

The logical-mathematical model of career success: the analysis of indicators of professional success of employees in a sales company

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Abstract.

The significance of the problem presented in the article is explained by the fact that the increasing level of professional performance success of employees of a sales organization in terms of rapidly changing Russian economy, as part of the world economic system, has a direct impact on the stability of the enterprise.

The purpose of the article is to develop a logical-mathematical model and to determine the factors that affect the success level of professional performance of sales company employees.

The major methodology applied in the research is the mathematical modeling method carried out by means of the discriminant analysis, which was implemented in order to discover the criteria that significantly divide employees into the successful and unsuccessful ones based on their level of professional success, as well as to develop a logical-mathematical model of the career success of sales companies' employees.

The structure of the logical-mathematical model of performance success of sales company employees includes one main as well as two additional formulas, in which the substitution of the values of the corresponding indicators of professional success results in the definition of a level of career success of employees of a trade organization.

The logical-mathematical model is aimed to elaborate on the key indicators that significantly affect the success of professional performance of trade companies' staff members, in relation to which the company psychological department workers (HR managers, business coaches) increase the performance level of employees who demonstrate a low degree of professional productivity.

Keywords: *Career success, an employee of a sales company, a logical-mathematical model, indicators of success, performance success.*

I. Introduction

According to the Rosstat data, more than 1.2 million enterprises and 13.7 million people in Russia engage in the business of retail and wholesale trade [18]. Due to this situation, sales companies encounter the urgent need of selecting and further developing the personnel who could work with clients and who have all the necessary knowledge, skills and competencies that will enable the organization to compete in the market.

The success of any trade company depends on how firmly it will take over and then be able to maintain the market share in its industry, that is how many customers will cooperate with this organization. In order to conduct a successful business activity, sales companies require qualified professionals who possess constantly updating

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knowledge, skills and effective behavior patterns and are able to attract new customers as well as to retain the existing ones [8]. Regarding the situation that implies a wide choice of companies that provide similar services in a particular area, the personnel becomes the key factor. The client chooses not so much the company as the person who represents it.

Otherwise speaking, the economic stability of a company is a result of the professional success of its employees. Therefore, it is important to address the definitions of success of professional activities provided by foreign and national psychologists.

Tolochek V.A., referred to by Kononov A.N., states that scientists constantly introduce new definitions of performance success, depending on the content of the discipline in the context of which they conduct a research, and augment the list of elements that make up this concept [15].

In his monograph, Kononov A.N. made an attempt to summarize the views of researchers on the problem of professional success [15]. It was considered possible to select and present those reflections that are of interest within the scope of the research and the subsequent development of a logical-mathematical model of the professional achievement of trade companies' employees (Table 1). It is crucial to note that nowadays psychology contains a significant number of definitions and interpretations of professional performance success described by different authors. Thus, the table provided in the article does not include complete information on the subject and could be supplemented in the future.

The definition of career success of trade organization's employees proposed by Kononov A.N. on the basis of the theoretical analysis of scientific literature is worth mentioning. According to the opinion of the researcher, the career success of employees is an integral characteristic of professional performance that includes external indicators comprising the sales volume for a certain period of time, the average cost of an order, the number of successful deals made with customers, the ability to build a long-term cooperation with customers, as well as a number of internal indicators that are the work satisfaction, the level of aspiration implementation, the achievement of a certain social status and the personal assessment of both mental and physical contribution to the result.

Table 1. The reflections on the problem of professional performance success provided by national and international psychologists

The national researchers		The international researchers	
Berezhnaya N. I.	Performance success is an integral notion that includes psychological and psychophysiological characteristics of personality that contribute to the achievement of productivity and efficiency of work. In addition, the employee must possess the knowledge, skills and competencies needed for a certain profession.	Judge T.A., Kammeyer-Mueller J.D.	Performance success is a combination of two key elements: on the one hand, it is the positive performance results accumulated by the employee throughout the career, and on the other hand it is the psychological characteristics and qualities that contributed to the top professional achievements.
Klimov	Career success is the	Gungor P.	P. Gungo defines

E.A.	productivity of its subject in the process of work. This category is related to the efficiency and quality of the activity performed.		professional performance success considered in a broad sense as what is done or not done by the employee, whereas in a narrow sense this notion applies to the worker's productivity, that is estimated by the amount of the product manufactured per unit of time, as well as its quality in accordance with the established standards, the timeliness of the product release and the amount of working time spent on production.
Antsyfero va L.I.	According to Antsyferova L.I., the sense of success in the working process is a relatively stable system of person's feelings regarding the results achieved and is based on the level of aspiration and self-esteem of a subject. The success instigates the holistic development of a personality and influences the further professional identity.	Dedrick D.L., Gardner D.G.	According to the opinion of the researchers, the professional performance success implies the degree of professional achievement of an employee in a certain period of time.
Busygina I.S., Kornienko A.V.	Performance success is a set of personal characteristics of an employee. Also, the worker's awareness of the personal achievements obtained through the entire career path contributes to further professional development.	Dessler G., David F.	It is proposed to consider the performance success as a result of a combination of motives, competencies and productivity of an employee.
Efremova O.I.	The researcher regards the success of a	Spencer L.M.	The performance success is a combination of

	<p>professional activity as a positive result of the individual's performance in the process of achieving significant goals or implementing a designed plan. The performance progress of a subject is closely related to the goals of society and is regarded as a criterion for evaluation, recognition, approval or censure of the individual expressed by society. The professional success instigates self-development and self-fulfillment of the individual.</p>		<p>knowledge and skills of an employee in addition to the personal qualities and talents.</p>
<p>Zibrova E.A.</p>	<p>The professional success is the achievement of complete success in a professional sphere, which is reflected in the absence of mistakes, as well as in efficiency and quality of work.</p>		

The views of the psychologists presented in Table 1 indicate that in the global psychological science, the considerable attention is paid not only to the accuracy of employees' performance of their professional duties, but also to their personal qualities, which are all combined into the level of professional success.

A number of sales companies focus on the introduction of new products and services. However, this approach solves only a part of the problem of company's economic success, since innovations themselves do not produce results if they are not supported by competent work of salespeople. The recognition of a particular product and company occurs only due to the professional skills and personal qualities of an employee. The personality of a particular person plays a crucial role [19].

The career success of an employee is of great importance both for the enterprise and the employee, since the success of an individual will ultimately contribute to the achievement of company goals [13].

It is important to note that almost every employee of a trade organization is able to achieve significant results in the activity, as the majority of workers obtain all the qualities needed. Professional skills and competencies could be acquired in the course of work and are considered as secondary, while the employee's personality traits play a major role [2].

The income stability and a firm position of a sales company in the market directly depends on the ability of its employees to build a long-term cooperation with clients. The formation and further development of a strong partnership with clients is achieved only due to the personal qualities of the employee [3].

The fact that the head of the enterprise or a sales department is aware of strengths and weaknesses of the

personality of each employee gives an undeniable advantage over other organizations and is considered as one of the most important criterion for the successful performance of employees, as well as the entire company [4].

Moreover, it should be taken into account that the professional success of an employee depends not only on the intelligence, but also on the emotional factors and personal characteristics [6].

The purpose of the research is to determine the professionally significant qualities that have an impact on the level of success of professional performance of employees in a sales company and to create a logical-mathematical model of professional success based on the data obtained. In order to implement the research plan it is necessary to select the appropriate method for assessment of the level of professional performance success of employees.

Table 2 provides a brief description of features of existing methods for personnel assessment applied in companies [15].

Table 2. Methods applied for the evaluation of work performance success of employees

Performance evaluation method	Description of a method	Features of its implementation
Ranking method	A list of employees is compiled based on their degree of success in the organization by assigning them an individual rank.	Ranking criteria are not always objective and definite.
Method of rating scales	In order to assess the success of employees, a number of key criteria and a scale of numbers each representing a different rating are provided. Thereafter, an employee is evaluated and the level of success is determined for each of the criteria.	It is the most common method.
Essay evaluation method	An expert describes the strengths and weaknesses of a subordinate in terms of professional performance either in free or specified form, focusing primarily on the employee's skills and competencies.	The assessment criteria could also include the employee's qualifications, previous achievements, and recommendations for further professional development
Critical incident technique	The evaluation process focuses on the employee's behavior during specific, real-life situations that could have a significant impact on the productivity and success.	The expert manager might keep record of situations under discussion and then analyze as well as discuss them with the employee evaluated.
Management by objectives	The level of professional success of an employee of a sales enterprise is determined on the basis	The method under consideration includes three important elements: the formation and

	of achieving the objectives set by the management.	setting of an objective, the process of achieving the results desired and the subsequent evaluation of the employee.
Behaviorally anchored rating scales (BARS)	The method combines the constituents of a traditional rating scale method and critical incident technique.	Unlike rating scales, behaviorally anchored rating scales are applied to determine the success of an employee, using a description of specific behavior instead of a generalized gradation "high, medium, low". This implies that the evaluation criterion is more accurate and understandable for the expert which instigates the increase of the objectivity of the ratings and the reduction of likelihood of errors during the process of rank interpretation.
360-degree feedback	360-degree feedback is considered to be one of the most popular methods. It comprises results on several levels obtained not only within the organization, but also from external sources. This particular aspect distinguishes this technique from traditional methods of personnel evaluation that consist mainly of feedback on the employees provided by management. Performance success is evaluated by the employee, the colleagues as well as by internal and external customers (those who, in one way or another, use the products or services of the employee).	The distinctive feature of a 360-degree method is the shift of responsibility for evaluation results onto more than one person, which allows to eliminate the problem of biased attitude towards the employee on the part of the manager to a great extent, thereby increasing the impartiality during performance evaluation of the worker's activities. The information on employee's performance obtained from external sources who interact with the worker allows to regard the results of the activity from a variety of points of view. The participation of several people in the course of employee evaluation makes the process and its results more accurate and impartial for the employee. However, the engagement of multiple participants in the assessment requires plenty of time and financial expenditures, as

		<p>well as confidentiality.</p> <p>It is important to remember that employees participating in the evaluation of their colleagues often express positive review on each other, which leads to the high results, yet poorly reflects the level of their real professional success. There is the opposite situation that implies that the results obtained from subordinates or colleagues of the evaluated employee might be intentionally low in order to remove the employee from the position and to undermine the professional's credibility.</p>
<p>720-degree feedback</p>	<p>This method is a variation of the 360-degree feedback.</p>	<p>It is supposed to reevaluate the employee according to the previously developed criteria and scales in order to identify the dynamics of the professional success.</p>
<p>Expert evaluation method</p>	<p>The method is applied through the involvement of experts who are provided with a list of professionally significant qualities of employees. Relying on their knowledge and experience, the experts grade the value of a particular quality.</p>	<p>1. The method displays low-quality results on condition that the employees involved in success evaluation have a short employment period in the organization. In case this situation occurs due to objective reasons, the decision on the employee should be specifically balanced.</p> <p>2. The method allows to receive the up-to-date information on the performance success of the evaluated employees, however, it is not possible to make projections on their career development in each instance.</p> <p>3. In certain situations, experts might demonstrate bias during the assessment. This could be proved by drastically different results of particular employees.</p> <p>4. Occasionally, experts</p>

		fail to estimate the success of employee's performance on the context of a proposed criterion, due to the lack of awareness of personal characteristics of the evaluated employee. In the situation described, it is preferable to evaluate only the criteria which the expert is fully confident in.
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Based on the analysis conducted, the expert evaluation method was selected in order to carry out the assessment and to develop logical-mathematical models of performance success of sales companies' employees.

The method under consideration is a special type of evaluation of qualitative and quantitative aspects of professional activity of employees and is applied to provide the differential assessment of various criteria of the work performance success. It is based on the evaluation of particular characteristics conducted by the experts, who are provided with a list of professionally important qualities of the employees. The method is applied for the purpose of differential evaluation of various criteria concerning the success of professional performance. This allows to identify the individual differences between employees of a company and to assess the willingness to carry out professional activities of both a particular employee and the entire personnel, as well as to assess the performance of employees and create a system for the professional selection of employees [15, 16].

II. Materials and Methods

In order to develop a logical-mathematical model of career success of sales company's employees, the expert evaluation method was applied with the use of "Otto Lipmann's questionnaire for the professions mostly involving mental work", which includes 83 items [1].

A group of experts, consisting of 31 executives of a sales company, selected 35 professionally significant qualities of employees (that are the criteria for professional success), which, in their opinion, affect the level of professional success. Each expert reviewed the proposed questionnaire, assigning a value from 0 to 2 to each quality, where 0 denotes that the quality is not important; 1 – the quality is preferred; 2 – the quality is required.

The assessment scale from 0 to 5 was associated with each professionally significant quality selected by experts and included in the expert questionnaire. In the process of the evaluation of employees, "0" was set by the expert in case the employee does not possess the quality, and "5" – if it is strongly displayed.

The following levels of performance success of the sales company's employees, selected for the research, were calculated with the use of descriptive statistics methods: 0 to 2.3 denoted a low level of professional success; 2.4 to 3.5 indicated an average level of professional success; 3.6 to 5 defined a high level of professional success.

The IBM SPSS Statistics v 21 statistical software package was used in order to further process the received data.

Discriminant analysis was conducted to create a logical-mathematical model of the performance success of the employees in the sales company.

The research was carried out in 17 cities of Russian Federation (Moscow, Saint Petersburg, Nizhny Novgorod, Yaroslavl, Kaluga, Tula, Ryazan, Vladimir, Tver, Vologda, Cherepovets, Voronezh, Lipetsk, Rybinsk, Ivanovo, Kostroma and Obninsk). It was conducted on the basis of the enterprise that engages in the business of retail

and wholesale trade of office supplies (stationery, paper products, office and household appliances, furniture, household goods) on the "b2b"market. The study involved employees aged from 23 to 57, with the work experience in the company from 4 months to 13 years. Age and gender differences were not taken into account in the research.

III. Results

The number of employees of the trade organization who took part in the study was (n=384). The employees were divided into three groups (Figure 1) according to the level of their performance success, based on the data obtained as a result of the expert survey, which included 35 characteristics (professionally significant qualities selected by the experts) that are necessary for the successful professional activity of the employees of the sales company.



Figure 1. Distribution of employees by the level of their performance success as a result of the expert survey

Logical-mathematical (structural) model of the professional success of the employees in the trade company.

Tables 3-4 present the results of discriminant analysis of three groups of sales company's employees with different levels of career success.

The data presented in Table 2 displays that the first canonical function (100%) is more informative than the second one (0%), and the canonical correlation coefficient (0.997) is close to 1 and is highly significant.

Table 3. Canonical correlation coefficient

Function	Eigenvalue	% of explained variance	Cumulative %	Canonical correlation
1	192.773 ^a	100.0	100.0	.997
2	.052 ^a	.0	100.0	.222

The first column of Table 4 lists predictors of performance success, which correspond strictly to the ordinal numbers of the criteria of the expert questionnaire of evaluation of employees' career success in the sales company. All predictors significantly ($p \leq 0.00$) divide employees by the level of professional success.

Table 4. Indicators (predictors) that divide employees by the level of performance success

Predictors of performance success	Function	
	1	
The absence of speech impediments; clear articulation (ASI)	174*	151
The ability to quickly shift attention from one activity to another (ASA)	168*	.102
The ability to conduct a scientific conversation, dispute, dialogue, to argue, to prove the point of view (ACSCD)	168*	.090
The ability to find new uncommon solutions (AFNS)	167*	.165
The ability to draw conclusions from contradictory information (ADC)	165*	.084
The ability to notice changes in the environment without consciously focusing attention on them (ANC)	165*	.133
Skill to hold one's own (SHO)	164*	036
The ability to choose the material needed for the solution of a certain problem (ACM)	164*	035
The ability to choose information, that is necessary to resolve a particular problem, from a large amount of data (ACI)	164*	.046
The ability to understand the implications (irony, jokes) (AUI)	164*	.001
A talent for self-observation (TS)	164*	026
An equable temperament, self-control in case of conflicts (ETSC)	163*	.123
The ability to consider the problem from various perspectives (ACPV)	163*	123
The ability to intelligibly explain the thoughts and intentions to the listener (AIET)	160*	.014
Emotional stability while making important decisions (ESWMI)	159*	.150
The ability to rapidly build rapport with new people (ARBR)	157*	006
A talent for a long-lasting high-performance activity (vigor) (TLHA)	157*	062
The ability to take responsibility in difficult situations (ATR)	157*	125

Predictors of performance success	Function	
	1	
Professional observation skills (POS)	154*	.048
The ability to balance attention while performing several actions, duties, tasks (ABA)	153*	.105
Rapid adaptation to new conditions (RANC)	153*	.029
The ability to rationally combine business and personal relations with the others (ACBPR)	151*	.111
The ability to leave conventional standard methods and solutions that have become useless, and look for new extraordinary answers (ALSMS)	151*	.088
The ability to conduct a business conversation, negotiations (ACBC)	164	338*
The ability to see beyond the given and obvious (ASB)	167	.257*
The ability to objectively evaluate one's achievements, strengths and skills (AOEA)	158	255*
The ability to selectively recall the material required (ASRM)	177	.253*
The persistence of being in a good mood (PGM)	162	227*
The ability to act quickly in the conditions of time pressure (AAQCTP)	155	209*
The ability to make the right decision under a lack of required information or time needed for its interpretation (AMRD)	161	209*
A low level of suggestibility, the ability to be immune to the influence, particularly exerted by authority figures (LS)	172	.196*
The ability to make a good impression on people and to establish trust (AMGI)	157	189*
The ability to recognize several possible solutions and select the most effective one (ARS)	163	.174*
Persistence of overcoming the emerging difficulties (POED)	161	.161*
The ability to quickly find the right tone, the appropriate form of communication depending on the psychological state and individual characteristics of the interlocutor (AQFRT)	156	159*
Total:	3	2

The data presented in Table 4, that are the indicators that significantly divide employees into the successful

and the unsuccessful ones by the level of their performance success, indicate that the level of performance success of an employee is determined with 100% accuracy by the main indicators (displayed in this table), 23 of which relate to employees with a high level of performance success; and 12 - relate to employees with a low level of performance success.

Based on the structural matrix and the calculations of coefficients of canonical differential functions (DF), the logical-mathematical model of the performance success of sales company's employees could be written in the form of one main (1) and two additional (2) - (3) formulas:

$$\text{Performance success} = 1\text{DF} + 2\text{DF} \quad (1)$$

where

$$1\text{DF} = 0.685 (\text{ASB}) + 0.578 (\text{PGM}) + 0.558 (\text{AFNS}) + 0.508 (\text{ASA}) + 0.456 (\text{ADC}) + 0.443 (\text{ARST}) \\ + 0.435 (\text{ACBC}) + 0.420 (\text{ACPV}) + 0.409 (\text{ASRM}) + 0.407 (\text{AUIP}) + 0.405 (\text{LS}) - 31.973 \quad (2)$$

$$2\text{DF} = 0.939 (\text{ACBC}) - 0.633 (\text{ASB}) + 0.562 (\text{ATR}) - 0.541 (\text{LS}) + 0.512 (\text{AOEA}) + 0.496 (\text{PGM}) \\ + 0.484 (\text{AUIP}) - 0.470 (\text{ASRM}) + 0.461 (\text{AMGI}) - 0.477 (\text{AFNS}) - 0.432 (\text{ANC}) \\ + 0.441 (\text{ABA}) + 0.408 (\text{ASI}) - 0.344 \quad (3)$$

In order to create a logical-mathematical model, the predictors that have a value of 0.400 or higher were applied.

Using the logical-mathematical (structural) model presented above and substituting it with the values of the corresponding indicators of the level of performance success specified in the model, it is possible to assign any employee of a sales company to one of the levels of performance success with 100% accuracy.

IV. Discussion

Ratios used in psychological studies, various inequations and equations that describe the main patterns within the studied process, system or object, are included in the notion of a mathematical model. Logical-mathematical modeling is a special type of sign modeling and an effective tool (method) applied in psychological research nowadays [5].

Due to the accuracy and unambiguity of mathematical results in the context of description of the main behavioral processes, the interest of psychological specialists to the application of mathematical models in experimental psychological research grows every year [12].

The attention of specialists to the phenomenon of professional success has led to the emergence of a large number of studies aimed to identify the predictors (indicators) of performance success, as well as to classify the criteria, conditions, and indicators of employee success. As an example, the study of the correlation between the level of salary and socio-demographic and gender factors that affect the professional success of employees could be mentioned [17].

Hirsch A. proposed an integrative framework of career performance consisting of four career resources: a) human capital resources, the knowledge, skills and competencies that are important for professional achievements in the activity selected; b) social resources namely the presence of a mentor or social support (performance approval expressed by the influential individuals) of an employee; c) psychological resources, including various positive

psychological characteristics; and d) identity resources, that is one's professional self-concept in a certain sphere, the thoughts and concerns associated with this professional role [9].

Within the framework of this study, the professionally significant qualities selected by experts and included in the logical-mathematical model, are mostly related to "a)" and "c)", that is to various skills and psychological qualities of the employees that contribute to the growth of their professional success level.

Interpersonal communication skills are crucial for the interaction with other people and involve the ability to manage the emotions, in particular, to control the level of anxiety and anger, since this is extremely important for effective teamwork and communication with the others [7].

The predictors of performance success that significantly divide employees by the level of work performance success: "An equable temperament, self-control in case of conflicts (ETSC)" (0.163) and "The ability to rapidly build rapport with new people (ARBR)" (0.157) confirm the views of specialists on the importance of interpersonal interaction skills for employees of sales companies contributing to their professional success.

The psychologists note that as opposed to the other predictors of success, such as conscientiousness or general intelligence level, interpersonal communication skills are unique as they are more manageable and can be adjusted by specialists if necessary [7].

It could be assumed that poor development of interpersonal communication skills or its absence significantly complicates the success of not only an employee of a sales company, but also the entire personnel. By interacting with other people, colleagues, and clients, employees get a better understanding of themselves as well as their own individual characteristics.

In addition, interpersonal communication skills are key, since they have a tendency for development and increase the level of professional performance success of employees, as well as their opportunities for employment and career advancement. These skills are required of the professionals who, by virtue of their professional activity, should establish cooperation with people, manage the work of others, or help people to solve various types of problems [10].

Self-control in case of conflicts is the quality that is extremely important in areas related to interactions with people. Therefore, the employee's willingness to structurally resolve the arising conflicts, which are inevitable in any group, as well as to compromise and to maintain composure, have a direct influence on the career success of the employee in a sales company.

A conflict is an inevitable phenomenon in a company. Disagreements and confrontations between an employee and a manager or a seller and a consumer could contribute to production and organizational changes, under the conditions that they are manageable, and the participants of the conflict possess analytical skills as well as developed personal qualities [14].

V. Conclusion

Thus, the results of the evaluation of performance success of the employees in the sales company conducted with the application of the expert survey based on the "Otto Lipmann's questionnaire" allowed a group of experts consisting of 31 managers to select 35 professionally significant qualities (indicators of success) from 83 criteria. The qualities chosen affect the level of professional success of employees in the trade enterprise.

The findings of the discriminant analysis provided the opportunity to establish that out of 35 professionally significant qualities, 23 relate to the employees with a high level of success, and 12 to the employees with a low level of success and that all predictors significantly (at the level of $p \leq 0.00$) divide employees by the level of professional success.

As a result of the research conducted, the logical-mathematical model of performance success of employees

of the sales company was developed. The model under discussion can be presented in the form of a formula: "Performance success = 1DF + 2DF". The predictors that have a value of 0.400 or higher were applied.

Promising areas of research within the context of the topic could include the study of professional success from the perspective of gender and age differences, as well as the development of special psychological programs aimed to develop the potential of employees of a sales company in order to increase their level of professional success and the stability of the sales company.

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