Prospects for the Use of Digital Technologies in the System of Digital Labeling and Traceability of Chocolate

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ABSTRACT
This article considers the prospects for the use of digital technologies in the Russian economy using the example of the existing system of digital labeling and traceability of products. A comparative analysis of the mandatory attributes (characteristic features of a article), presented in the catalog of labeled products, is carried out using the example of the already implemented labeling system in relations to garments, made of natural fur, footwear and drugs. Based on the analysis of the results of the implementation of the system digital labeling and the traceability of products, as well as the observed problems and trends in the market of raw materials for the production of chocolate (cocoa beans and cocoa butter) and finished products, the author proposed a list of general and specific attributes, that must be presented in the catalog of labeled products in the event of the dissemination of the system of digital labeling and traceability of products in relation to chocolate. Specific examples of indicating general and specific attributes for chocolate and compound chocolate bar (other products) are given.
Keywords: *digital labeling, system of product traceability, consumer properties, product quality, product attributes, chocolate, cocoa butter substitutes*

1. INTRODUCTION

The development of scientific and technological progress, the formation of a global information network and a unified information space, the growing role of knowledge in the life of society, the emergence of new information products and services, as well as other factors contribute to an increasingly complete and active transformation of the economies of the countries of the world. The process, observed over the past 20-35, years can be described as the digitalization of the economy, which is based on information and communication technologies.

There are many modern interpretations of the concept of "digital economy", given by various international organizations and communities (Organization for Economic Cooperation and Development, British Computer Society, World Bank, etc.), foreign government bodies (European Parliament, Department of Communications and Digital Economy of Australia, etc.), as well as in other literary sources. The key element in the proposed definitions of the concept of "digital economy" is the implementation of such operations as trade, information transfer, the interaction of subjects of economic relations, etc. via the Internet [1].

The national program "Digital Economy of the Russian Federation" [2], the implementation of which is planned until 2024, was developed with the aim of using information technologies to improve the quality of life of the population and the conditions for doing business, ensure technological development and independence of the state, as well as transforming priority sectors of the economy and ensuring the competitiveness of the products of domestic enterprises in the global market.

The implementation of ambitious goals is possible through the fulfillment of tasks, assigned to government bodies. So the main directions of activity of customs authorities are presented in the Strategy for the development of the customs service of the Russian Federation until 2030 (Strategy) [3]. They are determined in accordance with the policy of the high-tech transformation of the customs sphere. Successful implementation of the measures, as provided for by the Strategy, will make it possible to simplify and accelerate customs operations for bona fide participants of foreign economic activity (foreign trade operator), promote the development of international trade, and increase the investment attractiveness of Russia.

One of the national information products, which was developed within the framework of digital technologies in 2016 and is coordinated by the Ministry of Industry and Trade of Russia, is a system of product traceability, that provides for mandatory digital labeling of products with identification means. The application of this mechanism for certain categories of products has already proven its efficiency. The advantage of the system is, that it helps to increase the competitiveness of bona fide market participants by reducing the share of trafficking in products, increasing the collection of customs and tax payments, protecting the life and health of citizens, as well as protecting their rights.

By 2024, it is planned to apply the labeling system to all product groups. Within the framework of food products, the first object of the experiment is milk and dairy

products (the terms for the implementation of mandatory labeling is January 20, 2021 – October 1, 2021) [4].

Within the framework of this article, a list of general and specific attributes, that are required to be presented in the catalog of labeled products within the framework of the system of the digital labeling and traceability of products, in relation to this type of confectionery products such as chocolate, distinguished based on the analysis of its properties and characteristics, was developed and proposed.

The choice of this type of product for analysis is due to the high rates of its diversification, changes in the quality of the used raw materials and production technology, which leads to the production of finished products with different levels of consumer properties, incl. cost.

The main raw materials for the production of chocolate are cocoa beans and cocoa butter. Currently, the market of the leading exporting countries of this raw material (African countries - Cote d'Ivoire, Guinea, Ghana, and Liberia), which account for 70% of the total world production of cocoa beans, is showing negative trends. Drought, aging, and disease of cocoa trees and, consequently, a decrease in their ability to yield [5] entail a shortage of raw materials and an increase in their cost, while the global demand for cocoa beans is growing every year, especially in Asian countries.

The situation on the world market of cocoa beans and cocoa butter is becoming acute by the increasingly active use of cocoa raw materials substitutes in chocolate by manufacturers, incl. such "alternative" types as palm oil and its derivatives, rapeseed, coconut, shea butter, etc., which are significantly inferior to cocoa butter in terms of their cost and consumer properties. According to the studies of some scientists [6; 7] the consumption of palm oil and its derivatives, which are the most popular types of vegetable oils in the manufacture of chocolate, is harmful to human health and affects its lifespan.

The relevance of the topic of this work is also confirmed by the analysis of the assortment of chocolate, sold in retail stores, which showed, that there are imported samples on the Russian market with violation of the requirements of the technical regulation of the Eurasian Economic Union 022/2011 "Food products in terms of their labeling" [8]. Basically, there was a discrepancy between the specific name of the product and the actual composition of the product, and the lack of information on the type (types) of cocoa butter substitute(s), used in the product.

Misinformation draws amiss the consumer about the properties of the product and its quality. The specific name of the product is of particular importance, since, when choosing a product, the consumer primarily pays attention to it, and not to the composition of the product.

Moreover, cases of the sale of products of a well-known world brand in the Russian Federation with a quality lower, than that of a similar product, sold on the European market, were revealed. An example is the case, initiated by the Federal Antimonopoly Service in August 2020 on the discrepancy between the content of organic acids (a qualitative feature) in "Lindt" chocolate, available for purchase in Russia, and in samples, purchased in Europe [9]. This proves, that the policy of international companies in the field of foreign trade in this type of product implies the possibility of selling the same chocolate (products) with different consumer properties in Russia or in European countries.

2. METHODOLOGY OF THE STUDY

The information base of this work is national and supranational regulatory legal acts in the field of technical regulation and the functioning of the traceability system; information from analytical publications and information agencies; opinions of Russian scientists about the influence of palm oil on human health and the results of their studies; the results of the study of samples of imported chocolate.

A special place is occupied by the results of the application of the system of digital labeling and traceability of products in relation to garments, made of natural fur, footwear and drugs.

The study methodology was based on the methods of systemic and comparative analysis, as well as synthesis.

In most cases, the functioning of the traceability system is based on the national system of digital labeling and traceability of products of the Center for the Development of Advanced Technologies, created to implement global projects in the digital economy "Honest MARK". The main task of this system is to guarantee consumers the authenticity and declared quality of the purchased products [10].

Information about trade items is stored in the GS1 RUS database in the form of tables with sets of fields. Each field is an attribute. Attributes are the characteristics, used to describe all the characteristic features of the trade item.

The stage of development of the proposed attributes of chocolate is preceded by a comparative analysis of the mandatory attributes (there are also optional ones), presented in the catalog of labeled products, using the example of an already implemented system in relations to garments, made of natural fur, footwear and drugs (Table 1) [11; 12; 13].

Table 1 Comparative analysis of mandatory attributes for garments, made of natural fur, footwear and drugs

Seq No.	The name of the mandatory attribute	The name of product group		
		Garments, made of natural fur	**Footwear**	**Drugs**
1	Participates in labeling			+
2	Barcode/GTIN	+	+	+
3	Hierarchy level			+
4	Publication date (plan)	+	+	+
5	Product name on the label	+	+	+
6	Brand (trademark)	+	+	+
7	MA number			+
8	Date of state registration			+
9	Marketing Authorization holder address			+
10	10-digit HS code	+	+	+
11	Trade name of the drug			+
12	Pharmaceutical form			+
13	The number of units of measurement for the dosage of the drug			+
14	Type of secondary (consumer package)			+
15	Material of secondary (consumer package)			+
16	Quantity/measure of the drug in the secondary (consumer package)			+
17	Quantity/measure of the drug in the secondary (consumer package) - units of measurment			+
18	Is there an unlabeled (primary) package inside the secondary (consumer) package			+
19	Description of embedded unlabeled (primary) package			+
20	Is the packer/bagger located in Russia?			+
21	Adress of secondary (consumer packaging) packer / bagger			+
22	Full product name	+		
23	Producer's name	+		
24	Country of origin	+		
25	Product size	+		
26	Combined product (Yes/No)	+		
27	Type of fur	+		
28	Dyed (Yes/No)	+		
29	Model	+		
30	Color	+		
31	Conformity declaration number	+		
32	Conformity document type	+		
33	Date of issue	+		
34	Producer model		+	
35	TIN of the producer/importer		+	
36	Shoe type		+	
37	Upper material		+	
38	Lining material		+	
39	Bottom material		+	

In order to a more complete and accurate filling of the mandatory attributes for each group of products, guidelines were developed for working with products in the catalog of labeled goods (in the "Catalog GS46" system) [11; 12; 13].

The table shows, that in relation to different product groups, the number and list of mandatory attributes differ. Conventionally, they can be divided into general ones - established for all products and specific - reflecting the features of individual products.

General to all considered groups of products are such attributes as the name of the product on the label, brand (trademark), 10-digit HS code, barcode/GTIN, and publication date (plan). Let's pay attention to the name of the product on the label, which will include the trade name of the drug, the form of the drug, and the dosage for the drug [13]; for garments, made of natural fur and footwear, it means a product name, that shows all the identifying characteristics, by which a consumer can distinguish one product from another. In this case, abbreviations in its indications are allowed [11; 12]. For garments, made of natural fur, the full name of the product should also be indicated, i.e. full name of the product without abbreviations, containing fixings, combined materials, as well as components (belts, mitts, removable parts - collars, etc., do not indicate the model, color, size, etc.) [11]. From the above it follows, that the main purpose of any product name, given in the attribute, and a detailed listing of its features (for example, shoe type, upper material, lining material, and bottom material) is to assist the consumer in choosing products in accordance with his needs and expectations.

The greatest number of attributes is typical for drugs. They also include the provision of information on primary and secondary types of packages and information on marketing authorization. For garments, made of natural fur, the

country of origin, product size, type of fur, presence (absence) of fur dyeing, model, color, and other distinctive features will play a key role.

The identification of chocolate-specific attributes, offered within the system of digital labeling and traceability of the product, was also carried out taking into account the current trends of the world's leading producers of high-quality cocoa raw materials and finished products. For example, the "CHOCOSUISSE" Association of swiss chocolate producers [14] uses a system of digital labeling and traceability of products in relation to cocoa beans - from plantation to factory, taking into account the country of origin, region of growing cocoa beans and their variety.

Based on the studied information about the system of digital labeling and the traceability of products and the observed trends in the market of raw materials and finished products, a list of mandatory general and specific attributes, planned to be indicated in the catalog of labeled products in the event of digital labeling for chocolate was developed and proposed. According to the above, one of the main general attributes for all types of products is the "name", which should reflect not only the specific name of the product, but also features, that characterize the variety of products. Thus, for chocolate, in addition to the specific name of the product (chocolate, filled chocolate, chocolate with additions, compound chocolate bar, etc.), there will be characteristics, reflecting the type of chocolate (milk, dark, bitter, white, etc.). (Table 2).

Table 2 The list of mandatory general and specific attributes, planned to be indicated in the catalog of labeled products for chocolate within the framework of the system of the digital labeling and traceability of the products

Seq No.	The name of the mandatory attributes		
	General attributes	**Seq No.**	**Specific attributes**
1	Full product name	10	Country of origin and region of growing of cocoa beans
2	Product name on the label	11	Cocoa bean variety
3	Name of the country of production	12	Chocolate part composition
4	Producer's name	13	The presence of a substitute(s) in the chocolate part
5	Brand (trademark)	14	The nature of the substitute(s) in the chocolate part, the content of the substitute(s) to the total weight of the chocolate mass (%) (if any)
6	10-digit HS code	15	Filling composition (for filled chocolate)
7	Net weight (g)	16	Nature of additions (for chocolate with additions)
8	Barcode/GTIN	17	Content of cocoa butter, total solids of cocoa products, non-fat solids of cocoa products, milk solids and/or milk processing products, milk fat, and total fat in the chocolate mass (%)
9	Publication date (plan)		

From Table 2 it follows, that attributes Nos. 1-9 are general. To provide more complete information about chocolate, in addition to the characteristics, previously developed for other groups of products, mandatory information on the country of production of the finished product and the net weight (g) should be indicated. Note, that both the full and the name of the product on the label are formed on the basis of specific attributes No. 10-17, indicated in Table 2.

The characteristics, that determine the main consumer properties of chocolate (specific attributes) are the following:

1. Country of origin and region of growing of cocoa beans (No. 10). Cocoa bean variety (No. 11)

The country of origin and region of growing of the cocoa beans are of central importance since it is the climatic conditions, in which the cocoa tree is grown, that form the organoleptic characteristics of the chocolate. Also, the information, presented in these characteristics, has a great influence on the cost of cocoa beans and chocolate as a finished product.

2. Composition of the chocolate part (No. 12). The presence of a substitute(s) in the chocolate part (No. 13) The nature of the substitute(s) in the chocolate part, the content of the substitute(s) to the total weight of the chocolate mass (%) (if any) (No. 14) Filling composition (for filled chocolate) (No. 15) Nature of additions (for chocolate with additions) (No. 16)

These quality characteristics are basic, on the one hand, for the formation of the full name of the product and the name of the product on the label, on the other hand, for determining, for example, the organoleptic properties of chocolate.

The trends, observed in the vegetable oils market (i.e. the active use of not only cocoa butter in the production of chocolate, but also palm oil and its derivatives, rapeseed, coconut, shea butter, etc.), are to some extent the reason for the producers' incorrect product-specific names, which necessitate the designation of the presence of a substitute(s) in the chocolate part (No. 13), its (their) nature (No. 14) and percentage (No. 14) as individual attributes. This will allow you to form a correct and clear idea of the specific name of the product and its quality. The information, obtained during the purchase of the products and reading out the identification means, will allow to notify the consumer in advance, that the product may have a "tallowy" after taste, an intense smell of vegetable oils, an oily consistency, and a heterogeneous structure. The degree of "perception" of substitutes depends on their quantity, however, even the permitted level (no more than 5% of added vegetable fats, other than cocoa butter, of the total weight of the finished product) [15] affects the consumer properties of chocolate, which, accordingly, will entail changing such attribute as "product name".

3. Content of cocoa butter, total solids of cocoa products, non-fat solids of cocoa products, milk solids and/or milk processing products, milk fat, and total fat in the chocolate mass (%) (No. 17)

These attributes reflect various physical and chemical characteristics of chocolate and filling, the need to determine which depends on the type of chocolate. Characteristics are given in accordance with the international food standard "Codex Alimentarius. Standard for chocolate and chocolate products (CODEX STAN 87-1981, Rev 1-2003)" [15] and GOST 31721-2012 "Chocolate. General technical conditions" [16], since the technical regulations of the Eurasian Economic Union for confectionery products was not developed. The indication of certain characteristics depends on the type of chocolate in accordance with regulatory documents. For example, for white chocolate, the weight parts of cocoa butter are at least 20%, milk fat is 2.5-3.5%, the total solids of milk and/or its processing products is at least 14% [15].

3. RESULTS OF THE STUDY

Based on the analysis of global trends in the chocolate market, its general and specific properties, and characteristics, as well as the developed guidelines for working with products in the GS46 System, a list of general and specific attributes, that must be presented in the catalog of labeled products within the system of the digital labeling and the traceability of products in relation to chocolate, distinguished on the basis of an analysis of its properties and characteristics, in the event of the dissemination of digital labeling to this type of product.

4. DISCUSSION OF RESULTS

Let us consider examples of specifying general and specific attributes, that must be presented in the catalog of a labeled product, within the framework of the system of the digital labeling and traceability of products in relation to chocolate (Table 3).

Table 3 General and specific attributes, that must be presented in the catalog of labeled products within the framework of the system of the digital labeling and traceability for imported products: "Dark chocolate with whole roasted hazelnuts" [16; 17]

Seq No.	The name of the mandatory attributes	Product "Dark chocolate with whole roasted hazelnuts"
	General attributes	
1	Full product name	Dark chocolate with whole roasted hazelnut
2	Product name on the label	Dark chocolate with whole roasted hazelnut
3	Name of the country of production	Germany
4	Producer's name	Alfred Ritter GmbH & Co. Kg
5	Brand (trademark)	Ritter Sport
6	10-digit HS code	1806 32 100 0
7	Net weight (g)	100
8	Barcode/GTIN	4000417702005
9	Publication date (plan)	11/10/2020
	Specific attributes	
10	1. Country of origin and region of growing of cocoa beans	See note
11	Cocoa bean variety	See note
12	Chocolate part composition	Sugar, biter cocoa, cocoa butter, emulsifier (soy lecithin)
13	The presence of a substitute(s) in the chocolate part	None
14	The nature of the substitute(s) in the chocolate part, the content of the substitute(s) to the total weight of the chocolate mass (%) (if any)	None
15	Filling composition (for filled chocolate)	None
16	Nature of additions (for chocolate with additions)	Hazelnut kernel (large additions)
17	Content of cocoa butter, total solids of cocoa products in chocolate mass (%) * other characteristics in relation to dark chocolate are not standardized in regulatory documents	Cocoa butter content - see note Total solids of cocoa products - not less than 50%

Note. The attribute is filled based on information, provided by the producers. Currently, this information is not available on manufactured products.

The table shows, that the full specific name of the product coincides with the name of the product on the label and corresponds to the composition of the chocolate part, described in the attributes. Regarding characteristics No. 10, No. 11, and No. 17 (cocoa butter content), it is not possible to provide reliable information, since these attributes are filled in on the basis of the information, provided by the producers. Currently, this information is not available on manufactured products. In the sample under consideration, there are no substitutes in the chocolate part, there is no filling, but there are large additions in the form of a hazelnut kernel. The content of the total solids of cocoa products is indicated correctly, based on the name of the product and its composition.

The dissemination of the system of the digital labeling and product traceability to chocolate will allow, incl. to exclude the presence of such products as, for example, "Nelly", on the Russian market, which currently exists on the market with such a product name in the label as "Confectionery: Milk chocolate with milk filling "Nelly", but contains cocoa butter substitutes. An expert examination of the fatty acid composition of this product, carried out earlier as part of the final qualification work, showed, that the chocolate part contains partially hydrogenated palm oil. Attributes No. 1, No. 2, and No. 14 in the framework of the system of the digital labeling and traceability of chocolate would look like this:
No. 1 and No. 2: Confectionery products: Filled compound chocolate bar "Nelly".
No. 14: Partially hydrogenated palm oil. Content of substitute(s) to the total weight of chocolate mass (%) - the attribute is filled in based on the information, provided by the producer. Currently, this information is not available on manufactured products.
In the case of specifying the attributes as presented above, they do not contradict the low consumer properties of the product, which were also determined during the organoleptic analysis of the sample earlier (off-flavor of chocolate, with an extraneous "tallowy" "fatty" taste, that does not disappear for a long time. Not a strong milky taste; odor unusual for cocoa products, there is a faint smell of milk).
The proposed list of attributes for further study of this topic can be expanded and adjusted taking into account changes in global trends and the development of digital technologies.

5. CONCLUSION

The implementation of digital technologies in various directions of state activity is one of the most important conditions for increasing its competitiveness. Digitalization contributes to the optimization of economic processes and the development of new advanced systems.
The system of digital labeling and traceability of products, which is currently actively used not only by customs authorities, but also by other ministries and services, ensures market transparency and compliance with its requirements.
Further improvement of digital labeling, consisting in the application of general and specific attributes, proposed in this work in relation to chocolate, which must be presented in the catalog of a labeled product, will allow, on the one hand, the consumer to make a competent choice of a product, that meets his needs and expectations, and on the other hand, will provide producers with a competitive advantage in the market.

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