Life cycle management in network retail enterprise based on introduction of innovations

Irina Krasyuk 1*, Tatyana Kirillova 1, Vladimir Bakharev 1, Boris Lyamin 1

1 Peter the Great St. Petersburg Polytechnic University, Polytechnicheskaya st., 29, St. Petersburg, 195251, Russia

* E-mail: iri-krasjuk@yandex.ru

Abstract. Innovations are a continuous process so the issues related to life cycle management of a retail enterprise are relevant. Effective management of enterprise life cycle allows reducing risks and decreasing the degree of uncertainty of its innovation activity. To describe the innovations life cycle the authors used Verhulst equation according to which the logistic function determines the innovations life cycle as a sigmoid – s-shaped curve. The method suggested by the authors determines the correlation interaction between determination of the moment when the innovation is introduced into retail enterprise activity and the innovation ageing period. The article substantiates that it is reasonable to use sales volume as a factor of effect from introduction of innovation in retail enterprise. Such factors as profit, efficiency, consumer traffic or mean receipt sum can be used as well. The novelty of the author approach is that it contains the interaction between life cycle stages of retail network and innovation introduction moments which enables to estimate the effectiveness of innovations in the enterprise. The information provided by such analysis will enable the management to elaborate a competent and effective development strategy of the company and in such a way increase its competitiveness.

1. Introduction

The scientific and technical basis of strategic development of contemporary economics is the innovation processes occurring in various fields including retail.

Currently retail is characterized by high level of innovation activity. The specifics of modern retail development in the Russian Federation is a great share of network organizations implementation of which considers standardization of technological and retail processes, higher quality of retail service. The outdated retail technologies, methods and ways of retail organization are modernized or replaced by new progressive innovation business technologies. Traditionally four types of innovations are used in retail: product, process, marketing and organizational. The concept of long-term social economic development of Russia considers economics conversion to innovation type of development, forming a competitive national system, effective regional innovation systems, development of science driven innovation enterprises and support of their innovation activity [1]. The innovation activity is a continuous process: enterprises influenced by market factors are constantly making changes to implemented operational processes. This makes issues related to period of innovations introduction and retail enterprise life cycle relevant.
Effective management of retail enterprise life cycle allows reducing risks and decreasing the degree of uncertainty of its innovation activity.

2. Problem and assumption of study
According to management theory each organization undergoes several development stages during its life cycle. As a rule a life cycle of an enterprise includes several stages: origination and establishment, growth when the enterprise actively fills the market segment selected by it, maturity characterized by attempts to reserve the kept market share and finally the recession ending in the enterprise losing its market share [2]. The issue being the center of this study is in the complexity of management of life cycle of network retail enterprise considering its scope and influence of many environment factors. The hypothesis of study formulated according to the established issue of study is that the life cycle of particular retail enterprise can be managed on the basis of calculation of innovation introduction moment. Functioning of this system will aid determining dynamics of innovation demand and practicability of innovations introduction in retail network.

3. Theory
Life cycle of a retail enterprise can be transformed through introducing of innovations that result not in transfer to recession stage but in return to company maturity stage (figure 1).

\[
\frac{\xi(t)}{\xi_0} = \frac{\xi_{\text{max}} \cdot e^{rt}}{\xi_{\text{max}} + \xi_{0} \cdot (e^{rt} - 1)},
\]
Where $\xi(t)$ – function of s-shaped curve of innovation life cycle describing the effect from its introduction (increased sales volume of the enterprise);

$\xi_{\text{max}}$ – limit of the innovation effect corresponding to the maximum possible increase of enterprise sales volume determined by the city, district population, people purchasing power, etc.;

$\xi_0$ – effect from innovation at the moment of its introduction;

$e$ – exponent;

$r$ – coefficient of increased effect from innovation in result of synergy effect from mutual influence of two and more innovations;

$t$ – time.

Considering that time parameter $t$ going to infinity value of logistic function $\xi(t)$ will go to limit of innovation effect:

$$\lim_{t \to \infty} \xi(t) = \xi_{\text{max}}$$  \hspace{1cm} (2)

Aimed for managing life cycle of retail enterprise the first and the second derivatives of logistic function need be determined $\xi(t)$ and that will enable us to describe the velocity and the acceleration of increasing effect from innovation introduction:

$$\xi(t)' = \frac{r \cdot \xi_{\text{max}} \cdot \xi_0 \cdot e'' \cdot (\xi_{\text{max}} - \xi_0)}{((\xi_{\text{max}} + \xi_0 \cdot (e'' - 1))^2)},$$ \hspace{1cm} (3)

$$\xi(t)'' = \frac{r^2 \cdot \xi_{\text{max}} \cdot \xi_0 \cdot e'' \cdot (\xi_{\text{max}} - \xi_0) \cdot (\xi_{\text{max}} - \xi_0 \cdot (1 + e''))}{((\xi_{\text{max}} + \xi_0 \cdot (e'' - 1))^3)}.$$ \hspace{1cm} (4)

Maximum of the first derivative of logistic function $\xi(t)$ coincides with moment of transfer from accelerating increase of effect from innovations (maximum sales volume) to reduced sales volume of retail enterprise. At the maximum of the first derivative the second derivative of logistic function is equal to zero. This moment coincides with the situation when the reserve of effect from innovation is quite substantial, a slight upgrade of innovation as well as modernization of innovation in dynamically changing conditions are possible.

The minimum function of the second derivative coincides with the moment of time when the innovation becomes outdated and the enterprise sales volume substantially reduces. Management of life cycle of retail enterprise greatly depends on determining the moment when the enterprise becomes outdated as it signals to start active search, development and further introduction of next innovation into activity of enterprise.

Besides the sales volume factors of profit, activity effectiveness calculated in percent as the ratio of total net profit of the enterprise to its sales volume as well as factor of consumer traffic or mean receipt amount can be used as the index of effect from introduction of innovation in retail enterprise. Each of these factors can be used to estimate the effect from introduction of innovations.

A variation of the suggested factor is to use a more complex approach from the point of practical calculations based on methods of functional and cost analysis [4]. The essence of such approach is to measure the effect from position of usefulness for users. In this case the estimation is substantiated considering the industry specifics of the enterprise, determining specifics of target sales markets, etc.

4. Applicative aspect of the study
The specifics of innovations in the retail field are in a variable nature of their origin. Innovations introduced in retail enterprises are managerial, organizational, marketing, process and technological. The latter have the greatest influence to functioning of retail enterprises and are characterized by high frequency of occurrence and quick introduction to activity of retail facilities. For instance nowadays internet shops, online pay offices, mobile applications to order products, etc. are widespread. [5].

According to life cycle analysis of one of the largest retailers in the country – federal retailer Х5 Retail Group (figure 2) currently the company is at the development stage. The fundamental role in such a situation was taken by innovations which are continuously introduced into activity of the studied retailer (table 1). The introduced innovations have various origin and multi-directional influence.

![Volume of trade X5 Retail Group 2012-2017, million rubles.](image)

**Figure 2.** X5 Retail Group sales volume [6].

| Innovation                                           | Direction of innovation action                                                                 |
|------------------------------------------------------|-------------------------------------------------------------------------------------------------|
| Retail operating workers outsourcing                 | Reduced circulation expenses of retail network                                                 |
| Multi-format of retail network                        | Satisfy needs of buyers with various profit level                                              |
| Display of goods in shopping place in partitive packages of manufacturers | Reduced circulation expenses of retail network                                                 |
| Self-scanners                                        | Attract buyers by modern service technologies, higher service quality, reduced circulation expenses |
| Selling goods under its own trade marks              | Attract buyers by high quality goods at lower prices                                           |
| Issue loyalty goods                                   | Attract buyers by additional discounts and special offers                                      |
| Franchising                                          | Geographic expansion of retail network at reduced costs                                        |
| Opening of distribution centers                      | Reduced circulation expenses of retail network                                                 |
| Establish long-term relations with local             | Reduced retail prices to goods on sale                                                        |

**Table 1.** Innovations introduced into activity of X5 Retail Group.
manufacturers of goods

| Internet shop | Attract buyer by modern service technologies, reduced circulation expenses of retail network and reduced retail prices to goods on sale |

At the moment when the innovation is being introduced to the activity of a single retailer irrespective of provisional estimations and experts forecasts the potential of a single innovation is uncertain and can be both overestimated and underestimated as well as the expectation related to the innovation. It is typical for retail when various retail enterprises as well as retail networks introduce identical innovations but the moments of innovations are different. The time interval can be as long as several years depending on financial capabilities of a retail enterprise. Here comes the situation when an innovation introduced into activity of one retail enterprise and resulted in increased sales volume was as well introduced in the other enterprise at the recession stage and then the innovation results in the fact that the enterprise life cycle goes to a development stage [7–9]. The innovation activity of network retail enterprises is determined by objective economic conditions of retail business. There are several theories which describe the process of development of competitive relations in retail. From the scientific point of view 5 of them bear the most interest: “wheel of retailing”, the theory of “swaying retail”, “natural selection” theory, “evolution through dialectic process” and “life cycle” theory in retail. According to “life cycle” theory the policy of retail enterprises regarding marketing, procurement and innovation policy should be very flexible so that operational strategies can be always adapted to life cycle stages. Considering that the profit varies depending on life cycle stage the risks as well as profits from introduction of innovations require thorough analysis [10–12]. Active innovation activity promotes longer stage of fast development and maturity that provides maximum profit. In order to obtain good results of operational activity managers of retail companies should timely modify their competitive strategies, introduce innovations considering quickly changing stages of retail enterprise life cycle [13–18].

5. Conclusions
1. In highly competitive environment the issue of innovation introduction in a retail enterprise becomes of high relevance. Selecting an innovation solution and introducing it into activity of an enterprise should be based on scientifically grounded approaches to provide management of the retail enterprise which include the investigated here scientific and practical recommendations on enterprise life cycle management and substantiation of innovations introduction period.
2. Life cycle of a retail enterprise can be changed through the retail network.
3. The economic effect from introduction of innovation in a retail enterprise can be measured using estimation of dynamics: sales volume, profit, efficiency, consumer traffic or mean receipt sum. Each of these factors can be used to estimate the effect from introduction of innovations.
4. To estimate the effect from introduction of innovation in a retail enterprise we can use an approach based on method of functional cost analysis which is based on measuring the effect from the prospective of consumer utility. In this case the estimation is substantiated considering the industry specifics of the enterprise, determining specifics of target sales markets, etc.

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