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Standardization As an Effective Channel of Diffusion of Innovations

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Summary: *For the purpose of formation of the channel of diffusion of innovations the main models of innovative process are analysed. As the channel of diffusion of an innovation it is offered to use standardization depending on specifity of model of innovative process. The question of planning of development of standards on innovative products is considered, risks when planning are revealed it is noted that standardization of innovations demands special approach. Possibilities of planning of development of standards on innovative food products are considered.*
Key words:

1. INTRODUCTION

In the modern world innovations are the main source not only for social and economic progress, but also for competitive advantage of business. Thus, achievement of effective management of innovative process is a relevant problem of modern economics. To achieve this purpose it is necessary first of all to launch the process of successful commercialization of innovative products.

The methodology of the system description of innovations in the content of market economics is based on the international standards, recommendations on which are accepted in Oslo in 1992. Hence the name is "Oslo Manual". According to this manual; Innovations are a difficult and diversified activity with many interacting components. The innovation is considered to be carried out in case of its implementation in the market or in production process [6]. In other words, if the innovation isn't commercialized, it can hardly be considered as innovation in the spirit of "Oslo Manual".

Commercialization of an innovation is realized by its distribution through various channels such as communication channels (for example by "word of mouth", by SMS, by any information in written form, etc.), and technical channels (standards, patents, etc.).

Distribution of innovations through various channels was widely studied by E. Rogers [7], and F. Bass [2,9].

Distribution of innovations with time (diffusion of innovations) is presented in Figure 1. The analysis of the process of diffusion of innovations allocates the major factors which influence the process – time of distribution and the channel of innovations. We will consider these factors in more detail. The main objective of the modern enterprises which produce innovative products is to reduce life cycle of innovative process by way of choice of the most rational channel of diffusion of innovations.

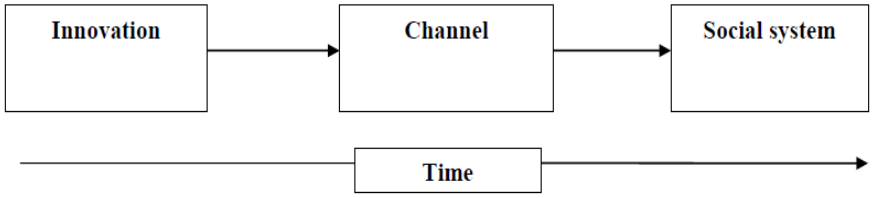

Figure 1. Distribution of an innovation through the channel of innovations with time

As the catalyst of promotion of innovations it is possible to consider standardization which besides a role of "accelerator" allows to ensure safety of products and to concentrate investments and resources on the important innovative directions. The key role of standardization as a bridge between research work, innovative activities and the market is admitted in all last political initiatives of the European public authorities. For example, in the offer on the creation of the Horizon 2020 program accepted by the European commission on November 30, 2011 the role of standardization in support of the market of innovations implementation is especially noted [4]. Implementation of the mentioned program started at the end of 2013.

Throughout the entire world innovations are supported at an early stage by effective cooperation between the research centers, business and standardization. Scientific and technical inventions act as an intermediate result of a research and production cycle and in the process of implementation of the innovative project turn into innovations. Standardization of innovations promotes production to the maximum extent satisfying need of future consumer and meeting safety requirements established by the legislation.

As the famous German expert in the field of standardization and intellectual property Dr. Cnut Blind notes (Academic department of innovative economics, Berlin Technological University): “Standards and patents are the most important indicators of technological development, the main driving force of growth of the modern economy based on information and knowledge” [11]. Standardization of innovative products promotes commercialization of ideas; successful promotion of products on the market and for many types of products is the most successful channel of diffusion of innovations based on long-term experience of rationing of requirements to quality and safety of products. Thus, there is an important task – to insert the channel "standardization" in innovative process correctly. For this purpose it is expedient to consider previously existing models of innovative process, from linear to more difficult models.

In R. Rothwell's work, "Towards the Fifth-generation Innovation Process", five generations of models of innovative process is highlighted [8]. The author considers the given models according to chronology of their introduction, describing the factors which influenced formation of the concept of models.

i. First generation "**technology push concept**" (distribution of the model of 1950 −1960): The concept of this model is caused by the economic growth which in turn, is caused by intensive development of industry and emergence of new technological capabilities. The following thesis is the cornerstone of the concept: the idea of creation of new products arises within R&D, and the market plays only a passive role, accepting results of researches and development.

ii. Second generation "**market pull**" (distribution of the model of 1960−1970): During emergence of this model production growth and increase in concentration of industrial production were observed. Development of innovations is carried out on the basis of already existing technologies. The basic principle of this model that innovations result from detection of needs of the buyer, revealed as a result of accurately focused researches and development which are coming to the end with emergence of new products in the market. The basis of this approach was formed by QFD (Quality Function Deployment), for the first time was offered Akao, Yoji for the design of an oil tanker by Mitsubishi Heavy Industries [3]. Within this model research development is a reaction to inquiries of the market. Feedback from one stage of innovative process to another began to be used since this model.

iii. Third generation "**coupling**" **model of innovation** (distribution of the model of 1970 – 1980): Growing structural unemployment. Companies were forced to adopt strategies of consolidation and rationalization, with growing emphasis on scale and experience benefits. Successful innovation process on the basis of a portfolio of wide-ranging and systematic studies are covering many sectors and countries ("coupling", model of innovation). This combined model as result of association of two previous linear models with definition of the sphere of R&D and new requirements of society as main sources of innovative ideas.

iv. Fourth generation "**integrated model**" (distribution of the model of 1980 – 1990): The desire as much as possible to reduce the life cycle of innovative production led to the formation of cross-functional teams which facilitate the removal of many organizational problems at the enterprise level.

v. Fifth generation "**networking process**" (distribution of the model of 1990): Speed of entry into the market of innovative products – one of the most important factors of innovative process. The companies show big flexibility and adaptability due to the use of modern information technologies, expert systems, etc. Ability to operate the speed of innovations (fast innovations) defines competitiveness of the company. This model is development of the previous model.

It should be noted that today all given models of innovative process are used. In our opinion, for developing countries the most suitable are models 1 – 4. Now it is important to consider a question how it is possible "to enter" standardization in the presented models.

2. MODELING FRAMEWORK

i. Standardization as a channel of diffusion of innovation in a model of innovative process "technology push concept" (Figure 2).

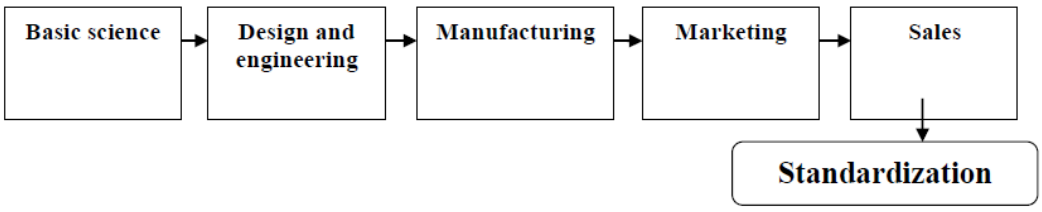

Figure 2. Channel of Diffusion of Innovation (technology push concept)

Standardization as the channel of diffusion of innovations in the context of this model, in our opinion, can be considered only after products entry into the market, after a while since the beginning of sales. This feature is caused by need of existence of data about products demand. In case of buyer's existence of demand and gradually increasing filling of the market, the standards on products will promote further diffusion of an innovative product. Shortcomings of this model consist in lack of a support of market requirements, and also are caused by duration of innovative process, in comparison with the models described below.

ii. Standardization as a channel of diffusion of innovation in a model of innovative process "market pull" (Figure 3).

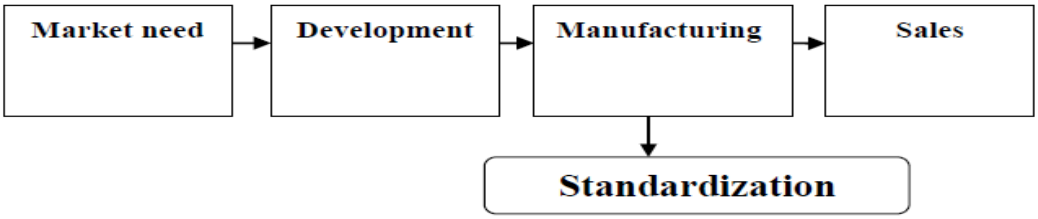

Figure 3. Channel of Diffusion of Innovation (market pull)

Unlike the previous model, the market requirement is at the head of all innovative process, thereby causing a probable demand of a final innovative product. Standardization as the channel of diffusion of innovations can, "be joined", after a stage "production", along with an entry of an innovative product into the market. Linearity of model and lack of feedback between blocks can be prerequisites to emergence of entry risks of entry of innovative products in to the market.

iii. Standardization as a channel of diffusion of innovation within the combined model of innovative process «coupling» model of innovation (Figure 4).

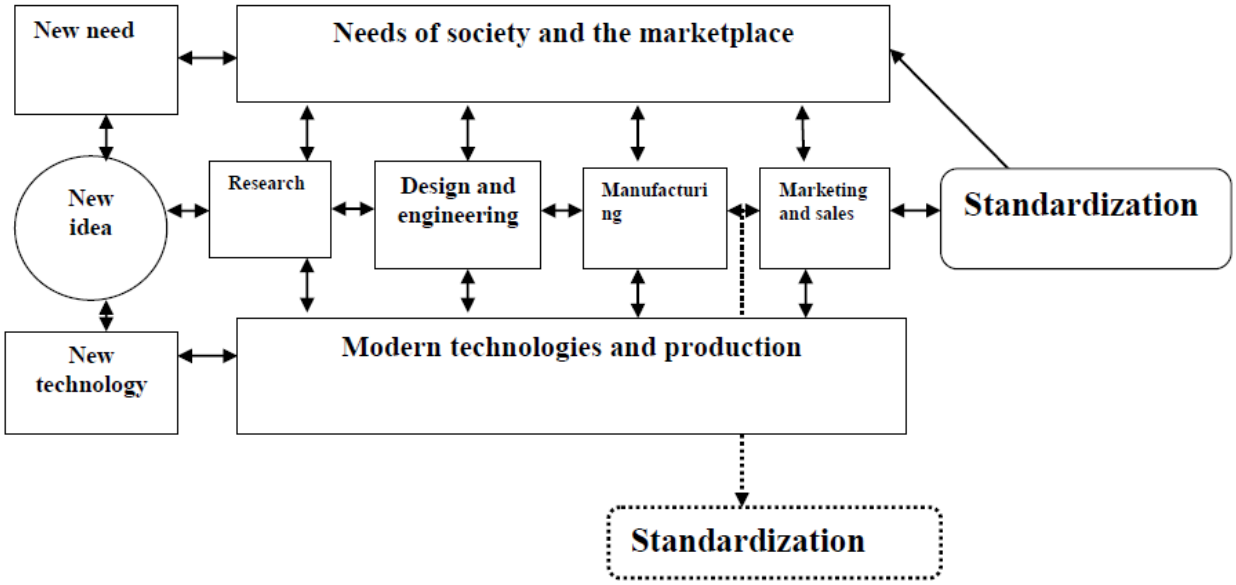

Figure 4. Channel of Diffusion of Innovation (coupling)

This model unites the previous models with addition of feedback during all innovative process. Throughout all technological part of innovative development requirements of the market and society are considered, thereby foreseeing a demand of a final innovative product. Standardization

within the presented model can serve as the channel of diffusion of innovations till the beginning of sales and when sales start. The second option of use of this channel is shown in figure by a dotted line.

iv. Standardization as a channel of diffusion of innovation within the integrated model with formation of cross-functional team (Figure 5)

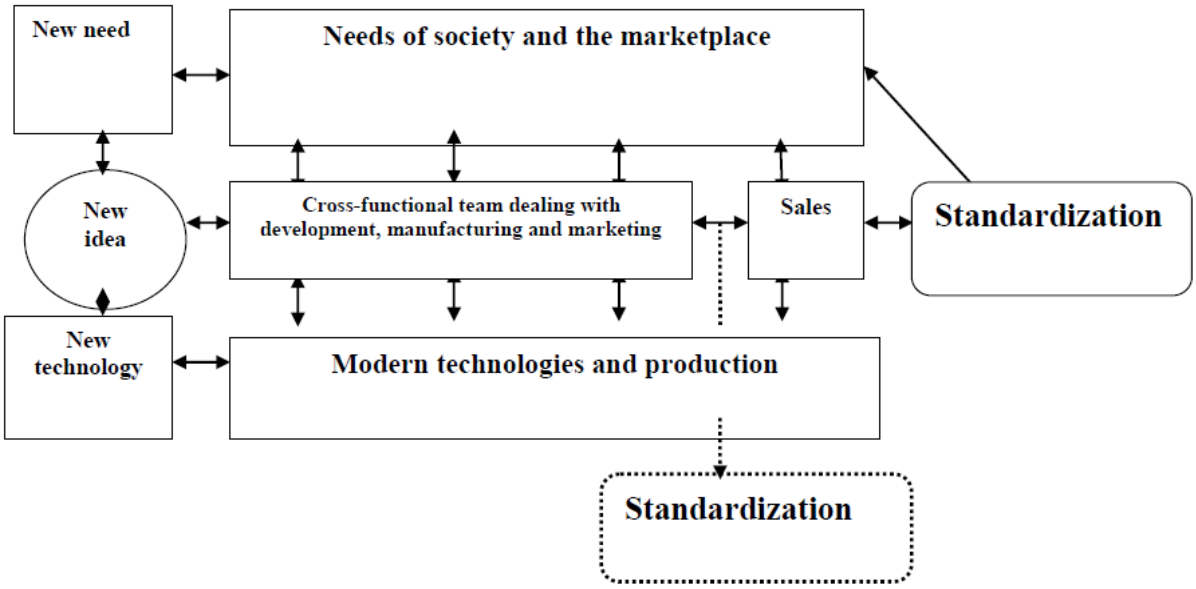

Figure 5. Channel of Diffusion of Innovation (formation of cross-functional team)

As well as in the previous model, standardization as the channel of diffusion of innovations can be involved at the different moments of innovative process. The second option of use of this channel is shown in figure by a dotted line.

The question arises: at what time is it necessary to develop a standard on an innovative product? Planning of standardization works related to innovative products requires special approach. If the standard is developed and becomes effective early enough, there are no potential users of the standard; if the standard is entered later, its demand of manufacturers of products decreases as the market is close to saturation and interest of consumers falls (see Figure 6).

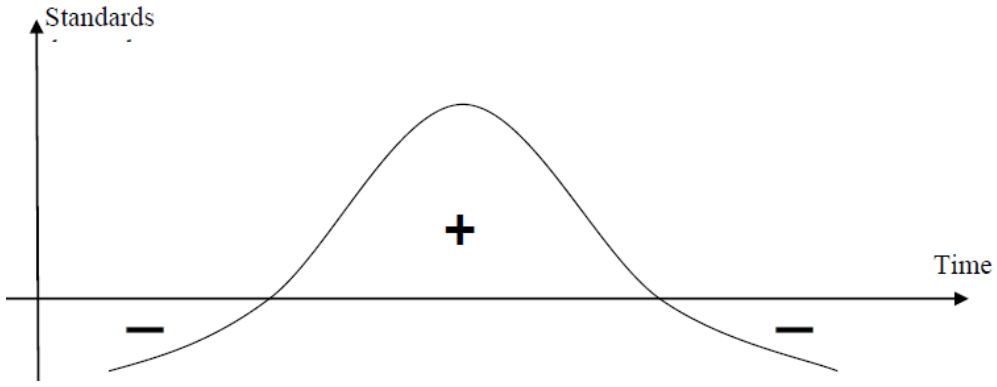

Figure 6. Effect from application of standards

The knowledge generally leads to explain the timeliness of development of the standard with maximum share of probability. That would permit to set a positive vector of development of productions at early stages of development of the market. Use of market researches and statistical

data when scheduling on standardization would promote optimization of this process. For example, now for modeling of dynamics of advance of innovative products the theory of diffusion of innovations becomes very popular [2,7]. We will consider basic provisions of this theory.

We will consider the model of diffusion of innovations presented by E. Rogers [7]. At the heart of E. Rogers's model there is segmentation of potential consumers of an innovation on the basis of individual predisposition to perception of an innovation. It describes the 5 segments. In Figure 7 dependence of extent of development of the consumer market on time is presented which passed since the beginning of distribution of products among consumers. Being guided by the theory of diffusion of innovations, it is possible to claim that this curve illustrates stages of acceptance of products by society; it is close to function of density of normal distribution and doesn't depend on a type of products (is universal). It is important to note that each consumer group lags behind other group at a size of the mean square deviation +/-σ.

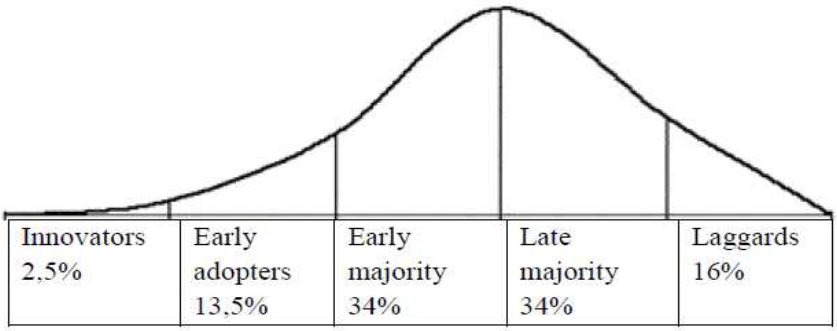

Figure 7. Main stages of acceptance of products by society

Use of the theory of diffusion of innovations for scheduling on standardization on the example of electro technical products were investigated in work [1] in terms of which it was established that the standard has to be developed during appearance of "early adopters". Interest of consumers in products is already obvious, but the market isn't close to saturation yet, therefore during this period it is possible to provide the maximum effect from application of the standard. During appearance of "innovators" to develop the standard is a premature action since it is unclear, whether this type of products will be demanded in the market, in the period of "the early majority" the market is close to saturation, increase in demand is slowed down that assumes decrease in effect from application of the standard. The illustration of this approach is given in Figure 8.

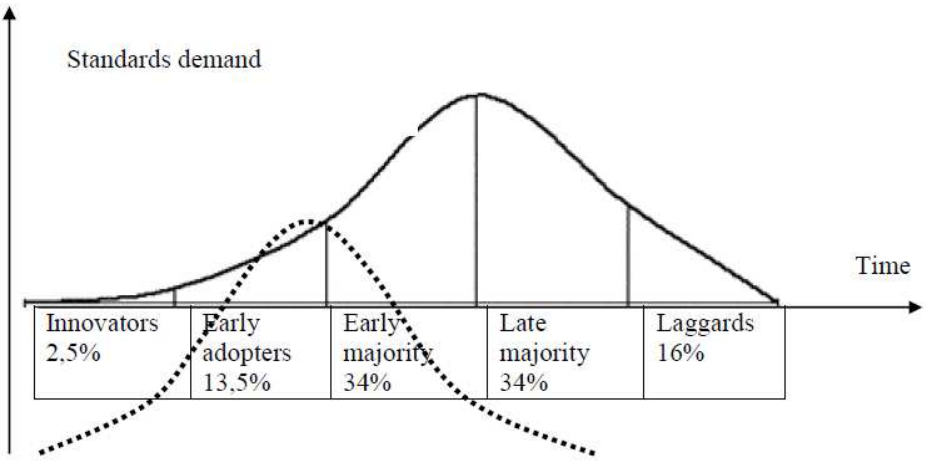

Figure 8. Dependence of a standard demand (dotted line) on time of its development on the curve of diffusion of innovations

We will consider as taking into account diffusion of innovations, planning of development of standards on innovative food products in relation to conditions of Russia could be conducted. Products examples given in the present article at the time of start of production could be considered as innovative food products.

3. ANALYSIS

3.1 Quick-Frozen Vegetables

In the Russian Federation production startup was in 1990. Data on growth of production are given in Figure 9 (according to [10]).

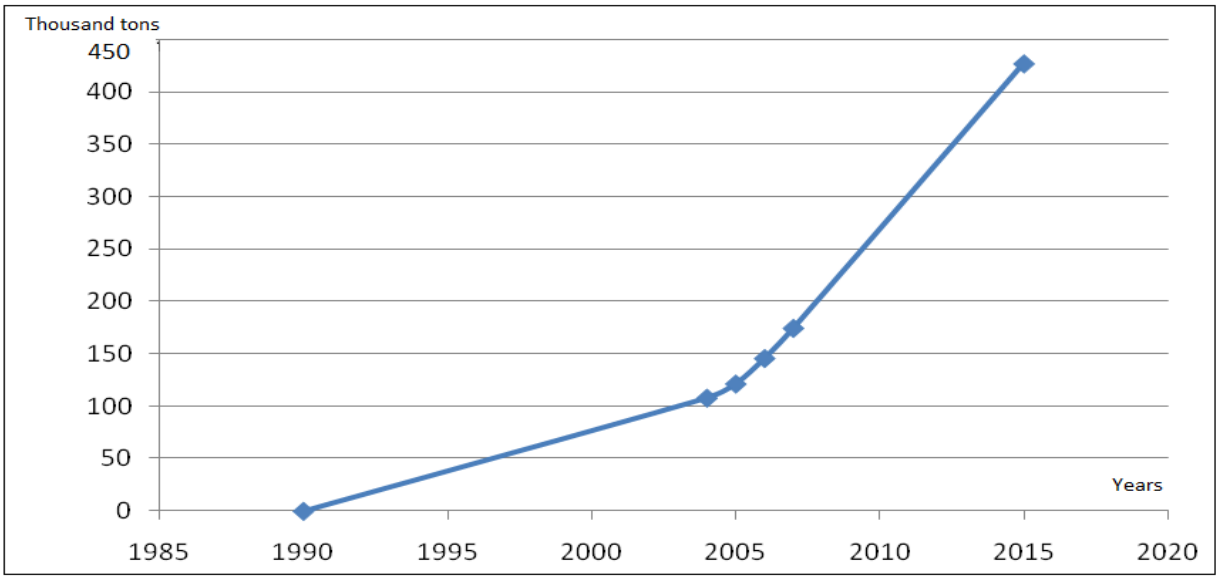

Figure 9. Dynamics of incremental capacity of fast-frozen vegetables

On the basis of the offered model of "diffusion of innovations", we will make calculation of optimum time for development of the standard for fast-frozen vegetables.

1. The period from the beginning of sales to peak of sales is 2015-1990 =25 years.
Thus, it is possible to calculate $\sigma = 25/3 \approx 8$ years.

2. In accordance with the offered approach it is expedient to carry out development of the standard on these products to the period of emergence of group of "Early adopters" from 1998 (1990+8) to 2006 (1990+8*2).

At the same time first standards for quick-frozen vegetables were developed in 2011 (GOST R 54683-2011 «Frozen vegetables and their mixes. General specifications»)

According to calculations given, GOST R 54683-2011 was developed with delay for 5 years at the moment when the market of quick-frozen vegetables was close to saturation that obviously reduced the maximum effect from application of this standard.

3.2 Airan

In the Russian Federation production startup was in 1990. Data on growth of production are given in Figure 10 (according to [5]).

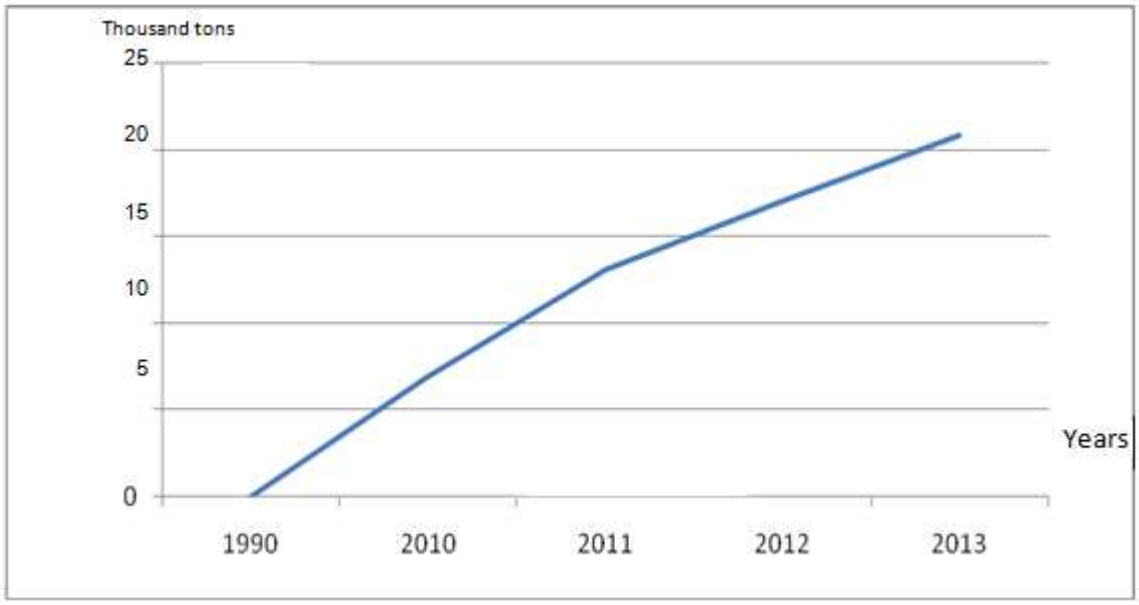

Figure 10. Dynamics of incremental capacity of Airan

On the basis of the offered model of "diffusion of innovations", we will make calculation of optimum time for development of the standard for Airan.

i. The period from the beginning of sales to peak of sales is 2013-1990=23 years.
Thus, it is possible to calculate $\sigma = 23/3 \approx 8$ years.

ii. In accordance with the offered approach it is expedient to carry out development of the standard on this product to the period of emergence of group of "Early adopters" from 1998 (1990+8) to 2006 (1990+8*2).

At the same time first standards for Airan were developed in 2009 (GOST R 53668-2009 Airan. Specifications).

4. CONCLUSIONS

According to calculations given, GOST R 53668-2011 was developed with delay for 3 years at the moment when the market of Airan was close to saturation that obviously reduced the maximum effect from application of this standard. The given examples testify that scheduling on standardization for these types of products wasn't effective – standards were developed with delay.
The offered approach allows using standardization as the rational channel of diffusion of innovations, to prove scientifically planning of standardization works related to innovative food products, for increase of the maximum effect from the applied standard and, as a result, there is an increase in competitiveness of such products. The presented model of planning works of innovative products related to standardization will allow using in full the scientific and technical potential of development, ensuring development of standards “in the right place at the right time".

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