11], each property is estimated using a dimensionless coefficient and the mathematical dependence of the estimate on the property indicator is determined by an exponential function:

$$K_{ij} = e^{-(/P^0/)^{mj}} \tag{5}$$

where mj is a positive number within 0<mj<∞;
P0 - a linear function of Pij

$$P^0 = \frac{2P_{ij} - (P_{ij}^{\max} + P_{ij}^{\min})}{(P_{ij}^{\max} - P_{ij}^{\min})} \tag{6}$$

where $P_{ij}^{\max}$ Ц $P_{ij}^{\min}$ - the lower and upper limits of the value of the indicator of the j-th property, provided by the technical specifications.
From here:

P0=-1 when $P_{ij} = P_{ij}^{\min}$

P0=+1 when $P_{ij} = P_{ij}^{\max}$

If the restrictions imposed by the technical specifications concern only the lower limit of the indicator value, then the formula is applied:

$$K_{ij} = e^{-(e^{-P^0})} \tag{7}$$

The described group of techniques has a disadvantage of using the same type of dependence for all indicators. However, the formulas for linear and nonlinear dependence are quite suitable for use. In most of domestic methods, linear dependences are used to assess properties, and in most foreign ones, nonlinear ones.

Different formulas are used to determine a comprehensive quality assessment. As a rule, the following are used to calculate complex quality assessments without taking into account the weight of individual properties:

$$K_0 = \sqrt[n]{\prod_{j=1}^{n} K_{ij}} \tag{8}$$

where n is the number of quality indicators of properties that characterize the quality of the product taken into account.

Due to the simplicity of the calculation, most of the methods for the comprehensive assessment of quality, taking into account the weight of properties, give preference to the arithmetic mean of individual properties.

For techniques using the geometric mean of estimates of individual properties, the basic calculation formula is as follows:

$$K_0 = \sum M_j \sqrt{\prod_{j=1}^{n} K_j^{M_j}} \tag{9}$$

Where: Ko - an objective comprehensive assessment of product quality indicators based on metrological methods.

Mj - the weight of individual properties, with 0 ≤ Mj ≤ 1, a 0 ≤ Kj ≤ 1

3 stage. The properties of the function (U) are quantitatively expressed by expert measurements, i.e.

$$U = \frac{f(X_k)}{f(Xstage)} \tag{10}$$

Where: U is an indicator of the usefulness of a product property;

f(Xstage) - subjective attitude towards a product property (score from 0 to 1);

f(Xk) - actual characteristic of the property (measured property)

Consumer requirements (U) - a set of subjective relations of the consumer to the product and its individual properties.

4 stage. Assessment of the usefulness of the product for the consumer

The basic calculation formula of methods using the geometric mean of the consumer's assessments of individual properties is expressed by the formula:

$$Kp = \sum M_j \sqrt{\prod_{j=1}^{n} K_j^{M_j}} \tag{11}$$

Where: Kp- subjective comprehensive assessment of product quality indicators;

Mj - the weight of individual properties in the opinion of the consumer, and

≤ Mj ≤ 1, and 0 ≤ Kj ≤ 1

Stage 5.Evaluating the overall utility of a product

The calculated formula for the cumulative indicator of the usefulness of a product is expressed by the following formula:

Ки=Ко*Кр

where: Ки- cumulative assessment of the usefulness of the product for the consumer

Ко –an objective comprehensive assessment of product quality indicators based on metrological methods.

Кр- subjective comprehensive assessment of product quality indicators;

6 stage. Evaluation of the integral quality of the product for the manufacturer

Integral quality can be expressed in the following form:

$$kq = A \times D^a \times Q^b \times P^{-y} \tag{12}$$

Where: Кq -integral product quality;

D is the main parameter of the products determined by the Metrology;

Q-useful properties of products determined
based on the methods and principles of qualimetry;
p - production expenses, quantified by costs
of live and past labor;
a, b, y-elasticity coefficients, show the degree of influence
consumer properties and production costs by the amount of
integral quality;
A-proportionality coefficient, shows the dimension
of integral quality for D=1, Q=1, P=1;

kq-numerically characterizing the level of integral quality qualimetric indicator of this type of product.

4 Conclusions

The results of the algorithmization of the design and construction of a monocultural innovative organization allow in one automatic process to select the type of a homogeneous product, its quality and other consumer properties, usefulness for the consumer and manufacturer. This algorithm is recommended for use by specialists dealing with algorithmic management activities.

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