

Improvement of a telecommunications company tariff policy taking into account subscribers' preferences

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Abstract

According to most analysts, the era of extensive growth in the telecommunications market has almost finished. The ongoing competition between leading telecommunications companies is bringing the problem of developing a rational telecommunications policy to the forefront.

The ever-changing telecommunications market, subscribers' preferences, the expanding variety of services, the need for updating user data, the inadequate efficiency of the existing systems to form exact subscriber definitions demonstrate the need for more flexible tariff methods and policy. In spite of Russian and foreign scientists taking into consideration the pricing problems in forming tariff plans, the main accent is placed on price formation according to the profits either of the whole telecommunications field or company expenses in most attempts. The problem of differentiation of tariff plan characteristics with the purpose of subscribers' preference calculations has not been sufficiently explored. Moreover, the structural problems of tariff plans, where phone subscribers' preferences should be taken into consideration, and the whole tariff policy, in which formation of the entire complex of existent and prospective tariff plans should be taken into consideration, have not been properly researched. For solving these problems, we have offered a model of forming telecommunications company tariff policy using methods of intellectual data analysis and taking into consideration discovered preferences of subscribers and investors.

Key words: telecommunications company, telecommunications service market, tariff plan, subscriber preferences, subscriber consumption profile, client life-time value, intellectual methods of data analysis, clustering, modeling, tariff policy.

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Introduction

Until now the telecommunications services market has been growing rapidly both around the world and in Russia. The first commercial mobile communications appeared in Russia only in 1991

(NMT 450 and GSM standards) [1], however in 2007 3G, and in 2012 4G technologies were introduced. The history of mobile communications development before 2007 is associated primarily with voice communication. However, active development of the data transmission

market with Internet access started with 3G technology and mobile phones. The main limits on development of the mobile communications market are technical and the high prices for network development of data transmission.

However, these days the level of mobile communications development in Russia has reached the technical level of development of the advanced countries, and this has happened in a shorter period of time than in other countries around the world. The number of subscribers using mobile communications in Russia has grown 80 times over 11 years, from 2000 till 2011 [2] (Figure 1).

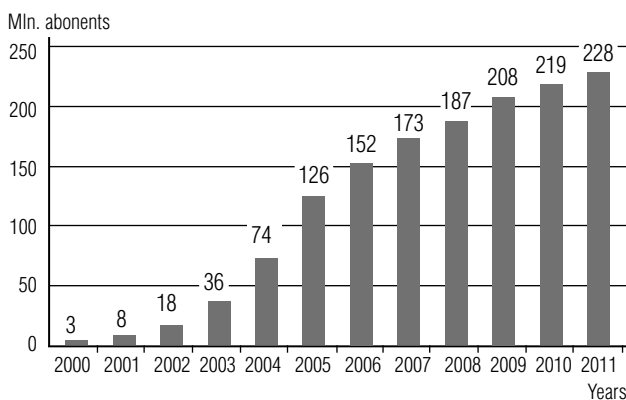


Fig. 1. Dynamics of growth in Russia's mobile communications subscriber base
Source: Analytical reviews of AC&M Consulting, 2004 – 2012

Nowadays the telecommunications services market is one of the main sectors critically important for many fields of the Russian economy and the functioning of the State. According to J'son & Partners Consulting, the total value of the Russian telecommunications field was 1.28 trillion rubles in 2014 [3]. According to preliminary results of growth in this field in 2015 presented by TMT Consulting in a report entitled "Russian telecommunica-

tion market in 2015–2020", the value of the telecommunications market is going to reach 1.67 trillion rubles [4].

The rate of profit growth was 2.1% in 2015, which is a bit higher than the rate in 2014 (1.7%) (Figure 2). The reasons for minimal growth of the market rate was the substantial profit increase from TV paid services: 21.3% in 2015 in comparison with 6.9% in 2014. Taking into consideration that the penetration of pay TV was 71% at the end of 2015 and the growth of user numbers was also small, less than 4%, at the same time that it had been 9% in 2014, the high profit growth may be explained only by the increase of tariffs. As a result, the average invoice for one subscriber has increased 14% to 151 rubles over a year.

The rate of exchange growth in payments for some inter-operational services has had a positive effect: 4% growth. At the same time, the rate of mobile communications growth decreased by 0.7% in 2015, internet access by 0.9%. All of that happened when mobile communications was 58% in the telecommunications field in 2014, meaning more than half of the profits of the field. Internet access was 11%, paid TV and interoperational services – only 4% each.

At the same time, statistics claim that 1.8 million subscribers have reduced phone services in 2015. Although new services came in the place of the traditional telephone and in future, it is going to be demanded, however, according TMT Consulting prognosis, its volume falls from 45% in 2015 to 34% in 2020. In the next 5 years, TMT Consulting predicts a decrease in the rate of growth of the Russian telecommunications market. The average growth will be 1.3% in 2015–2020 (CAGR). Profit growth from Internet access and other services is going to be offset by the reduction of voice communication profits in fixed as well as in mobile communications [4].

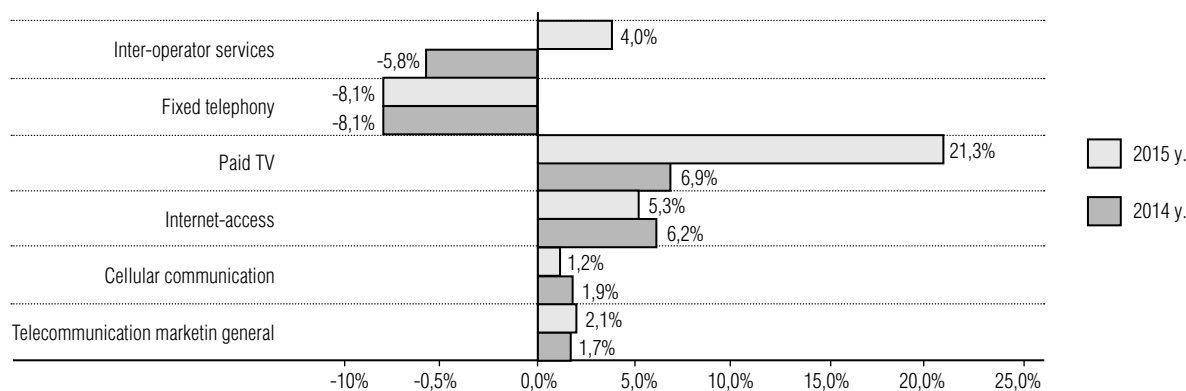


Fig. 2. The structure of the telecoms market

The expenses for equipment and software are the most important budgetary items in the whole structure of expenses in the telecommunications field. The part of decisions built on the basis of imported equipment and software constitutes more than 80% of total volume of consumption. Due to ruble devaluation, ruble cost of main expenses is increasing, which is very negative for the financial stability of telecommunications services market players. Undoubtedly, in this situation companies that can afford not to make considerable short-term investments will have profited.

Although the analysts of J'son Partners Consulting [3] give a "stable" prognosis for the telecommunications field, they stress that in the near future we should expect a decline in profits from voice services, an increase of expenses for currency debt payment and potential problems connected with the holding of the same level of main expenses. An uneasy situation is getting worse because the era of extensive growth of telecommunications services is almost over and the competition between the main market players is getting stronger. It is especially caused by the appearance of new players (like Tele2) implementing a very aggressive marketing policy on the telecommunications market in Moscow and its region.

1. Tariff policy as part of a telecommunications company's marketing policy

The main elements of the mobile communications market are the subscriber, the mobile operator, tariff plan and mobile communications network. The subscriber is actually a SIM-card (Subscriber Identification Module), which doesn't belong completely to a mobile communication device and in fact can be used by one person or a group of people it although it is registered to private individuals and corporate entities. The mobile operator is a company, which offers mobile communications services for both private and corporate clients with a contract (tariff plan). It extends the area of mobile communications coverage and improves its functioning. The mobile communications network is a set of stations, which forms a coverage zone. Any subscriber has an opportunity to be registered in a mobile communications network of any operator [5].

The tariff plan is a form of a commercial offer for mobile communications services from the company of the operator to the subscriber. It contains not only prices but also the structure of possible traffic usage and various juridical information regulating the relationship between the operator and the subscriber. Without doubt, price is

the main part in the agreement. The tariff is the price, which the client pays for an item, for all service fields.

The important metric characterizing commercial efficiency of a telecommunications company is ARPU (Average Revenue Per User) [6]. This metric allows us to understand how much money on average a subscriber spends during the service period. This index can be calculated if the whole profit is divided by the number of active subscribers. According to TMT Consulting [4], an increase of the subscriber base size by 10 million is predicted in 2015, however, a decrease has been determined for all mobile communications major operators in 2015 (Q3) in comparison with the Q3 2014 ARPU (Figure 3).

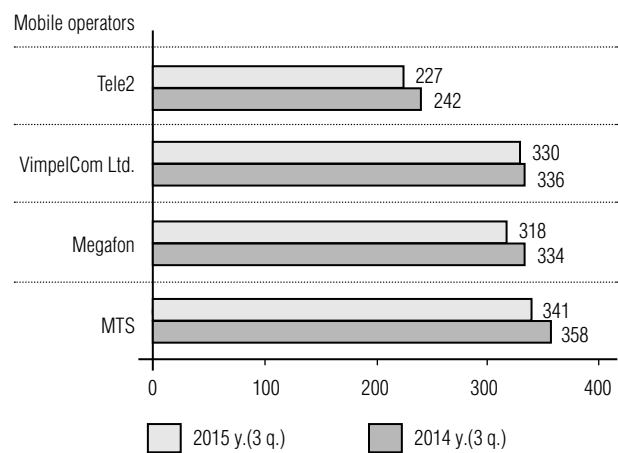


Fig. 3. ARPU of federal Russian mobile operators (rubles)

The decrease in growth is continuing also in wide-band access to the Internet. The illustration that the market is fully served not only in cities but also in towns is the growth of 3% in private user numbers – almost the same increase has been seen in the profits of the companies. ARPU growth is difficult in highly competitive conditions and also because of the tendency to package services (Internet + Internet TV + TV + phone). The result of increased profit and loyalty from a subscriber is a fact that the subscriber pays less for each part of the package than when he or she got it one by one.

The analysts of all telecommunications companies stress that for the last several years there has been significant decrease in consumer loyalty as seen in the outflow of subscribers. In this situation, company managements came to the conclusion that to be competitive when forming the tariff policy they need to take into consideration subscriber prefers instead of forcing them to get new tariff plans which are more interesting for companies by any means. In this situation, we can also talk about the increase of tariffs.

When forming tariff policy at telecommunications companies, one of the main conditions is the firm strategy. Among the main strategies of the service field are keeping stability on the market, enlarging the market, maximizing profits and forming the image of an elite service provider. For a major telecommunications company in a condition of oligopoly rivalry when extensive growth is almost over, the most preferred strategy is profit maximization. Within the context of strategy implementation, the most difficult parts are correct calculation of the demand for a company service, expense appraisal of the telecommunication service, segmentation of the target audience and customer preferences.

An important part of marketing policy in a telecommunications company, which is developing its strategy of prices [7], is the tariff and price policy. We can point out several ways of price formation strategy: premium and defense price strategy, depletion and penetration strategy, price differentiation and balancing strategy. Thus, in 2007 MegaFon applied a price break strategy. Dumping of market prices increased their subscriber base and expanded the market but as a result, competition became more acute between the telecommunications companies. At present, using the urgent repayment strategy, Tele2 is rapidly increasing its share of the market, first in the regions, and since 2015 in Moscow and the Moscow region. This strategy has been continually used by Tele2 for entering the telecommunications market.

The strategy of forming different prices for the same product for different groups of customers or horizontal price differentiation is fairly widespread in the telecommunications field. This method of differentiation supposes the discovery of customer specialties and taking them into consideration when forming price policy.

The methods of intellectual data analysis by which you can find out latent patterns in subscriber activity by

monitoring personal and consumer characteristics of subscribers are used in practice to understand customer preferences. The methods of intellectual data analysis are used during analysis of the consumer communications service market but their use is fragmentary and has an unsystematic character. During consumer cluster analysis for discovering a group of customers who have the same consumer characteristics, as a rule, the quantity of clusters comes from expert thoughts and tasks [8]. The sets of researching consumer and personal characteristics are often created intuitively based on common sense. In a situation of crisis, with ruble devaluation, difficult access to foreign capital and the fall of purchasing power, it is very important for telecommunications companies to find potential points of growth and to optimize their business.

2. Moscow telecommunications services market

Changes in the Moscow telecommunications services market are characterized by the same process as the whole telecommunications field. The worldwide trend of falling consumption of voice communications and SMS influenced very visibly changing profit volume earned in this field in 2014. According to J'son & Partners Consulting [3], beginning in Q2 2014 a decrease of profit volume was ascertained in the Moscow telecommunications services market compared with the same periods in 2013. The trend remained consistent for the first quarter of 2015 (*Figure 4*).

This is the result of the saturation of the Moscow telecommunications market, i.e. all possible clients have gained access to mobile service. But as shown in *Figure 5*, the consumer base is growing. This can be explained by each individual getting a greater number of SIM-cards.

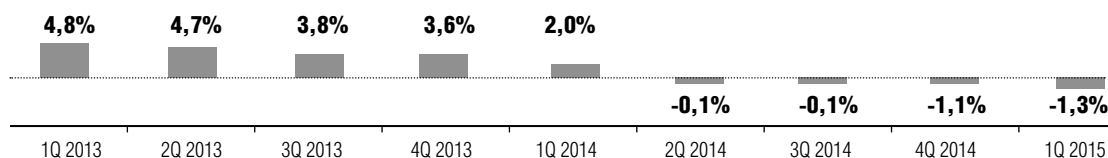


Fig. 4. Profit volume of Moscow telecommunications services in comparison with the previous year

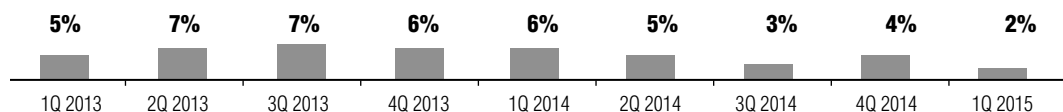


Fig. 5. Moscow telecommunications market volume in comparison with the previous year

It is believed that the number of consumers is continually growing and when the 5G network is introduced to the market the number of consumers can rapidly increase. The main reason is a special technical development. Previously one customer used one SIM-card and that was enough. These days the quantity of actively used devices per person is increasing. The arrival on the telecommunications market of the fifth generation network and development of the field with M2M (Machine to machine) and IoT (Internet of things), characterized by smart electronic equipment interconnected with the Internet – can practically move situation to rapid growth in consumer numbers [9]. At the same time, consumer growth is not going to influence the growth of profit volume. New equipment, especially from the IoT field, is characterized by extremely low traffic consumption, and M2M devices can be used without any telecommunications operator. This allows us to reach a conclusion about important rapid change of the whole telecommunications services market and its function. From this standpoint, the most competitive players of the market will be companies that not only have new technologies, but also develop a tariff policy based on consumer preferences. All of this makes it necessary to use a combined approach to improving the existing mechanisms of forming a rational tariff policy in telecommunications companies and developing informational and logical shaping of the tariff policy model on the basis of intellectual analysis and mathematical modeling.

3. A model for forming the tariff policy of telecommunications companies

As a rule, company managers of the “big three” (Beeline, MegaFon, MTS) are guided by similar things when forming new tariff plans: their own active tariff plan, the tariff plans of competitors, their relationship with business partners, by strategic purposes of the company and investors’ preferences, by consumer preferences and the actions of the State regulating this field. Less importance is assigned to consumer preferences. At this moment, there is no strictly objective methodology for forming the whole policy and new tariff plans in Russian telecommunications companies. This situation is the result of the manifold nature and complexity of the given task [10].

The consumer telecommunications base accounts for more than dozens of millions of customers. It can be extended without attracting new individuals but increasing the quantity of electronic devices, which are the channels of consumption served by a mobile operator. In

this situation, the use of methods pointing to work with one customer is irrational because the creation of each consumer operated model is going to be more expensive eventually than its use. Thus, it is more effective to create models, which take into consideration the preferences not only of one group of consumers, but also of those who have the same characteristics and consumer profiles. In addition, when creating new tariff plans, it is important to take into consideration consumer preferences, which have similar consumer profiles and the demands formulated by investors in relation to the time intervals at which profit should be maximized [11].

In order to form a consumer profile, it is necessary to create a set of indicators, which together allow you to identify consumer preferences. This set consists of:

- ◆ the different traffic types by consumption volume: voice communications, text messaging, Internet access, additional services;
- ◆ call direction: incoming and outgoing connections;
- ◆ the operator of the called consumer: inside the network, competing mobile operator, municipal phone number;
- ◆ called consumers’ geography: home network, long-distance call, international call;
- ◆ calling consumers’ geography: home region, roaming in Russia and abroad.

As has been shown in the set above, only indicators calculated in natural units (minutes, megabytes, goods) are used for forming consumer profiles, and in the same way, no social and demographic characteristics are taken into consideration because as the consumer isn’t seen as an individual but as a SIM-card. It is very useful to apply a cluster algorithm, for example, the method of self-organized cards by Kohonen [12].

The price characteristics of tariff plans are used for forming groups of tariff plans. Using the total charge for every consumer and total traffic, it is possible to get the real cost for each consumer product of all customers for every tariff plan. Offering a method for forming tariff plan cost characteristics is the main difference of this research compared to other works where the nominal declared traffic cost of each consumer is used. Because there is a possibility of multicollinearity of the initial price indexes (rubles per minute, per megabyte, per unit) when characterizing each tariff plan one should use stable, latent factors obtained, for example, with the main component method for emerging tariff plan groups on the basis of these price characteristics. Moreover, on the basis of these independent factors using the cluster analysis method it is possible to identify tariff plan

groups which have similar characteristics and those mainly different between them.

The present paper analyzes the influence of the company tariff policy on the profit from its business. For estimating the company profit, we propose to use client life-time value (CLV), which shows the discounting profit from the customer for all the time used for consuming the company service [13]. CLV indicators also describe the satisfaction of the customer with the company and allow one to take into consideration the part of consumer flow-out during the analyzed period [14].

The results of customer cluster and tariff plans can be tabled which is matrix where on the lines there are consumer clusters, characterizing consumer profiles, on the columns there are groups of tariff plans. There are CLV indexes of consumer cluster for each group of tariff plan (Table 1) in the cells on the lines and column crossing, where:

$k_i \in K, i = 1, \dots, I$ – consuming profiles of mobile company’s subscriber clusters;

K – set of the all subscriber profiles;

$p_j \in P, j = 1, \dots, J$ – clusters of the tariffs having similar price characteristics;

CLV_{ij} – client life-time value, $i = 1, \dots, I; j = 1, \dots, J$.

Table 1.

**CVL cluster subscriber
for each group of tariff plans**

Subscriber clusters	Group of tariff plans			
	p_1	p_2	...	p_j
k_1	CLV_{11}	CLV_{12}	...	CLV_{1j}
k_2	CLV_{21}	CLV_{22}	...	CLV_{2j}
...
k_i	CLV_{i1}	CLV_{i2}	...	CLV_{ij}

The client life-time value can be calculated according to the formula:

$$CLV(t_s) = GC(t_s) \cdot \sum_{m=1}^{t_s} \frac{r^m}{(1+d)^m} - M(t_s) \cdot \sum_{m=1}^{t_s} \frac{r^{m-1}}{(1+d)^{m-0.5}} \quad (1)$$

where $t_s \in T, s = 1, \dots, S$ – sub-periods defined by investors;

T – maximal planning period;

$CLV(t_s)$ – client life-time value till the moment t_s ;

d – discount rate;

$GC(t_s)$ – revenue from subscribers till the moment t_s ;

$M(t_s)$ – expenses on a subscriber till the moment t_s ;

r – part of the subscribers outflow on period from t_0 to t_s ;

t_0 – the beginning of the planning moment.

Hypothesis. It is possible to suppose that in spite of the same consumer profile subscribers who have chosen different tariffs and have different payment plans will bring different long-term profit to the company. This directly affects the summary period of consuming company services by subscribers, i.e. this affects subscriber outflow. By analyzing this matrix, it is possible to estimate which groups of tariffs are most preferable for each subscriber consuming profile, i.e. which tariffs group will have maximal CLV value till the moment t_s with a given consuming profile. This will make it possible to make conclusions about the expedience of transferring subscribers who have a given consuming profile to tariffs for other groups.

Statement 1. Subscribers from the same cluster have the same consumption behavior. It is supposed that when subscribers who belong the same cluster are changed from one tariff group to another then characteristics of subscriber consumption are kept the same but income and subscriber outflows are changed according to the subscribers’ chosen tariff group characteristics. Possible changes could only stimulate traffic consumption, because the tariff should match the subscriber’s consumption profile. Therefore, by defining for each subscriber consumption profile those groups of tariffs, which bring the biggest profit it is possible to stimulate subscribers to choose corresponding tariffs groups.

It is possible to reveal investors’ preferences based on one of the decision making support methods of usage results. They are characterized by part of voting shares v_b , which provides maximal profit in each planning period a_s . Partial preferences are calculated the following way:

$$\sum_{s=1}^S a_s = 1, a_s \geq 0 \quad (2)$$

where $a_s, s = 1, \dots, S$ – part of voting shares which provides maximal profit for the planning period;

S – number of planning periods.

The criteria are: lobar rating of preferences of each investor by different period of profit maximization, also – the rate of risk for the given period in three categories (low, middle, high risks). Preferences discovery by profit maximization periods including risks allows us to consider interests of the investors more objectively.

For each investor, it is necessary to distribute his preferences on each period S . with assessment by two criteria: f_p – lobar preference of profit maximisation for the period s and f_r – rate of the risk. Let Z_p – set of values or gradation of criteria f_p , Z_r – set of values or gradation of criteria f_r . In this research, it is admitted that the importance of criteria is distributed over the whole scale

of measures evenly. The total number of investors is B , $b = 1, \dots, B$. The type of criteria “folding” function is defined as multiplicative, because this type of connection is obvious for the value of risk and profit for the period:

$$F(f|w,s,b) = f_{p,s,b}^{w_p} \cdot f_{r,s,b}^{w_r} \quad (3)$$

where w_p and w_r are coefficients of importance of the corresponding criteria ($w_p + w_r = 1$), with normalization for each investor

$$\sum_{s=1}^S f_{p,s}^{w_p} \cdot f_{r,s}^{w_r} = 1.$$

Ratios w_p and w_r are defined by the fraction of voting shares of investors.

The general type of calculation a_s is described by the following formula:

$$a_s = \sum_{b=1}^B (v_b \cdot f_{p,s,b}^{w_p} \cdot f_{r,s,b}^{w_r} / \sum_{s=1}^S (f_{p,s,b}^{w_p} \cdot f_{r,s,b}^{w_r})). \quad (4)$$

To calculate CLV with consideration of the “planning horizon” (period of time which characterizes preferences of investors), it is necessary to split all planning periods into sub-periods. Then for each sub-period and subscriber consumption profile, you need to define the optimal group of tariffs according to the formula:

$$CLV_{ijs} = GC(t_s) \cdot \sum_{m=1}^{t_s} \frac{r^m}{(1+d)^m} - M(t_s) \cdot \sum_{m=1}^{t_s} \frac{r^{m-1}}{(1+d)^{m-0.5}}, \quad (5)$$

where K – set of subscriber clusters consisting of I clusters, $k_i \in K, i = 1, \dots, I$ – subscriber consumption profiles of the telecommunications company;

P – set of clusters of tariffs, consisting of J clusters;

$p_j \in P, j = 1, \dots, J$ – price characteristics of persistent groups of tariffs;

T – maximal planning period of the tariff policy, consisting of S sub-periods of different length;

$t_s \in T, s = 1, \dots, S$ – sub-periods which are the defined time period to calculate profit of the company (the value of t_s is defined by investors);

$CLV_{i,j,s}, i = 1, \dots, I; j = 1, \dots, J; s = 1, \dots, S$ – client life-time value;

d – discount rate. In this article it is supposed that the discount rate is the same for each month of planning. Possible differences in the discount rate are not considered in this paper;

GC – revenue from subscribers;

M – costs of subscriber;

r – volume of outflow of subscribers.

For each subscriber consumption profile in a given planning period there is a defined tariff group, which is maximizing CLV according to the formula:

$$p_{is}^* = p_j (\max_{1 \leq j \leq J} CLV(t_s | k_i, P)), \quad (6)$$

where $p_j \in P, j = 1, \dots, J$ – tariff groups having similar price characteristics;

$p_{i,s}^* \in P$ – is a group of tariffs, which has maximal CLV for subscriber cluster i at the period s ;

$k_i \in K, i = 1, \dots, I$ – subscriber clusters which have consumption profiles of the mobile company;

K – set of all subscriber profiles;

$t_s \in T, s = 1, \dots, S$ – planning periods;

T – the whole planning period;

$$\max_{1 \leq j \leq J} CLV(t_s | k_i, P) -$$

maximal client life-time value cluster k_i at the period t_s from the whole set of tariffs groups P .

Statement 2. It is considered that company is able to stimulate subscribers to choose the tariff, which is the best in terms of all his preferences based on real consumption profile analysis. The influence of the marketing policy of the company and the effectiveness of marketing actions is not taken into consideration in this work.

Statement 3. Costs of stimulating the subscriber to move to a different tariff in this research is not taken into consideration because the influence of marketing actions also is not taken into consideration.

The calculation of the planning profit of the telecommunications company on the whole planning period T is defined by the formula:

$$P_r(T) = \sum_{s=1}^S \sum_{i=1}^I a_s \times Abon(k_i) \cdot CLV(T | k_i, \max P_{i,s}) \quad (7)$$

where $P_r(T)$ – the profit of the mobile company on the whole planning period T ;

$Abon(k_i)$ – number of subscribers of k_i subscriber consumption cluster.

The profit of a telecommunications company on any sub-period of planning can be calculated in the same way.

Conclusion

Analysis of telecommunications services conditions has shown that the market is in the state of completing extensive growth. The existing methods of telecommunications company policy need improving. We offer a way to make a model for forming the telecommunications company tariff policy, taking into consideration subscribers’ and investors’ preferences and giving a chance to rationalize tariff policy formation. ■

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Совершенствование тарифной политики телекоммуникационной компании с учетом предпочтений абонентов

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Аннотация

По мнению подавляющего числа аналитиков, эра экстенсивного роста рынка телекоммуникационных услуг практически закончилась, а постоянно усиливающаяся конкуренция среди ведущих телекоммуникационных компаний выдвигает на первый план проблемы формирования рациональной телекоммуникационной политики. Постоянная изменчивость рынка телекоммуникационных услуг, как и предпочтений абонентов, расширение многообразия предоставляемых сервисов, необходимость обновления данных пользователей, недостаточная эффективность существующих систем выявления и формирования рациональных предпочтений абонентов вызывают необходимость достаточно точного определения абонентских

предпочтений, а также разработки более гибких методов и моделей формирования тарифной политики телекоммуникационной компании.

Несмотря на то, что проблемы ценообразования при формировании тарифных планов затрагиваются как отечественными, так и зарубежными учеными, основной акцент в большинстве исследований делается на формировании цены с точки зрения доходности либо всей телекоммуникационной отрасли, либо издержек компании. В то же время проблема дифференциации ценовых характеристик тарифных планов, отражающая абонентские предпочтения как российскими, так и зарубежными авторами, исследована недостаточно глубоко. Кроме того, остаются не затронутыми проблемы тарифной политики в целом, при формировании которой должен учитываться весь комплекс существующих и перспективных тарифных планов и предпочтения потребителей. Для решения сформулированных проблем предложен подход и разработана модель формирования тарифной политики телекоммуникационной компании с применением методов интеллектуального анализа данных, учитывающая выявленные предпочтения абонентов и инвесторов.

Ключевые слова: телекоммуникационная компания, рынок телекоммуникационных услуг, тарифный план, предпочтения абонентов, профиль абонентского потребления, долгосрочная ценность клиента, интеллектуальные методы анализа данных, кластеризация, моделирование, тарифная политика.

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