Quality Level Choice Model under Oligopoly Competition on a Fitness Service Market

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Abstract The growth of complexity of business conditions causes the necessity of innovative approaches to strategic decision-making, instruments and tools that help them to reach the leading position in mid-term and long-term perspective. One of the instruments that allow increasing company's competitiveness is the improvement of the service quality. The goal of the research is to develop theoretical basis (models) and practical methods of the service quality level evaluation and choice which is made by the service provider. Research objectives are: analysis of consumer satisfaction with the service, development of game-theoretical models of service providers' interaction, definition of the strategy of service quality level choice, development of practical recommendations for Russian companies to implement the strategy.

Keywords: quality choice, willingness to pay, exponential distribution, two-stage game, Nash equilibrium, optimal quality differentiation, fitness industry.

1. Introduction

The growth of complexity of an external environment and business conditions, namely, high development of information and communication technologies and competition boost, predefines the identification of new sources of development of companies competitive abilities and ways to increase management effectiveness. This fact causes the necessity in development of innovative approaches to strategic decision-making, instruments and tools that may help companies to reach the leading position in mid-term and long-term perspective. One of the instruments that allow increasing company's competitiveness is the improvement of the service quality. Contemporary approaches to company management are based on the analysis of the adding value framework. The value of the service for the consumer is highly defined by its quality. Therefore, the problem of quality level choice under competition is a very important element of strategic management. The appropriate choice of service quality level and price provides a company with necessary conditions to maintain high competitiveness and stable development. At the same time service quality level is defined by consumer satisfaction. The aim of this paper is to propose evaluated theoretical and applied methodology of quality management under

competition which is correlated with the study the consumer satisfaction and companies strategic interaction in the market. In this paper we will define quality from the point of view of customers of the investigated service. Customer involvement in the production of the services creates additional argument for the importance of quality evaluation from the customers point. In the paper quality of service is a quantitative estimation of the level of consumer satisfaction with this service.
Assume as well that service quality is a complex notion defined through its characteristics. The characteristics of quality should be measurable, accurate and reliable. They are measured on the basis of customers' opinion. Thus, in this paper the quality is evaluated as a cumulative value assigned for the service quality characteristics and is cumulative measure of consumer's satisfaction with service quality. Therefore the higher is consumer satisfaction the higher is the service quality level.
After consumer satisfaction with the service is analyzed and service quality is evaluated, the goal of the research is to develop theoretical basis (models) and practical methods of the service quality level evaluation and choice which is made by the service provider. Therefore, the theoretical research objectives are:

- development of game-theoretical models of service providers' interaction,
- definition of the strategy of service quality level choice.

The empirical part of the research to suggest practical recommendations for Russian companies to implement the "quality price" strategy that may increase companies payoff under competition.
The survey was conducted in St. Petersburg in fitness industry. Consumer preferences and satisfaction were defined, game-theoretical analysis of St. Petersburg industrial market allowed finding the current state and equilibrium service quality levels. the change in market shares for Fitness clubs of St. Petersburg was evaluated in equilibrium.

2. Game-Theoretical Model of Duopoly

Suppose that there are 2 firms on the market which produce homogeneous services differentiated by quality. Let firm i produces goods with the quality s_i, and let $s_1 < s_2$. Assume, that the values of s_i are known to both firms and consumers. According to the model, firms use Bertrand price competition. In this case p_i is a price of firm i for the goods with quality s_i.
The game-theoretical model is presented as dynamic game which consists of the following stages: a) each firm i chooses its service quality levels s_i; b) firms compete in prices p_i.
Consumers differ in their willingness to pay for quality level s, which is described by the parameter $\theta \in [0, \infty)$. This parameter is called inclination to quality. The utility of a consumer with a willingness to pay for quality θ (consumer θ) when buying a service of quality s at a price p is equal to:

$$U_\theta(p, s) = \begin{cases} \theta s - p, p \leqslant \theta s \\ 0, p > \theta s \end{cases} \quad (1)$$

It is clear that the consumer θ will purchase the product of quality s at price p if $U_\theta(p, s) > 0$ and won"t buy a product otherwise.

The investigated industrial market is considered to be partially covered.
The model suggests that inclination to quality is exponentially distributed. This means that the majority of consumers have the willingness to buy services with the critical level of quality. The case when consumers are eager to buy the lowest level of quality is considered, but it may be extended to the situation with the highest level of quality. Therefore, in the model it is assumed that the parameter of inclination to quality θ is a random variable and has exponential distribution with density function:

$$f(x) = \begin{cases} 0, x \leqslant 0 \\ \lambda e^{-\lambda x}, x > 0 \end{cases} \tag{2}$$

The payoff function of the firm i which provides a service of quality s_i, where $s_i \in [s, s]$, is the following:

$$R_i(p_1, p_2, s_1, s_2) = p_i(s_1, s_2) \times D_i(p_1, p_2, s_1, s_2), i = \overline{1, 2}$$

where $p_i(s_1, s_2)$ is the price of the service of the firm i, $D_i(p_1, p_2, s_1, s_2)$ – the demand function for the service of quality s_i, which is specified.

Introduce the following variables: θ_1 and θ_2.

Consumer with inclination to quality θ is indifferent to the purchase of goods with the quality s_1 and price p_1, if

$$\theta s_1 - p_1 = 0 \tag{3}$$

Then we can find that:

$$\theta_1 = \theta_1(p_1, s_1) = p_1/s_1 \tag{4}$$

θ_1 characterizes a consumer, who is equally ready to buy a service with the quality s_1 and price p_1 or refuse to buy this service.

Consumer with inclination to quality θ is indifferent to the purchase of services with quality s_1, s_2 and prices p_1, p_2 respectively, if:

$$\theta s_1 - p_1 = \theta s_2 - p_2 \tag{5}$$

Therefore, θ_2 is equal:

$$\theta_2 = \theta_2(p_1, p_2, s_1, s_2) = \frac{p_2 - p_1}{s_2 - s_1} \tag{6}$$

θ_2 characterizes a consumer, who is indifferent to buy a good with the quality s_1 and price p_1 and a good with the quality s_2 and price p_2.

Then, demand function $D_i(p_1, p_2, s_1, s_2)$ for firms 1 and 2 can be presented as following:

$$\begin{cases} D_1(p_1, p_2, s_1, s_2) = \int\limits_{\theta_1(p_1, s_1)}^{\theta_2(p_1, p_2, s_1, s_2)} f(\theta)d\theta = F(\theta_2(p_1, p_2, s_1, s_2)) - F(\theta_1(p_1, s_1)); \\ D_2(p_1, p_2, s_1, s_2) = \int\limits_{\theta_2(p_1, p_2, s_1, s_2)}^{\infty} f(\theta)d\theta = 1 - F(\theta_2(p_1, p_2, s_1, s_2)). \end{cases}$$

Then the payoffs of each three firms will be evaluated by the sales return function:

$$\begin{cases} R_1(p_1, p_2, s_1, s_2) = p_1 \times D_1(p_1, p_2, s_1, s_2) \\ R_2(p_1, p_2, s_1, s_2) = p_2 \times D_2(p_1, p_2, s_1, s_2,) \end{cases}$$

where $p_i(s_1, s_2)$ is the price of the service of the firm i with quality s_i

Game theoretical model of quality choice is a two stages model, when the choice on each stage is made simultaneously.

- On the first stage firms i choose quality levels s_i;
- On the second stage firms i compete in prices p_i . It is assumed, that after the first stage all quality levels are known to both companies and consumers.

This game theoretical model should be solved using the backward induction method. It means that Nash equilibrium is fined in two steps. On the first step assuming that the quality levels are known we find prices $p_i^*(s_1, s_2)$ for services offered by each firm. On the second step, when the prices $p_i^*(s_1, s_2)$ are known we find quality levels s_1^*, s_2^* in Nash equilibrium for firms 1 and 2 correspondingly.

Taking into account the exponential distribution of inclination to quality θ , we can rewrite payoff functions as following:

$$\begin{cases} R_1(p_1, p_2, s_1, s_2) = p_1 \times (e^{-\lambda\theta_1} - e^{-\lambda\theta_2}) = p_1 \times \left(e^{-\lambda\frac{p_1}{s_1}} - e^{-\lambda\frac{p_2 - p_1}{s_2 - s_1}}\right) \\ R_2(p_1, p_2, s_1, s_2) = p_2 \times e^{-\lambda\theta_2} = p_2 \times e^{-\lambda\frac{p_2 - p_1}{s_2 - s_1}} \end{cases}$$

To find equilibrium prices, use the first order condition:

$$\begin{cases} \frac{\partial R_1}{\partial p_1} = e^{-\lambda\frac{p_1}{s_1}}\left(1 - \lambda\frac{p_1}{s_1}\right) - e^{-\lambda\frac{p_2 - p_1}{s_2 - s_1}}\left(1 + \lambda\frac{p_1}{s_2 - s_1}\right) = 0 \\ \frac{\partial R_2}{\partial p_2} = e^{-\lambda\frac{p_2 - p_1}{s_2 - s_1}}\left(1 - \lambda\frac{p_2}{s_2 - s_1}\right) = 0 \end{cases}$$

The obtained system of equations has unique solution, which may be calculated numerically using MATLAB algorithm, where an optimal strategy of the second company $p_2^* = \frac{s_2 - s_1}{\lambda}$, and optimal strategy of the first company p_1^* are defined from the first equation of the system and are unique.

Thus, for instance, if we have information that $s_1 = 100, s_2 = 150, \lambda = 0,15$ then one can obtain the following equilibrium prices: $p_1^* = 115, p_2^* = 333$.

On the second stage of the analysis the companies compete in quality. As the solution on the first stage is obtained numerically, on this stage we will also use

MATLAB to get the optimal quality strategies and numerical values for market shares and payoffs in equilibrium.

First analyze how the payoff functions change with quality. It can be shown numerically that payoff function of second company increases with its quality for any fixed service quality level of the first company. Therefore, the optimal service quality level strategy of second company is the highest possible quality level: $s_2^* = \overline{s}$.

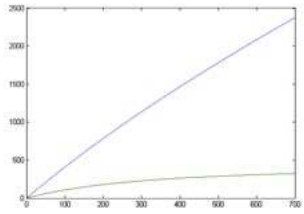

Fig. 1: Companies payoff function with respect to second company service quality level.

Figure 1 presents the payoff values for both companies when company 2 service quality level is increasing.

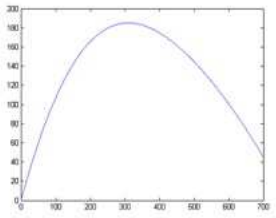

Fig. 2: Company 1 payoff function with respect to its service quality level.

Next, determine the quality levels, where the maximum value function of the first company is achieved. For this purpose, knowing the quality level of second company, with a predetermined pitch changing the quality service level of the first company. For each pair of service qualities from the first-order conditions the prices are obtained in equilibrium. Figure 2 represents the change in payoff of the first company with respect to its service quality level (see Fig. 2). The graph shows that there exists a unique quality level of the first company where the company payoff achieves its maximum value.

When quality levels are calculated, equilibrium price , demand and revenue can be found.

Table 1 presents an example of an optimal numerical solution for a described game when the input parameters are: $\lambda = 0,15; \overline{s} = 770$.

3. Game-Theoretical Model of Oligopoly

Suppose now that there are 4 firms on some industrial market. Similarly to the previous section, let firm i produce services of quality s_i, and lets $s_1 < s_2 < s_3 < s_4$. Assume, that the values of s_i are known to all firms and consumers. According to the model, firms use Bertrand price competition. In this case p_i is a price of firm i

Table 1: Numerical solution in duopoly and exponential distribution of inclination to quality.

s_1	s_2	p_1	p_2	D_1	D_2	R_1	R_2
460	770	626	2067	0,32	0,50	199	1029

for the goods with quality s_i.

The game-theoretical model is presented as dynamic game which consists of the following stages: a) each firm i chooses its service quality levels s_i; b) firms compete in prices p_i.

Consumers differ in their willingness to pay for quality level s, which is described by the parameter $\theta \in [0, \infty)$. This parameter is called inclination to quality. The utility of a consumer is defined as in the previous section.

The investigated industrial market is again considered to be partially covered. Now again the model when inclination to quality is exponentially distributed is analyzed. This means that the majority of consumers have the willingness to buy services with the critical level of quality. The case when consumers are eager to buy the lowest level of quality is considered, but it may be extended to the situation with the highest level of quality.

Suppose that there are 4 firms on the market which produce homogeneous services differentiated by quality. The payoff function of the firm i which provides a service of quality s_i, where $s_i \in [s, s]$, is the following:

$$R_i(p, s) = p_i(s) \times D_i(p, s), i = \overline{1, 4}$$

where $p_i(s) = p_i(s_1, s_2, s_3, s_4)$ is the price of the service of the firm i, $D_i(p, s) = D_i(p_1, p_2, p_3, p_4, s_1, s_2, s_3, s_4)$âĹŠ the demand function for the service of quality s_i, which is specified.

Introduce the following variables: θ_1, θ_2, θ_3 and θ_4

Consumer with inclination to quality θ is indifferent to the purchase of goods with the quality s_1 and price p_1, if

$$\theta s_1 - p_1 = 0$$

Then we can find that:

$$\theta_1 = \theta_1(p_1, s_1) = p_1/s_1$$

θ_1 characterizes a consumer, who is equally ready to buy a service with the quality s_1 and price p_1 or refuse to buy this service.

Consumer with inclination to quality θ is indifferent to the purchase of services with quality s_1, s_2 and prices p_1, p_2 respectively, if:

$$\theta s_1 - p_1 = \theta s_2 - p_2$$

Therefore, θ_2 is equal:

$$\theta_2 = \theta_2(p_1, p_2, s_1, s_2) = \frac{p_2 - p_1}{s_2 - s_1}$$

θ_2 characterizes a consumer, who is indifferent to buy a good with the quality s_1 and price p_1 and a good with the quality s_2 and price p_2.

Consumer with inclination to quality θ is indifferent to the purchase of goods with quality s_2, s_3 and prices p_2, p_3 respectively, if:

$$\theta s_2 - p_2 = \theta s_3 - p_3$$

Therefore, θ_3 is equal:

$$\theta_3 = \theta_3(p_2, p_3, s_2, s_3) = \frac{p_3 - p_2}{s_3 - s_2}$$

θ_3 characterizes a consumer, who indifferent to buy a good with the quality s_2 and price p_2 and a good with the quality s_3 and price p_3.

Consumer with inclination to quality θ is indifferent to the purchase of goods with quality s_3, s_4 and prices p_3, p_4 respectively, if:

$$\theta s_3 - p_3 = \theta s_4 - p_4$$

Therefore, θ_4 is equal:

$$\theta_4 = \theta_4(p_3, p_4, s_3, s_4) = \frac{p_4 - p_3}{s_4 - s_3}$$

and characterizes a consumer, who indifferent to buy a good with the quality s_3 and price p_3 and a good with the quality s_4 and price p_4.

Then, demand function $D_i(p_1, p_2, p_3, p_4, s_1, s_2, s_3, s_4)$ for firms 1, 2, 3 and 4 can be presented as following:

$$\begin{cases} D_1(p_1,p_2,s_1,s_2) = \int\limits_{\theta_1(p_1,s_1)}^{\theta_2(p_1,p_2,s_1,s_2)} f(\theta)d\theta = F(\theta_2(p_1,p_2,s_1,s_2)) - F(\theta_1(p_1,s_1)); \\ D_2(p_1,p_2,s_1,s_2) = \int\limits_{\theta_2(p_1,p_2,s_1,s_2)}^{\theta_3(p_2,p_3,s_2,s_3)} f(\theta)d\theta = F(\theta_3(p_2,p_3,s_2,s_3)) \\ -F(\theta_2(p_1,p_2,s_1,s_2)); \\ D_3(p_1,p_2,p_3,s_1,s_2,s_3) = \int\limits_{\theta_3(p_2,p_3,s_2,s_3)}^{\theta_4(p_3,p_4,s_3,s_4)} f(\theta)d\theta = F(\theta_4(p_3,p_4,s_3,s_4)) \\ -F(\theta_3(p_2,p_3,s_2,s_3)); \\ D_4(p_3,p_4,s_3,s_4) = \int\limits_{\theta_4(p_3,p_4,s_3,s_4)}^{\infty} f(\theta)d\theta = 1 - F(\theta_4(p_3,p_4,s_3,s_4)). \end{cases}$$

Then the payoffs of each firm will be evaluated by the sales return function:

$$\begin{cases} R_1(p_1,p_2,s_1,s_2) = p_1 \times D_1(p_1,p_2,s_1,s_2) \\ R_2(p_1,p_2,p_3,s_1,s_2,s_3) = p_2 \times D_2(p_1,p_2,p_3,s_1,s_2,s_3) \\ R_3(p_2,p_3,p_4,s_2,s_3,p_4) = p_3 \times D_3(p_2,p_3,p_4,s_2,s_3,p_4) \\ R_4(p_3,p_4,s_3,p_4) = p_4 \times D_4(p_3,p_4,s_3,p_4) \end{cases}$$

where $p_i(s)$ is the price of the service of the firm i.

Game theoretical model of quality choice is a two stages model, when the choice on each stage is done simultaneously.

- On the first stage firms i choose quality levels s_i;
- On the second stage firms i compete in prices p_i . It is assumed, that after the first stage all quality levels are known to both companies and consumers.

The choice on the first stage is made subsequently and on the second stage - simultaneously.

This game theoretical model should be solved using the backward induction method. It means that Nash equilibrium is fined in two steps. On the first step assuming that the quality levels are known we find prices $p_i^*(s)$ for services offered by each firm. On the second step, when the prices $p_i^*(s)$ are known we find quality levels $s_1^*, s_2^*, s_3^*, s_4^*$ in Nash equilibrium for firms 1, 2, 3, 4 correspondingly.

To solve the problem MATLAB algorithm similar to the one described in Section 2 is used. Here the Service quality is chosen in 4 subsequent steps.

4. Quality Estimation

In this research the quality is managed using game-theoretical approach which leads to the problem of quality measurement. The quality is observed from customer point of view. We introduce integrated service quality which means the composite index of consumer satisfaction with the service. The quality may have any value from the unit interval [0,1]. In situation when a customer is totally satisfied with received service, the quality of service is equal to one.

Service is represented as a set of characteristics, which should be measurable, precise and reliable. If characteristics are measurable, it is possible to predict them,

choose, plan, control and therefore manage. Only in this case the total quality can be objectively calculated and can be used to provide managerial recommendations.

In order to calculate service quality in the current state the results of questionnaire the program ASPID 3W by Hovanov (2004) is used. ASPID 3W is based on the method of summary measures. This method is universal and can be used both for product and service quality evaluation. The main idea of this method is to summarize all assessments of one complicated object into one united estimate, which will characterize the quality of this object. The method can be applied to any multivariate object: complicated technical systems, different versions of managerial, organizational and investment decisions, consumers' goods and services, etc.

The main steps of quality calculation using ASPID 3W are:

1. All initial characteristics are summarized in vector $x = (x_1, \ldots, x_m)$. Each of these characteristics is essential for quality calculation, but they became useful only after summarizing in one united indicator.
2. After that, vector $q = (q_1, \ldots, q_m)$ is formed form individual indicators, representing the function $q_i = q(x_i; i)$, $q_i = q(x_i; i)$ corresponding to the initial characteristics and evaluating the tested object using m different criteria.
3. The type of synthesized function $Q(q)$ is chosen which is corresponded with vector $q = (q_1, \ldots, q_m)$. Function $Q(q)$ is depended on vector $w = (w_1, \ldots, w_m)$ of non-negative parameters which determine relevance of independent indicators for aggregated estimation: $Q = Q(q) = Q(q; w)$.
4. The meaning of parameters $w = (w_1, \ldots, w_m)$ is determined. These parameters are interpreted as the weights which show the influence of independent characteristics $q_1, \ldots, q_m$ on Q. Assume that $w_1 + \cdots + w_m = 1$.

To sum up, the quality of services offered by each mobile operator is calculated as weighted sum of all characteristics of services (coverage area, speed and quality of data communication, quality of voice transmission, availability of mobile services offices and payment points, number of additional services, availability of tariffs and their diversity, technical support) multiplied on average price for this service. Weights are calculated using the results of the survey and are based on customers' satisfaction.

5. Experimental Section

5.1. Fitness Industry in St. Petersburg

The main aim of the empirical study is to test theoretical models for some industrial market. To do that first fitness industry in St. Petersburg, Russia is analyzed and we find out the quality levels of services offered by the companies in this market. For this purpose the questionnaire is used. The main research tool is questionnaire and it was conducted in St. Petersburg.

St. Petersburg and Moscow - two capitals of fitness industry (Moscow accounts more than 53 % Russia's national turnover, St. Petersburg - 17 %). In the end of 2008 (pre-crisis period) the center "Evolution - Sports Consulting" estimated that in St. Petersburg, there were 377 fitness clubs, but in the crisis period their number decreased dramatically (Fitness market in Russia. The results of 2010 and forecast for 2014. Analysis of price dynamics).

At the moment the market of fitness services in St. Petersburg has about 350 fitness clubs. According to the Fitness Faculty Company, in St. Petersburg since

the crisis the number of fitness units increased by 20 %, while only in 2012 this figure raised by another 40 %. In general, the potential growth of the market in the North-West region, according to the forecast of "TOP Fitness" is estimated in to be approximately 25-35 %.

At the moment, the St. Petersburg fitness industry is represented by chain and non-chain clubs, among them a leader in the market are chain players. It should be noted that this market is fairly strong with respect to local chains and clubs, which consequently reduces the number of representatives of Moscow (and thus the Russian leaders) presented in St. Petersburg. For example, the leaders of the market share in Russia - Russian Fitness Group (World Class clubs and FizKult) and Strata Partners (Orange Fitness and CityFitness) have, respectively, 5 (3 and 2) and 1 (0 and 1) clubs on the market. In addition, most of Moscow chains significantly weakened during the crisis.

Here is the list of the main leaders of the market, i.e. main chain clubs, which leadership is determined by the number of clubs on the market of St. Petersburg:

- FITNESS HOUSE
- SPORT LIFE
- ALEX Fitness
- Fitness Planet
- OLYMP
- Extra Sport

However, given the territoriality of competition, it must be mentioned that most chain clubs are widespread may lose to single clubs or chains with fewer clubs. Among the well-known medium-sized but successful regional players are:

- FIT FASHION
- TAURAS FITNESS
- WORLD CLASS
- The Flying Dutchman
- Neptune and others.

5.2. Service Quality Levels Evaluation

In order to evaluate current fitness club service quality levels the questionnaire was used as a main source of information. Dr. Harrington highlights in his works the essential role of questionnaires in quality evaluation (Harrington 1991) as they help to estimate the level of customers' satisfaction with the offered quality of services. The questionnaire was developed by authors and based on the SERVPERF approach to service quality evaluation.

In the paper we suppose that the fitness service has five characteristics which influence the satisfaction of consumers and their choice of the fitness club:

- Fitness club image,
- Gym,
- Rooms for group training,
- Timetable and variety of classes,
- Administration.

Table 2: Quality characteristics: club image component.

Code	Description
$M1.1$	Nice and comfortable location
$M1.2$	Comfortable parking space
$M1.3$	Pool is big and clean
$M1.4$	Interior is comfortable and pleasant
$C1.1$	Useful and informative web site
$H1.2$	High quality (professional) reputation
$U1.1$	Atmosphere of trust and understanding between clients and club workers
$H1.2$	The promises on service quality were fulfilled
$M1.4$	Variety of additional services (fitness-bar, medical service, etc.)

Each component is evaluated according to five quality dimensions of SERVPERF approach: tangibles, reliability, responsiveness, willingness to help customers and provide prompt service, assurance, empathy.

1. Club image or general characteristic of the club. This component describes the provider of the service, its location, reputation, reliability and other.

2. Gym and rooms for group training are described with the characteristics listed in the Table 3 and evaluated by the consumers only if they attend the gym and rooms for group training correspondingly.

Table 3: Quality characteristics: gym and rooms for group training component.

Code		Description
Gym	Group rooms	
$M2.1$	$M3.1$	Modern equipment is used
$H2.1$	$H3.1$	Safety level is good enough
$U2.1$	$U3.1$	Personnel is professional and has high competences
$O2.1$	$O3.1$	Personnel is attentive to clients' interests
$M2.2$	$M3.2$	Personnel is good-looking
$C2.2$	$C3.2$	Personnel has individual approach to each client during the training class

3. Timetable and variety of classes component may significantly influence the decision of the client to attend group training. That's why this component is considered separately.

4. Administration includes administrators of the club and sales departments employee.

Thus, the questionnaire comprehensively evaluates the perceived service quality by identifying and assessing the importance of each component of the service from the point of view of the client, and the level of satisfaction and importance of each quality characteristics.

To check the questionnaire on the criteria of clarity and accuracy the pilot test was conducted on the 15 respondents. Testing was made in the form of personal

Table 4: Quality characteristics: timetable and variety of classes.

Code	Description
$M3.1$	Group trainings are interesting and different
$C3.1$	Timetable is appropriate
$C3.2$	Timetable is prepared with respect to clientsâĂŹ demands and desires
$O3.1$	Demands on timetable changes are considered quickly

Table 5: Quality characteristics: administration component.

Code	Description
$M4.1$	Personnel is good-looking
$U4.1$	Personnel is polite
$C4.1$	Personnel has individual approach to each client problem
$O4.1$	Personnel solves clients' problems quickly
$H4.1$	Clients are informed quickly and on time

interviews, which made it possible to compile a complete set of requiring corrections or clarifications of the final questionnaire.

Sample description. The clients of the following four clubs participated in the interview:

1. OLYMP
2. FITNES FAMILY
3. FITNESS HOUSE
4. SPORT-LIFE

120 customers of the clubs participated in the survey (30 people from each club). The sample is uniform in the sense that there were almost equal number of men (40 %) and women (60 %), family (42 %) and single (58 %) customers. This allows us to understand better the difference among client groups , as well as to carry out a comparative analysis. It was also found that the biggest age group of customers of fitness services in St. Petersburg are the customers in the age of 20-29 years (42 %) and 30-39 years (34 %) with middle -income (54 %) and above average (37 %). It is interesting to notice that most of the customers of fitness services are occupied in the top management (24 %).

Based on the structure of the questionnaire during an interview respondents rated the quality of fitness services as a set of certain service characteristics. Therefore we present an assessment of service quality as a generalized quantitative characteristic, which is the aggregate indicator of quality, and thus determines the quality of fitness services in general as an integral quality (Gladkova, Zenkevich, Sorokina, 2011).

In order to calculate the service quality we used ASPID-3W (Hovanov, 1996), and conducted quality evaluation process, as follows:

1. The evaluation of composite indicators of perceived quality for each of the components of the four clubs: the image of the club, the gym, group training classes, the variety of classes and timetable, and administrative staff;

2. The calculation of integral measures of perceived quality of the components for each of the four clubs
3. The calculation of the composite indicator of the perceived service quality for each club : α_1-OLYMP, α_2-FITNESS FAMILY, α_3-FITNESS HOUSE, α_4-SPORT LIFE, where α_i: $0 < \alpha_i \leqslant 1$ (respectively, $\alpha_i = 1$ characterizes the quality perceived by the consumer as the maximum and gives him the most satisfaction).

The weights for processing ASPID-3W are the averages of the importance of each characteristic (for step 1) and the average of the importance of components (for step 2). In the Table 6 the average importance of each characteristic and component of the service are presented.

As the prices for the fitness services in each club, we take the standard figures listed in the price page on the websites and calculate the average for each club (see Table 7).

As a result of the procedures described above were obtained the evaluation of integrated fitness service in each club (see Table 8).

5.3. Service Quality Level Choice under Competition

It is assumed that each customer is characterized by inclination to quality (Gladkova, Zenkevich, Sorokina, 2011) , which can be calculated from the information that we got from the questionnaire. For this purpose the respondents were asked about the maximum prices they are ready to pay for the fitness service.
In order to apply game-theoretic modeling to determine optimal strategies for service quality for competing clubs on the investigated geographic market, it is necessary to formulate and test hypotheses about the distribution of customers of fitness clubs by the inclination to quality. Using the Kolmogorov-Smirnov test the hypothesis on the exponential distribution was tested and accepted at the level of significance 0.05.

Also from the price information the respondents are ready to pay for the services we found that the distribution parameter equal to the reciprocal of the sample mean is equal to 0.0666.

As a result, it was found that the characteristic penchant for quality has an exponential distribution. In the case of the exponential distribution of inclination to quality the game-theoretic model presented in the Section 2 can be applied to the of oligopoly competition of fitness clubs on the investigated geographic market. This model is a development of a game-theoretical model of duopoly in a vertical differentiation J. Tirole (Tirole, 1988) , which is applicable in the case of a uniform distribution of inclination to quality. In addition to the basic model of J. Tirole, there are also various modifications and improvements of the model for different cases. The solution of the model is realized in MATLAB as follows:

1. Arrange all the players according to their current quality levels (see Table 8)? Where the first player is the one with highest current integrated quality level.
   - OLYMP - current quality = 0,639,
   - FITNESS FAMILY - current quality = 0,597,
   - FITNESS HOUSE - current quality = 0,583,
   - SPORT LIFE - current quality = 0,614.
2. Using the value of the distribution parameter = 0.0666, we calculate the equilibrium quality strategies of the players, while setting the desired quality for

Table 6: Average importance of each characteristic and component of the service.

Characteristic Name	Importance	Group Name	Group Importance
Nice and comfortable location	6,53	Club Image	2,929
Comfortable parking space	5,40		
Pool is big and clean	6,25		
Interior is comfortable and pleasant	5,75		
Useful and informative web site	5,00		
High quality (professional) reputation	5,92		
Atmosphere of trust and understanding	6,36		
The promises on service quality were fulfilled	6,32		
Variety of additional services (fitness-bar, medical service, etc.)	6,08		
Modern equipment is used in the gym	5,96	Gym	3,541
Safety level in the gym is good enough	5,58		
Group training personnel is professional and has high competences	4,95		
Group training personnel is attentive to clients' interests	4,79		
Group training personnel is good-looking	4,48		
Group training personnel has individual approach	4,84		
Group trainings are interesting and different	5,23	Timetable	3,035
Timetable is appropriate	5,40		
Timetable is prepared with respect to clients' demands and desires	5,11		
Demands on timetable changes are considered quickly	4,93		
Administrative personnel is good-looking	6,24	Administration	2,518
Administrative personnel is polite	6,49		
Administrative personnel has individual approach	6,22		
Administrative personnel solves clients' problems quickly	6,38		
Clients are informed quickly and on time	60,34		

the leading player 0.9. Note that according to the model the quality is established (achieved) by the players in the order selected on the first step. Then, the equilibrium service quality strategies are as follows:

- OLYMP - equilibrium quality = 0,9,
- FITNESS FAMILY - equilibrium quality = 0,77,
- FITNESS HOUSE - equilibrium quality = 0,71,
- SPORT LIFE - equilibrium quality = 0,66.

Table 7: Prices of fitness services in each club, rub.

Club	Service price, RUB
OLYMP	20 638
FITNESS FAMILY	16 453
FITNESS HOUSE	16 830
SPORT LIFE	14 500

Table 8: Integrated fitness service quality.

Club	Integrated quality level α_i
OLYMP	0,639
FITNESS FAMILY	0,597
FITNESS HOUSE	0,583
SPORT LIFE	0,614

3. Further, in accordance with the equilibrium quality players simultaneously set prices for their services. Prices are set by the players in accordance with the laws of competition: the player with the highest quality has the right to charge a higher price, then the player with the lowest level of quality in setting a high price only to lose their customers.

Table 9: Modeling results.

Club	Integrated quality	Average current price	Equilibrium price	Equilibrium quality
OLYMP	0,639	20,64	22,64	0,900
FITNESS FAMILY	0,597	17,09	17,94	0,758
FITNESS HOUSE	0,583	16,83	16,33	0,684
SPORT LIFE	0,614	14,50	15,09	0,764

The equilibrium price and the equilibrium service qualities are the optimal strategies for the competition on the considered geographic market.

4. The use of optimal price and quality strategies will lead the companies to the following market shares:
   - OLYMP - 43 %,
   - FITNESS FAMILY - 34 %,
   - FITNESS HOUSE - 18 %,
   - SPORT LIFE - 5 %.

   It should be noted that in this model we assume that the players are rational and tend to increase (or maintain) its own market share and increase revenue (or maintain the level of revenue).

6. Results and Discussion

First of all, it is interesting to investigate the market shares of the fitness clubs on the geographic market. Exploring the fitness clubs, it was found that the behavior

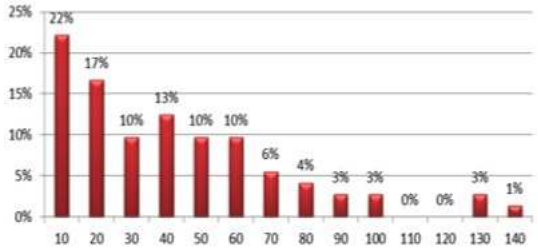

Fig. 3: Respondents distribution by inclination to quality.

of these clubs on the regional market can be described by means of four competitive roles (Kotler et al , 2007, 489–521).

The leader of this market is the territorial club OLYMP, which appeared earlier than the others in the market, has a large customer base and is often a leader in the introduction of price changes, the presentation of new programs, sporting goods and other services in their package.

FITNESS FAMILY is a contender for the leadership without any doubts, who uses violent methods to fight for market share.

The follower is the club FITNESS HOUSE, who used soft policy to retain its market share. Finally, SPORT LIFE which is characterized by the limited services provided for customers (SPORT LIFE has no pool, also has a small area, only one hall for group training and gym), focuses on a niche segment, attracting students and low-income clients to the club (a student club cards).

However, despite the various competitive roles, the major players except SPORT LIFE have equal shares of presence in the market, which is a consequence of undifferentiated quality and exceptional price competition, which is wide spread among fitness. SPORT LIFE retains share of 10 % due to low capacity.

According to the modeling results, players will need to improve the services quality following the leader, as well as to amend the prices (in accordance with the objective maximization of the revenue). This will lead to the change in their future market shares. It should be noted that the redistribution of shares will occur only as a result of specific programs aimed to improve the service quality of leader club, which should allow differentiating the leader from other players without price differentiation.

Differentiation in quality is a major problem to retain players' market shares. It can be seen that despite the decline in the shares, OLYMP's competitors still have to improve the quality of services at little change in prices. For example, FITNESS HOUSE club in order to retain its share of 17 % will have to improve the quality by 20 % (according to the evaluation of the integrated quality), while reducing the cost. An important factor in the evaluation of the results is the ability to set the optimal strategy of the player. Given that this club does not have the information obtained by us during this simulation, we can assume that the strategy will not be implemented, or will not be held lower prices, i.e. strategy will be implemented partially. In connection with this, the FITNESS HOUSE club's market share and revenue will be even smaller, and the rested share and capital will be distributed among the other competitors.

According to the modeling results it was shown that almost without changing the quality and prices (changes to 7 % and 4 %, respectively) SPORT LIFE club

is able to secure a share of 4 % to settle for a niche market. Note that the player SPORT LIFE in comparison to its competitors is fairly weak player and supports its existence only on thee niche market (in practice it acts in a democratic segment). The share of player SPORT LIFE is rather dependent on the policy of FITNESS HOUSE. If FITNESS HOUSE doesn't hold its share the customers can switch to the SPORT LIFE club and this will increase the competitiveness of the latter. However, if the implementation of the new policy is successful and if the quality reached the optimal level, the player FITNESS HOUSE can even win the share of SPORT LIFE (take its niche consumers the students by offering student card at a comparable price). This may raise a question of the existence of the fourth player. As a result of strong competition and service quality improvement, the very existence of this chain on the market is under consideration with the club gets under question. The market share of SPORT LIFE reduced almost by half, which is quite possible, and this will make it unattractive for business owners who may decide to close this club or remodel it entirely. When SPORT LIFE leaves the market its market share will be distributed among the remaining players.

Player 3 and 4 are similar enough in the sense of their possible ways of development. As a result of OLYMP's actions, their market shares will be reduced significantly despite the improvement of the service quality (the fact that the share will grow with the clients of players 3 and 4 should be considered when developing a marketing strategy). The vast number of customers of these clubs may not decrease at all or just slightly due to the development of the fitness industry and the appearance of new customers. Consequently, in the long term these clubs will lose its positions on the market and either leave the market or make a total renovation.

Finally, the main competitor, according to the staff of OLYMP, is FITNESS FAMILY club (quite big club with a low fullness level). It has considerable potential to increase its market share. The market share value of this club in thee equilibrium, which was obtained in Section 3, restrained only by a successful and increasing differentiation of the club OLYMP. FITNESS FAMILY will increase its share from the "mediocre" position of the above players 3 and 4. Its quality should to be improved by 29 % when the price only by 5 %, but given the "weak position" in quality, which are the characteristics of the personnel (gym and group training) as well as the variety of proposed activities, it can be said that these shortcomings in the service typical enough for a new player in the fitness service market. As practice shows, the cubs quickly improve these disadvantages and may become a leader of the investigated market.

The situation for OLYMP club is rather complicated: it is necessary to improve the service quality by 40 % , raising the price by 10 % only. It is understandable that this strategy is aimed not only to the increase of market share but to hold the aggressive competitor FITNESS FAMILY. OLYMP must devote all its efforts to achieve the optimal level of service quality to avoid the unfavorable scenario.

7. Conclusion

Therefore as a result of the research we developed the best strategies for each player of the investigated territorial market. On the basis of competitive analysis we evaluated the reality of these strategies implementation for each player. In addition, we also confirmed the competitiveness and potential of leadership of the club FITNESS FAMILY and its "danger" as a competitor for the club OLYMP. Therefore,

Table 10: Strategic quality and price changes for equilibrium achievement.

	Change of integrated quality		Change in price strategy	
Club	Value	%	Value	%
OLYMP	0,26	40,85 %	1,997	9,68 %
FITNESS FAMILY	0,17	28,64 %	0,8523	4,99 %
FITNESS HOUSE	0,13	21,44 %	-0,4978	-2,96 %
SPORT LIFE	0,04	6,84 %	0,5944	4,10 %

we reiterate the need to improve the service quality of the club OLYMP to preserve leadership on this market.

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