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COURSE WORK

Theme: *Econometric modeling of employee motivation in IT companies*

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INTRODUCTION

The study of the problem of motivation in international IT companies is relevant, as the IT industry is now one of the fastest growing, and the staff in such companies is the main intellectual resource that determines the success of the company. World practice confirms the high level of development and importance of this sphere of business. The combination of correctly selected personnel in accordance with their competent motivation allows to ensure maximum efficiency and to bring the IT-startup to the next level.

In the context of continuous development of the IT industry and competition on the personnel market, an efficient motivation strategy helps companies retaining the most valuable specialists in their workplaces and reducing the level of outflow of the country's intellectual resources. IT companies realize the importance of human resources in the company and in every possible way try to improve their approach to motivation.

A great contribution to the development of the problem of staff motivation both in general and in the IT industry was made by such scientists as M. Meskon, M. Albert, F. Hedouri, B. Robertson, S. Blank, F. Herzberg, D. McGregor and others.

The object of the study is the motivation of personnel in the IT industry. The subject of the study is the tools of motivation, the features of stimulating employees in the IT industry, methods of implementing motivation, motivational mechanisms.

The theoretical base of the research was the scientific works of researchers, periodicals, Internet information, data from the Harvard Business Review, BBC, Gallup polls, as well as state statistical bodies of different countries.

As for the practical part, the aim of this study was to have better understanding on factors of employee motivation and their association with actual motivation on the workplace in IT organizations. The dependent variable in this study is job motivation. The independent variables are motivational factors namely Flexible work schedule, Remuneration, Advanced Training, Medical Insurance, Access to Innovation, Popularity of the company, Appreciation of work, Equal attitude towards employees, and Freedom to make decisions. Survey method was used to collect data. The research instrument was a structured questionnaire. A total of 20 employees of an IT organization constituted the sample.

In the first chapter of this paper, the theory of the multiple regression analysis will be studied, then, in the second chapter, an analysis of the motivational factors in the IT industry will be made, and finally, in the third chapter, the econometric modelling of the motivational factors in the IT industry is made.

CHAPTER 1 – THEORY OF THE MULTIPLE REGRESSION ANALYSIS

PART 1.1

Definitions and tasks of the multiple regression analysis

Regression analysis is one of the most commonly used statistical methods in practice. Applications of regression analysis can be found in many scientific fields including medicine, biology, agriculture, economics, engineering, sociology, geology, etc. (Yan and Su, 2009).

Multiple regression analysis is a powerful technique used for predicting the unknown value of a variable from the known value of two or more variables also called the predictors. More precisely, multiple regression analysis helps us to predict the value of Y for given values of $X_1, X_2, \dots, X_k$. The variable whose value is to be predicted is known as the dependent variable and the ones whose known values are used for prediction are known independent (exploratory) variables.

In multiple linear regression, there are several independent variables or functions of independent variables. (Explorable, 2009).

In general, the multiple regression equation of Y on $X_1, X_2, \dots, X_k$ is given by:

$$Y = b_0 + b_1 \times x_1 + b_2 \times x_2 + \cdots + b_k \times x_k$$

The general multiple regression model is given by:

$$y = \beta_0 + \beta_1 \times x_1 + \beta_2 \times x_2 + \cdots + \beta_k \times x_k + \mu$$

Where, $\beta 0$ is the intercept; $\beta 1$ is the parameter associated with $x1$; $\beta 2$ is the parameter associated with $x2$, and so on.

Since there are "k" independent variables and an intercept, equation contains "k" unknown parameters. For shorthand purposes, reference to the parameters other than the intercept are said as slope parameters.

Partial correlation indicators are widely used for solving the problem of selecting factors; ranking of factors involved in multiple regression. Paired and partial correlation coefficient are thus used as an indicator of tightness of the multiple regression analysis.

Within a multiple regression model, we may want to know whether a particular x-variable is making a useful contribution to the model. Given the presence of the other x-variables in the model, does a particular x-variable help us predict or explain the y-variable. To carry out the test, statistical software will report k-values for all coefficients in the model. Each k-value will be based on a t-statistic calculated as

$$t = \frac{(sample\ coefficient - hypothesized\ value)}{Standard\ error\ of\ coefficient}$$

Model specification refers to the determination of which independent variables should be included in or excluded from a regression equation. It uses those tests and r, and by examining the coefficient of determination r^2. r^2 always lies between 0 and 1. The closer r^2 is to 1, the better is the model and its prediction.

The major conceptual limitation of all regression techniques is that you can only ascertain relationships, but never be sure about underlying causal mechanism. Multiple regression analysis is one of the most widely used statistical procedures for both scholarly and applied marketing research. Yet, correlated predictor variables-and potential collinearity effects-are a common concern in interpretation of regression estimates. Though the literature on ways of coping with collinearity is extensive, relatively little effort has been made to clarify the conditions under which collinearity affects estimates developed with multiple regression analysis-or how pronounced those effects are. (Mason, Perreault – 1991)

Two other problems can appear in the multiple regression model: Overfitting, that happens when there are too many independent variables, they account for more variance but add nothing to the model; and Multicollinearity, that happens when the independent variables are correlated with each other.

PART 1.2

The methods of the multiple regression analysis

Statistical methods, such as regression models, are the best tools for investigating any relation between small sample sizes of dependent and independent variables (Razi, Athappilly, 2005). The actual set of predictor variables used in the final regression model must be determined by analysis of the data. Determining this subset is called the variable selection problem. Different kinds of regression techniques exist so the regression model is as complete and realistic as possible.

In the simultaneous method of regression, the most standard one, all available predictor variables are placed in the equation at the same time and they are estimated on the basis of the proportion of variance in the variable Y.
In a simultaneous model, all variables are treated at the same time and on an equal basis. Such strategy is most appropriate when there is no logical or theoretical basis for considering the variables to be better than an other, either in terms of a hypothetical causal structure of the data or in terms of its relevance to the research goals (Cohen, 1975).

Selection methods allow the construction of an optimal regression equation. There are three methods in Multiple Linear Regression which are forward selection, backward elimination and stepwise regression. All three methods can be categorized into stepwise-type procedures (Ghani, Ahmad, 2010).
In the stepwise regression, a combination of forward and backward regression is used. At each step, if the value of r_2 increases, a parameter can be added, and if the value of r_2 decreases or is not significant, the parameter can be removed. All the variables in the model are checked to evaluate their significance in the model. Thus, the stepwise regression method requires to set two significance levels, one for adding variables and one for removing variables.

More precisely, forward regression starts with an empty model, where no variables have been chosen yet (Wang, Wright, Buswell, Brownlee, 2013). Then, the variables are sequentially added one by one to improve the regression model. This choice is usually based on the strength of their squared semi-partial correlations (NCSS Statistical Software).

Conversely, backward regression starts with all the variables already included in the regression model (Wang, Wright, Buswell, Brownlee, 2013). Then, the variables are sequentially tested and the ones least improving the model are deleted on the bases of smallest change in the r^2.

An alternative strategy is the method of hierarchical regression. The variables are included in the model according to a specific hierarchy the researcher set up himself on the basis of the purposes of the study or practicality. This is equivalent to doing semi-partial correlations and requires a real thought process from the researcher (Cohen, 1975).

Although the regression problem may be solved by a number of different techniques, the most popular method is the method of least squares. In least squares regression analysis, the estimates of the parameters are selected so as to minimize the sum of the squared residuals. The predictability of a model is thus often represented by the squared correlation coefficient between the observed and predicted phenotypic values (Xu et al. 2014).

Another method for measuring the adequacy of a regression model is through PRESS (Predicted Error Sum of Square) which is used to check the problem of Overfitting; the smaller the PRESS value, the better the regression model (Wang, Wright, Buswell, Brownlee, 2013).

PART 1.3

Methodology of the econometric modelling using multiple regression analysis

Multiple linear regression is the most common form of linear regression analysis. It is used to explain the relationship between one dependent variable and independent variables. The independent variables can be continuous or they can also be categorical, they are then called dummy variables. Multiple linear regression requires at least two independent variables.

There are assumptions that have to be met in multiple regression analysis:

- There must be a linear relationship between the dependent variable Y and the independent variables x. Usually it is visible on scatterplots.
- Multiple regression analysis requires that the residuals should be normally distributed, the distribution of data should cluster around the mean.
- There must be no Multicollinearity in multiple regression, the independent variables shouldn't be highly correlated with each other.
- The variance of the error terms should be similar across the values of the independent variables; it should be homoscedastic.

In general, the multiple regression equation of Y on $X_1, X_2, \dots, X_k$ is given by:

$Y = b_0 + b_1 \times x_1 + b_2 \times x_2 + \cdots + b_k \times x_k$

The general multiple regression model is given by:

$y = \beta_0 + \beta_1 \times x_1 + \beta_2 \times x_2 + \cdots + \beta_k \times x_k + \varepsilon$

Where, y is the dependent variable, x_1, x_2, x_k are the independent variables, β_0 is the intercept; β_1 is the parameter associated with x_1, β_2 is the parameter associated with x_2, and so on. Since there are k independent variables and an intercept, the equation contains k unknown parameters.

It is usually assumed that the error term ε follows the normal distribution with $E(\varepsilon) = 0$ and a constant variance $Var(\varepsilon) = \sigma^2$ (Yan, Su, 2009).

After choosing the different independent variables, according to one of the methods we have seen in the previous part of this chapter, then, the multiple regression analysis consists of three steps: Analyzing the correlation of the data, estimating the model, and evaluating the validity of the model.

Firstly, all the scatter plots of the independent variables should be checked for correlation. The closer the points are to a straight line, the stronger the linear relationship between two variables. The correlation coefficient r is used to test if there is a linear relationship between the variables. Its value goes from 1 to -1. When $r > 0$ the linear relationship is positive, when $r < 0$ the linear relationship is negative, and when $r = 0$, there is no linear relationship. The paired correlation coefficient (Pearson) is given as follow: $r = \frac{\sum(x-m_x)\times(y-m_y)}{\sqrt{\sum(x-m_x)^2\times\sum(y-m_y)^2}}$,

Where m_x and m_y are the means of x and y variables.

Partial correlation indicators are widely used for solving the problem of selecting factors and are given as: $r_{yx_1\times x_2} = \frac{r_{yx_1}-r_{yx_2}\times r_{x_1x_2}}{\sqrt{(1-r_{yx_2}^2)-(1-r_{x_1x_2}^2)}}$.

In the second step, estimation of the model, a popular method to estimate the regression coefficients is the method of ordinary least squares (OLS). The error term is the difference between the actual Y value and the Y value obtained from the regression model (Gujarati, 2012) and is given by: $\varepsilon = y - \hat{y}$. The OLS method minimizes the sum of the squared error term. The sum of squared error is given as:

$$SSE = \sum_{i}^{n}(y_i - \hat{y})^2 = \sum_{i}^{n}(y_i - \beta_0 - \beta_1 x_1 - \beta_2 x_2 - \cdots - \beta_k x_k)^2$$

The best estimates of the β coefficients are the values minimizing the sum of squared errors for the sample, the closer to 0 the better. After solving the k equations for estimating β, the estimating regression can be written as:

$Y_i = b_0 + b_1\times x_1 + b_2\times x_2 + \cdots + b_k\times x_k + e_i$

Where bs are the estimators of βs and e_i is the residual term. This is called the sample regression model (Gujarati, 2012). The Gauss-Markov theorem starts that the Ordinary Least Squares regression estimator of the coefficients of the model is the Best Linear Unbiased Estimator (BLUE) of the effect of X on Y (Campbell, Campbell, 2008) if the assumptions previously explained are met. Thus the best fit line of the data has the form: $y = mx + b$, where

b_k (slope) = m = $\frac{n(\sum xy)-(\sum x)(\sum y)}{n(\sum x^2)-(\sum x)^2}$ and b_0 (intercept) = b = $\frac{\sum y - m(\sum x)}{n}$.

Finally comes the third step of multiple regression analysis, the evaluation of the validity of the model. This problem is often solved by examination of the coefficient of determination R^2. The measure of R^2 is always between 0 and 1. If the value of R^2 of one of the independent variables is 1, it indicates that it accounts for all the variability of the values of Y in the sample data. Conversely, if the value of R^2 of one of the independent variables is 0, it indicates that it accounts for none of the variability (Hahn, 1973). In other words, R^2 represents the proportion of the variation in Y that is explained by x. The expression of R^2 is given by:

$$R^2 = 1 - \frac{SSE}{SSTO} = \frac{SSR}{SSTO} = \frac{[Cov(x,y)]^2}{S_x^2 S_y^2}$$

Where SSE is the error sum of squares, SSTO is the total sum of square, and SSR is the regression sum of square.

But, the number of independent variables increases R^2, so R^2 increases or stays the same, but never decreases. For this reason R^2 may not be a good indicator for model selection. Instead of R^2, adjusted R^2 can be used to avoid Overfitting.

Another possibility is making a test of significance, usually a F-test that evaluates the overall model by testing a null hypothesis, or a t-test that evaluates the significance of each individual coefficient and the intercept.

All references for Chapter 1 are ([15] … [21])

CHAPTER 2 – ANALYSIS OF THE MOTIVATIONAL FACTORS IN THE INFORMATION TECHNOLOGY INDUSTRY

PART 2.1

The state of the IT industry

The development of the IT sector has been significant for the last few years. According to International Data Corporation (IDC), the United States accounts for more than half of the world's Information Technology activities. Headquarters of the leading IT companies are located in the US and more than a quarter of the world's IT market, representing 4 billion dollars, is in the US. The industry accounts for 7.1 percent of US' GDP and 11.6 percent of the jobs of the private sector. There are more than 100000 IT-companies in the country, more than 99% of which are small and medium-sized businesses (less than 500 employees). [1]

In addition to the US, the most developed countries in the IT sector include China, India, Japan, Britain, Germany and others. As can be seen in Table 1, the most active development in the IT field is shown by countries such as India, Brazil and China with annual growth rates of 19.7%, 15.8% and 8.3% respectively. This suggests that developing countries are on the path of rapid development in the technical sector of the economy, while developed countries are slowing down their development once a certain point is reached. In developing countries, the growth rate of IT spending significantly exceeds the annual growth rate of GDP, which indicates the priority use of information technology to improve the competitiveness of these countries in the world.

	IT costs ($bn)	Annual growth (%)	GDP growth (%)
USA	654,55	3,9	1,9
China	182,74	8,3	7,7
Japan	146,53	3,4	1,5
Great Britain	113,75	4,6	1,7
Germany	98,51	1,7	0,4
France	72,99	-0,5	0,2
Brazil	55,86	15,8	2,5
Canada	50,77	3,3	2,0
Australia	38,84	0,2	2,7
India	37,35	19,7	5,0
Italy	36,44	-0,6	-1,9
Corea	36,17	-3,1	3,0
Russia	34,49	0,8	1,3
Spain	28,82	0,7	-1,2
Netherlands	27,90	-0,2	-0,8

Table 1 - Expenditure on IT in key countries of the world [2]

The general world trend in the most developed countries in the IT sector is such that this industry has become one of the key industries in economic activity. There is a general digitalization of the economies of the world, in which Russia is not yet taking an active part.

It is important to explore not only the general indicators on a country scale, but also the performance of individual IT companies in these countries. The 5 largest IT firms in India, China, the US, EU, Russia and their financial indicators (market capitalization and revenue) are considered.

Country	Company	Market capitalization ($bn)	Revenue ($bn)
USA	Apple	730	234
	Alphabet (Google)	580	74
	Microsoft	497	94
	Amazon	402	107
	Facebook	397	17
China	Tencent	316	22
	Alibaba	305	16
	Baidu	66	10
	JD.com	58	38
	Huawei	1.2	75
India	Tata consultancy service	71	17
	Infosys	36	10
	Wipro	22	8
	HCL Technologies	22	7
	Tech Mahindra	7	4
EU	SAP	129	25
	NOKIA	35	26
	Ericsson	22	25
	Dassault Systemes	24	3
	Sage	10	2
Russia	Yandex	6	1.3
	Mail.ru Group	4	0.75
	NKK	No data	2.3
	Lanit	No data	1.5
	Softline	No data	0.6

Table 2 - Financial performance of the largest IT companies in the world's regions [3; 4]

On this table, a big gap is observable between the financial performance of the largest IT companies in Russia and the ones in the other countries. Only two large IT companies in Russia are public, others do not have market capitalization. This shows that the promotion of this sphere in Russia's economy is slowly proceeding and requires comprehensive measures to accelerate the process of the digitalization, but there is potential and direction in which to strive to achieve the level of their foreign partners.

According to analysts' forecasts, the global cloud computing market will grow from 50 billion dollars to 240 billion dollars by the year 2020. At the moment, Russia accounts for about 0.6 percent of the world's IT products when about 300,000 programmers live in the country. [5]

Thus, even if the country has the potential to become one of the key countries in the IT field, at this stage, in Russia there are too many obstacles to take a leading position in the industry. This includes both legislative limitations and a low level of entrepreneurship development, especially in the IT sphere. However, there is a sufficient field for the development of the industry in Russia, in particular with the development of qualified specialists, new companies and the experience of world companies.

PART 2.2

The analysis of motivation systems in IT companies

In different cultures, in different world markets, different tools are used to motivate employees.

Often, organizations provide their employees with incentives that are not financial. Such incentives are used to improve the employees' life quality by giving them enjoyment and rest time (Earle, 2003). One of the most outstanding examples of companies working on this principle is Google. The company provides various ways to spend time, from game rooms to massages, yoga and a free lunch. In addition, other kind of services are offered, such as, after the death of a company's employee, Google pays his widow or widower 50% of his monthly salary for 10 years [6]. In addition to Google, in the US, other IT giants and start-ups provide scholarships for travel, student loans, cash bonuses for the child birth, and a monthly $30 for books. [7]

In Europe, a similar trend is developing. The most valuable factors of motivation are those that improve the employees' standard of living and make life easier. A variety of stress-related sessions in offices, such as yoga, sports centres and childcare centres in the offices of IT companies, are extremely popular. [7] In addition to the above, it can be noted that improved motivational approaches not only benefit the company and its current employees, but also increase interest in the company of job seekers and future employees.

Thus, innovations in the field of motivation have the following advantages:

- providing a solid basis for the employee to remain productive throughout the day;
- possibility to reduce the cost of medical insurance;
- attraction of future specialists.

In particular, such innovative approaches led to the discovery of another interesting tool for motivation - sleep. A study in Greece showed the benefits of daytime sleep.

It reduces the possibility of heart disease by 37%. [8] Advanced IT companies have realized the importance of sleep for employee productivity, and many of them provide rooms and chairs for daytime sleep in their offices. Companies such as Google or Uber have already accepted this for their usual work practices. [9]

It is important to note the difference in approaches and tools for motivating in different cultures and countries. The study, published in the African Business Management Journal, [10] interviewed employees of European and African companies, more precisely from France, Italy, the Netherlands, Scotland and Nigeria. The poll suggested respondents to place the main motivational factors in the workplace in importance from 1 to 18.

Motivational factor	Italy	France	Scotland	Netherlands	Nigeria
Enough time for family and personal life	9	9	6	5	13
Stimulating tasks	1	1	3	8	2
Less stress at work	17	17	17	17	18
Good working conditions	11	11	9	3	12
Good relations with the superiors	5	5	4	4	6
Reliability of employment	10	14	8	7	3
Freedom in choosing an approach to work	2	3	5	11	10
Cooperation with colleagues	6	4	1	2	7
Participation in decision-making	11	10	12	15	17
Contribution to company success	3	7	7	10	1
The possibility of a high salary	8	12	11	6	5
Bringing benefit the country	18	18	18	18	11
Live in the desired location	4	2	2	1	9
Opportunity for career growth	9	15	10	9	15
Diversity in the tasks	13	8	13	14	16
Work in a prestigious company	14	16	14	13	14
The ability to help others	15	6	16	16	9
Work in a well-defined work environment	16	13	15	12	8

Table 3 - Comparison of the Priority of Motivation Factors for Residents of Different Countries [10]

According to Table 3, the study showed a small difference in the answers between respondents from European countries, but when compared with respondents from Nigeria, the difference was huge.

Nigerian job-seekers noted more conservative factors as the highest priority: the stability of the workplace, contribution to the development and success of the organization and high salaries are of fundamental importance for them. At the same time, respondents from European countries noted that factors related to their personal quality of life are more valuable to them: more complex and interesting tasks, freedom to choose a work process, a good workplace location, cooperation with colleagues and interpersonal relations at work.

The results of this study confirmed that factors motivating employees differ from country to country and from company to company, depending on the environment in which a person works.

Thus, motivating employees is a difficult task. IT companies are especially known for their innovative approach to motivation. Constantly trying and experimenting, in practice they reveal the most effective methods of motivation of employees.

Effective motivation leads to a decreasing level of staff turnover, and employees take less sick leave. In addition, motivation increases the interest of each individual to work, which allows companies to raise their retirement age.

It is important to take into account the cultural and national differences of employees, to pay attention to their preferences and mentality, and also to adapt the approach accordingly with their motivation.

PART 2.3

The situation of the motivational systems for the IT market in Russia

In Russia, one of the main indicators of the effectiveness of HR-managers in the IT industry is the level of automation of management systems and motivation in Russian companies. TeqVentures conducted a study on this issue, highlighting several major Russian IT companies that have succeeded in this field. [11] The study identifies several main problems hampering the development of innovative personnel management in Russia:

- High requirements for software optimization: Russian companies, because of a conservative approach to management, are less inclined to change their business processes and optimize them in order to use solutions provided by the Western market.
- Self-sufficiency: 50% of companies have experience with the creation of their own HR-systems. Some companies, such as Mail.ru Group and MTS, even planned to sell their own developments in this area to other companies.
- Management's strong hierarchy and few responsibilities for employees: In western Europe and America, the technological revolution in the field of personnel management allow for a flat hierarchy and the possibility for employees to be part of the decision process. In Russia, the hierarchy is still mostly vertical and strong within companies.
- The conservative culture in Russian companies leads to a difficulty for employees to adapt to new technological solutions. Leading companies on the market use creative methods of promoting technologies within the company, such as gaming.

In leading Russian IT firms, the experience in integrating new technologies and approaches to staff motivation is more successful. One of the leading Russian IT companies in this field, Mail.ru Group, successfully adapts to these new systems, and implements its own developments in the management of the company. Evgeny

Malikov, the former vice president of the company until 2016, noted how the innovative approach to staff motivation in the company has changed. Malikov argues that the task was not to launch as many technologies in personnel management as possible, but to solve individual problems of employees and businesses with minimum costs and maximum effect. The company uses a variety of innovative ways to engage and motivate its employees, such as online gaming. For example, in order to increase the use of the company's internal network, employees were given access to surveillance cameras installed in the cafeteria and gym of the company, and also given the opportunity to make an appointment with a doctor, a massage institute or a beauty salon. [11] Thus, using such methods for involving and motivating employees, the company managed to achieve a high level of productivity. According to Evgeny Malikov, what in other companies takes from six months to a year, his team is now able to reach in 2-3 months. This shows the effectiveness of the current direction Mail.Ru Group is taking in the field of employee motivation. The company was able to become a leader among IT companies in Russia.

Another Russian company with an interesting approach to employee motivation is MTS. The company also uses traditional methods of motivation, combining them with more innovative tools, such as gaming. To facilitate the control processes in the company, where 6500 managers work, a mobile application was invented that helps them controlling their subordinates. Now, managers can submit ratings and comments to their subordinates after they perform certain tasks. Now the application is planned to run for use in other companies.

MTS vice president for human resources, Mikhail Arkhipov, notes how important it is to involve employees in new technology and practice, or simply to motivate them to work more productively. Recently the company created a useful service that helps employees visualize the organizational chart. Despite the usefulness, only ten people registered in the system. Then, this innovation was presented in a different way - the company created a quest: it was suggested to find a funny picture of a cat on the organizational chart. After 10 minutes, already ten thousand people registered in the system.

Government also got interested. Three years ago, the Ministry of Communications supported a study that revealed the interest of domestic IT companies in using financial incentives, like shares, as a tool to motivate employees. [12] World experience shows the effectiveness of the application of such incentives in IT companies, and it is important that modern companies think about such motivation tools.

It is also important to note that it is impossible to fully automate the process of managing and motivating staff: there are many aspects of human resource management that will not be able to be decentralized, for example everything related to negotiations, conflict resolution, or personnel inspiration. [11]

In general, in Russia, IT companies are the most advanced in matters of employee motivation. [13]

Despite the fact that the Russian industry still lags behind its foreign neighbors in this area, it is clear that advanced Russian IT companies, as well as some start-ups, realize the role of human resources in the company and do much to attract the best personnel, to stimulate them and use the most effective motivation tools.

CHAPTER 3 – ECONOMETRIC MODELLING OF THE MOTIVATIONAL FACTORS FOR THE IT INDUSTRY

PART 3.1

Panel Data Set of motivational factors in IT companies

The objective of the study was to identify the factors associated with employee motivation in IT companies. The data related to this objective were analyzed with the help of multiple regression analysis.

A survey method was used to collect the data. The focus of this research is on twenty employees of the IT company S Media link in Russia. The research instrument used in this study is a structured questionnaire, with factors to grade from 1 to 5 in order of importance for motivation at work, 1 being the less important and 5 the more important. The overall motivation of those employees has been measured and graded from 1 to 5.

Nine factors were first identified. Those factors were; flexible work schedule, high remuneration, advanced training, access to innovation, medical insurance, popularity of the company, appreciation of work and efforts, equal attitude towards employees, and freedom to make work decisions. Thus, the dependent variable in this study is IT companies' employee motivation, and those factors are the independent variables.

Y	*Dependent variable*	IT companies' employee motivation
x_1	*Independent variable*	Flexible work schedule
x_2	*Independent variable*	High remuneration
x_3	*Independent variable*	Advanced training
x_4	*Independent variable*	Popularity of the company

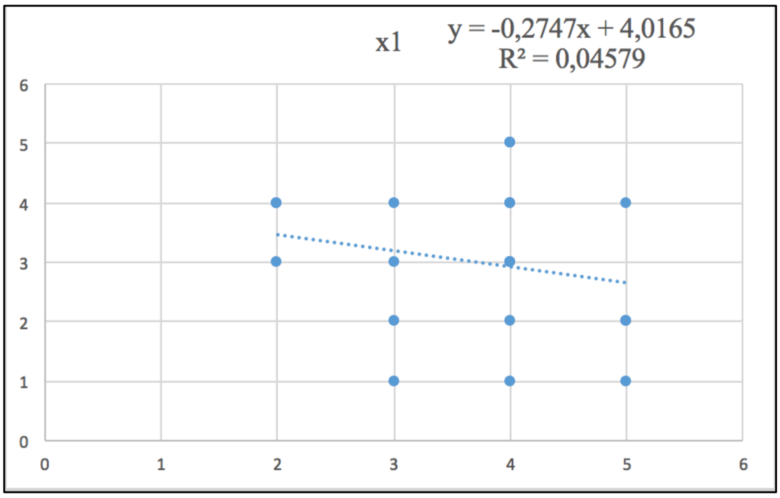
x_5	*Independent variable*	Access to innovation
x_6	*Independent variable*	Medical Insurance
x_7	*Independent variable*	Appreciation of work
x_8	*Independent variable*	Equal attitude towards employees
x_9	*Independent variable*	Freedom to make work decisions

Table 4 – Panel data set

The actual set of predictor variables used in the final regression model must be determined by analysis of the data. Determining this subset is called the variable selection problem. To select independent variables, a simple liner regression model is used, and every variable separately examined.

Y	x1
2	4
2	4
2	3
3	2
3	4
3	1
3	3
4	2
4	3
4	4
4	3
4	1
4	5
4	3
4	5
4	4
5	2
5	2
5	4
5	1

Table 5 – Variable x1 for the construction of the Simple Liner Regression Model



Picture 1 – Scatterplot and trend line for variable x1

By selecting the values given in Table 5, the scatterplot shown in Picture 1 is created. This scatterplot shows no linearity and no strong correlation between the variables, the value of R^2 is not significant.

This means that the relation between the independent variable x1 and the dependent variable Y is weak, and x1 could be deleted from the model at the next step.

To verify and be sure of this previous result, the parameters of the simple liner regression are calculated.

n	Y	x1	xy	x²	y²
1	2	4	8	16	4
2	2	4	8	16	4
3	2	3	6	9	4
4	3	2	6	4	9
5	3	4	12	16	9
6	3	1	3	1	9
7	3	3	9	9	9
8	4	2	8	4	16
9	4	3	12	9	16
10	4	4	16	16	16
11	4	3	12	9	16
12	4	1	4	1	16
13	4	5	20	25	16
14	4	3	12	9	16
15	4	5	20	25	16
16	4	4	16	16	16
17	5	2	10	4	25
18	5	2	10	4	25
19	5	4	20	16	25
20	5	1	5	1	25
20	**74**	**60**	**217**	**210**	**292**
	5476	**3600**			

m=	-0,166666667
b=	4,2
r=	-0,213980246
R²=	0,045787546

Table 6 - Calculation of the Simple Liner Regression Model's Parameters for x1

The coefficient of determination R^2 is 04.57%. This means that around 5% of the variation in the dependent variable is explained by this independent variable.

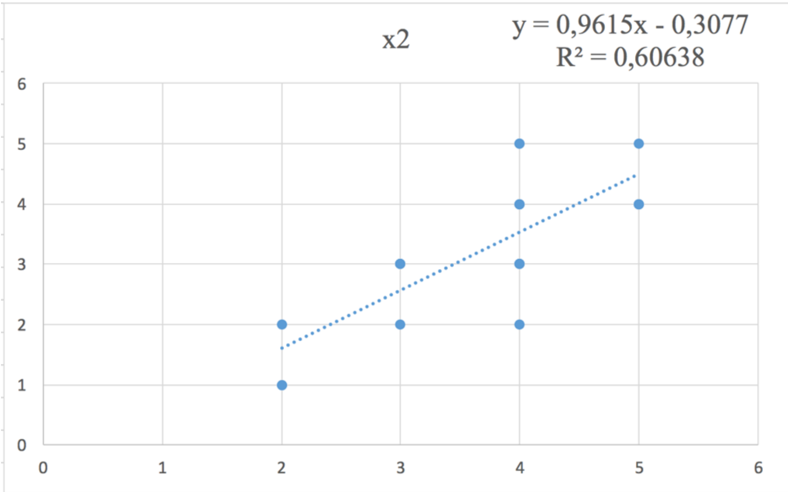
The correlation coefficient r is -0,21. This means that the reliability of the linear relationship between Y and x1 is quite low.

This results confirm that the independent variable x1 could be deleted from the model at the next step.

The second variable x2 is checked.

Y	x2
2	2
2	1
2	1
3	3
3	3
3	2
3	3
4	4
4	4
4	3
4	4
4	3
4	2
4	5
4	3
4	5
5	4
5	5
5	4
5	4

Table 7 – Variable x2 for the construction of the Simple Liner Regression Model



Picture 2 – Scatterplot and trend line for variable x2

By selecting the values given in Table 7, the scatterplot shown in Picture 2 is created. This scatterplot shows a linear relationship and a strong correlation between the variables, the value of R^2 is significant.

This means that the relation between the independent variable x2 and the dependent variable Y is strong, and x2 will stay in the model at the next step.

To verify and be sure of this previous result, the parameters of the simple liner regression are calculated.

n	Y	x2	xy	x^2	y^2
1	2	2	4	4	4
2	2	1	2	1	4
3	2	1	2	1	4
4	3	3	9	9	9
5	3	3	9	9	9
6	3	2	6	4	9
7	3	3	9	9	9
8	4	4	16	16	16
9	4	4	16	16	16
10	4	3	12	9	16
11	4	4	16	16	16
12	4	3	12	9	16
13	4	2	8	4	16
14	4	5	20	25	16
15	4	3	12	9	16
16	4	5	20	25	16
17	5	4	20	16	25
18	5	5	25	25	25
19	5	4	20	16	25
20	5	4	20	16	25
20	**74**	**65**	**258**	**239**	**292**
	5476	**4225**			

m=	0,630630631
b=	1,65045045
r=	0,77870123
R^2=	0,606375606

Table 8 - Calculation of the Simple Liner Regression Model's Parameters for x2

The coefficient of determination R^2 is 60,63%. This means that around 60% of the variation in the dependent variable is explained by this independent variable.

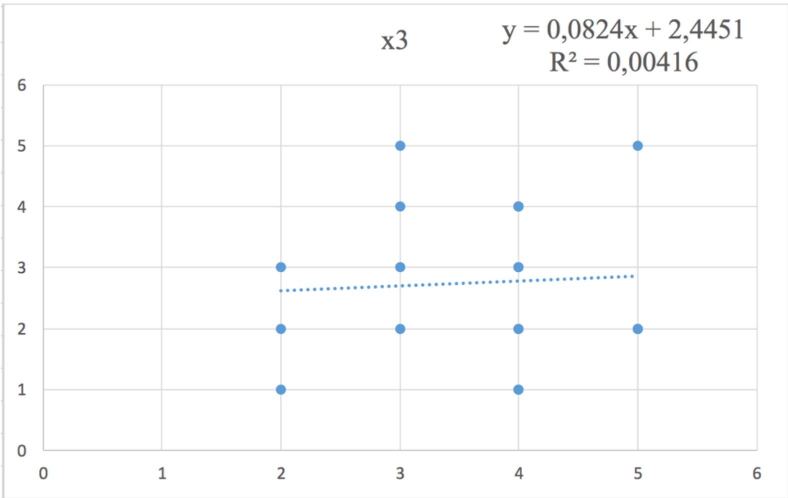
The correlation coefficient r is 0,77. This means that the reliability of the linear relationship between Y and x1 is very good.

This results confirm that the independent variable x2 will stay in the model at the next step.

The third variable x3 is checked.

Y	x3
2	2
2	3
2	1
3	4
3	5
3	3
3	2
4	3
4	4
4	4
4	1
4	2
4	4
4	1
4	3
4	2
5	2
5	2
5	2
5	5

Table 9 – Variable x3 for the construction of the Simple Liner Regression Model



Picture 3 – Scatterplot and trend line for variable x3

By selecting the values given in Table 9, the scatterplot shown in Picture 3 is created. This scatterplot shows no linearity and no strong correlation between the variables, the value of R^2 is not significant.

This means that the relation between the independent variable x3 and the dependent variable Y is weak, and x3 could be deleted from the model at the next step.

To verify and be sure of this previous result, the parameters of the simple liner regression are calculated.

n	Y	x3	xy	x^2	y^2
1	2	2	4	4	4
2	2	3	6	9	4
3	2	1	2	1	4
4	3	4	12	16	9
5	3	5	15	25	9
6	3	3	9	9	9
7	3	2	6	4	9
8	4	3	12	9	16
9	4	4	16	16	16
10	4	4	16	16	16
11	4	1	4	1	16
12	4	2	8	4	16
13	4	4	16	16	16
14	4	1	4	1	16
15	4	3	12	9	16
16	4	2	8	4	16
17	5	2	10	4	25
18	5	2	10	4	25
19	5	2	10	4	25
20	5	5	25	25	25
20	**74**	**55**	**205**	**181**	**292**
	5476	**3025**			

m=	0,050420168
b=	3,561344538
r=	0,064463233
R^2=	0,004155508

Table 10 - Calculation of the Simple Liner Regression Model's Parameters for x3

The coefficient of determination R^2 is 0,41%. This means that around 0,4% of the variation in the dependent variable is explained by this independent variable.

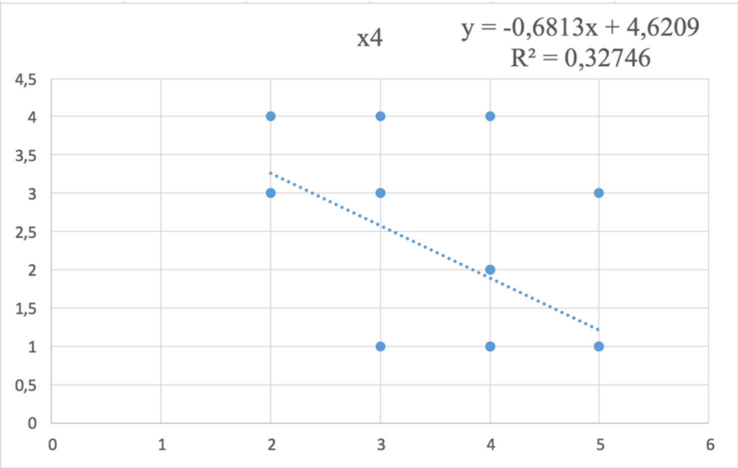
The correlation coefficient r is 0,06. This means that the reliability of the linear relationship between Y and x3 is low.

This results confirm that the independent variable x3 could be deleted from the model at the next step.

The fourth variable x4 is checked.

Y	x4
2	3
2	3
2	4
3	3
3	3
3	4
3	1
4	2
4	1
4	1
4	1
4	1
4	1
4	2
4	2
4	4
5	1
5	1
5	3
5	1

Table 11 – Variable x4 for the construction of the Simple Liner Regression Model



Picture 4 – Scatterplot and trend line for variable x4

By selecting the values given in Table 11, the scatterplot shown in Picture 4 is created. This scatterplot shows a linear relationship and a correlation between the variables, the value of R^2 is quite significant.

This means that the relation between the independent variable x4 and the dependent variable Y is quite strong, and x4 will stay in the model at the next step.

To verify and be sure of this previous result, the parameters of the simple liner regression are calculated.

n	Y	x4	xy	x²	y²
1	2	3	6	9	4
2	2	3	6	9	4
3	2	4	8	16	4
4	3	3	9	9	9
5	3	3	9	9	9
6	3	4	12	16	9
7	3	1	3	1	9
8	4	2	8	4	16
9	4	1	4	1	16
10	4	1	4	1	16
11	4	1	4	1	16
12	4	1	4	1	16
13	4	1	4	1	16
14	4	2	8	4	16
15	4	2	8	4	16
16	4	4	16	16	16
17	5	1	5	1	25
18	5	1	5	1	25
19	5	3	15	9	25
20	5	1	5	1	25
20	**74**	**42**	**143**	**114**	**292**
	5476	**1764**			

m=	-0,480620155
b=	4,709302326
r=	-0,572237267
R²=	0,32745549

Table 12 - Calculation of the Simple Liner Regression Model's Parameters for x4

The coefficient of determination R^2 is 32,74%. This means that around 33% of the variation in the dependent variable is explained by this independent variable.

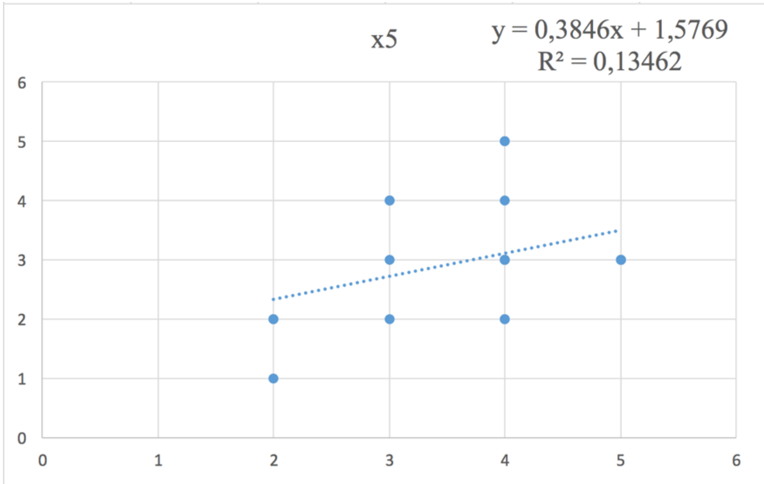
The correlation coefficient r is -0,57. This means that the reliability of the linear relationship between Y and x1 is low.

This results don't confirm that the independent variable x4 will stay in the model, it could be deleted at the next step.

The fifth variable x5 is checked.

Y	x5
2	2
2	2
2	1
3	2
3	3
3	4
3	4
4	5
4	3
4	2
4	4
4	2
4	3
4	3
4	3
4	5
5	3
5	3
5	3
5	3

Table 13 – Variable x5 for the construction of the Simple Liner Regression Model



Picture 5 – Scatterplot and trend line for variable x5

By selecting the values given in Table 13, the scatterplot shown in Picture 5 is created. This scatterplot shows a linear relationship and a correlation between the variables, the value of R^2 is quite significant for this model.

This means that the relation between the independent variable x5 and the dependent variable Y is quite strong, and x5 will stay in the model at the next step.

To verify and be sure of this previous result, the parameters of the simple liner regression are calculated.

n	Y	x5	xy	x²	y²
1	2	2	4	4	4
2	2	2	4	4	4
3	2	1	2	1	4
4	3	2	6	4	9
5	3	3	9	9	9
6	3	4	12	16	9
7	3	4	12	16	9
8	4	5	20	25	16
9	4	3	12	9	16
10	4	2	8	4	16
11	4	4	16	16	16
12	4	2	8	4	16
13	4	3	12	9	16
14	4	3	12	9	16
15	4	3	12	9	16
16	4	5	20	25	16
17	5	3	15	9	25
18	5	3	15	9	25
19	5	3	15	9	25
20	5	3	15	9	25
20	**74**	**60**	**229**	**200**	**292**
	5476	**3600**			

m=	0,35
b=	2,65
r=	0,366899693
R²=	0,134615385

Table 14 - Calculation of the Simple Liner Regression Model's Parameters for x5

The coefficient of determination R^2 is 13,46%. This means that around 13,5% of the variation in the dependent variable is explained by this independent variable.

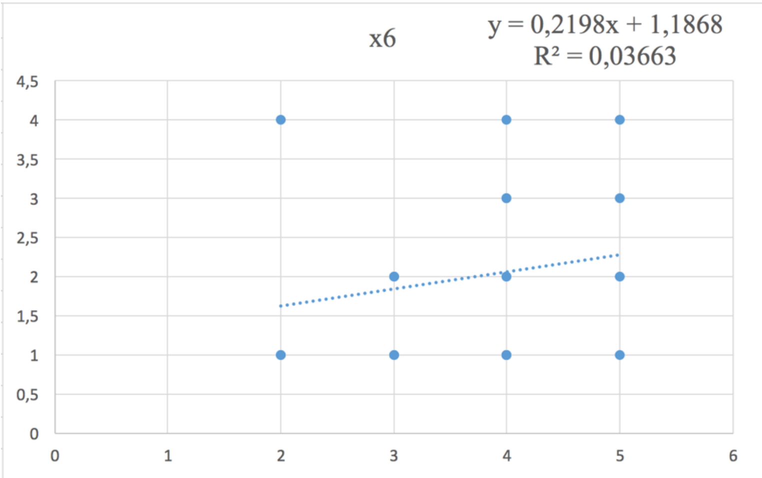
The correlation coefficient r is 0,36. This means that the reliability of the linear relationship between Y and x5 is good.

This results confirm that the independent variable x5 will stay in the model at the next step.

The sixth variable x6 is checked.

Y	x6
2	1
2	1
2	4
3	1
3	1
3	2
3	2
4	4
4	1
4	3
4	2
4	3
4	2
4	1
4	1
4	1
5	3
5	4
5	1
5	2

Table 15 – Variable x6 for the construction of the Simple Liner Regression Model



Picture 6 – Scatterplot and trend line for variable x6

By selecting the values given in Table 15, the scatterplot shown in Picture 6 is created. This scatterplot shows no linearity and no strong correlation between the variables, the value of R^2 is not significant.

This means that the relation between the independent variable x6 and the dependent variable Y is weak, and x6 could be deleted from the model at the next step.

To verify and be sure of this previous result, the parameters of the simple liner regression are calculated.

n	Y	x6	xy	x^2	y^2
1	2	1	2	1	4
2	2	1	2	1	4
3	2	4	8	16	4
4	3	1	3	1	9
5	3	1	3	1	9
6	3	2	6	4	9
7	3	2	6	4	9
8	4	4	16	16	16
9	4	1	4	1	16
10	4	3	12	9	16
11	4	2	8	4	16
12	4	3	12	9	16
13	4	2	8	4	16
14	4	1	4	1	16
15	4	1	4	1	16
16	4	1	4	1	16
17	5	3	15	9	25
18	5	4	20	16	25
19	5	1	5	1	25
20	5	2	10	4	25
20	**74**	**40**	**152**	**104**	**292**
	5476	**1600**			

m=	0,166666667
b=	3,366666667
r=	0,191389751
R^2=	0,036630037

Table 16 - Calculation of the Simple Liner Regression Model's Parameters for x6

The coefficient of determination R^2 is 3,66%. This means that around 3,7% of the variation in the dependent variable is explained by this independent variable.

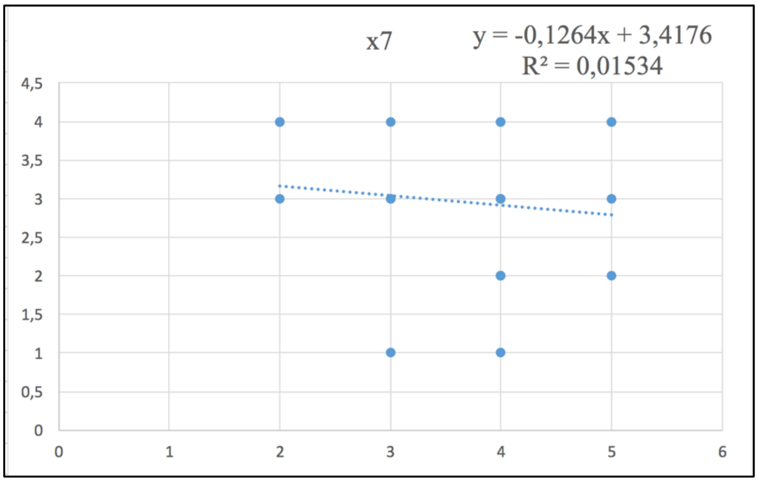
The correlation coefficient r is 0,19. This means that the reliability of the linear relationship between Y and x6 is not very strong.

This results confirm that the independent variable x6 could be deleted from the model at the next step.

The seventh variable x7 is checked.

Y	x7
2	4
2	4
2	3
3	1
3	3
3	3
3	4
4	1
4	2
4	2
4	2
4	4
4	3
4	4
4	3
4	3
5	4
5	3
5	4
5	2

Table 17 – Variable x7 for the construction of the Simple Liner Regression Model



Picture 7 – Scatterplot and trend line for variable x7

By selecting the values given in Table 17, the scatterplot shown in Picture 7 is created. This scatterplot shows no linearity and no strong correlation between the variables, the value of R^2 is not significant.

This means that the relation between the independent variable x7 and the dependent variable Y is weak, and x7 could be deleted from the model at the next step.

To verify and be sure of this previous result, the parameters of the simple liner regression are calculated.

n	Y	x7	xy	x^2	y^2
1	2	4	8	16	4
2	2	4	8	16	4
3	2	3	6	9	4
4	3	1	3	1	9
5	3	3	9	9	9
6	3	3	9	9	9
7	3	4	12	16	9
8	4	1	4	1	16
9	4	2	8	4	16
10	4	2	8	4	16
11	4	2	8	4	16
12	4	4	16	16	16
13	4	3	12	9	16
14	4	4	16	16	16
15	4	3	12	9	16
16	4	3	12	9	16
17	5	4	20	16	25
18	5	3	15	9	25
19	5	4	20	16	25
20	5	2	10	4	25
20	**74**	**59**	**216**	**193**	**292**
	5476	**3481**			

m=	-0,121372032
b=	4,058047493
r=	-0,123847583
R^2=	0,015338224

Table 18 - Calculation of the Simple Liner Regression Model's Parameters for x7

The coefficient of determination R^2 is 1,53%. This means that around 1,5% of the variation in the dependent variable is explained by this independent variable.

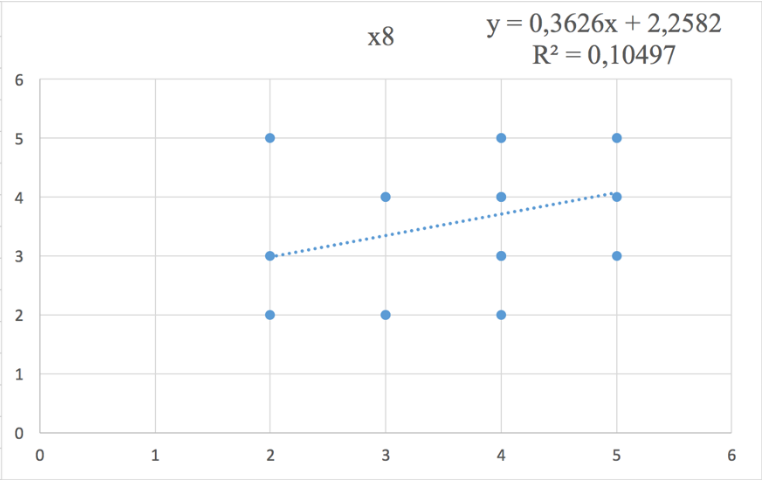
The correlation coefficient r is -0,12. This means that the reliability of the linear relationship between Y and x7 is low.

This results confirm that the independent variable x7 could be deleted from the model at the next step.

The eighth variable x8 is checked.

Y	x8
2	3
2	5
2	2
3	2
3	2
3	4
3	4
4	4
4	2
4	3
4	5
4	5
4	3
4	4
4	4
4	3
5	5
5	5
5	3
5	4

Table 19 – Variable x7 for the construction of the Simple Liner Regression Model



Picture 8 – Scatterplot and trend line for variable x8

By selecting the values given in Table 19, the scatterplot shown in Picture 8 is created. This scatterplot shows a linear relationship and a correlation between the variables, with some outliers. The value of R^2 is quite significant for this model.

This means that the relation between the independent variable x8 and the dependent variable Y is not low, and x8 will stay in the model at the next step.

To verify and be sure of this previous result, the parameters of the simple liner regression are calculated.

n	Y	x8	xy	x^2	y^2
1	2	3	6	9	4
2	2	5	10	25	4
3	2	2	4	4	4
4	3	2	6	4	9
5	3	2	6	4	9
6	3	4	12	16	9
7	3	4	12	16	9
8	4	4	16	16	16
9	4	2	8	4	16
10	4	3	12	9	16
11	4	5	20	25	16
12	4	5	20	25	16
13	4	3	12	9	16
14	4	4	16	16	16
15	4	4	16	16	16
16	4	3	12	9	16
17	5	5	25	25	25
18	5	5	25	25	25
19	5	3	15	9	25
20	5	4	20	16	25
20	**74**	**72**	**273**	**282**	**292**
	5476	**5184**			

m=	0,289473684
b=	2,657894737
r=	0,323996873
R^2=	0,104973973

Table 20 - Calculation of the Simple Liner Regression Model's Parameters for x8

The coefficient of determination R^2 is 10,49%. This means that around 10,5% of the variation in the dependent variable is explained by this independent variable.

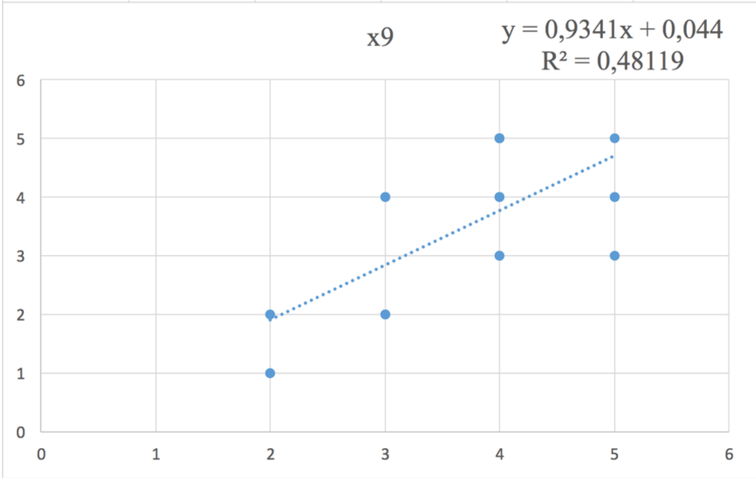
The correlation coefficient r is 0,32. This means that the reliability of the linear relationship between Y and x5 is good.

This results confirm that the independent variable x8 will stay in the model at the next step.

The last variable x9 is checked.

Y	x9
2	1
2	1
2	2
3	4
3	2
3	2
3	4
4	3
4	5
4	5
4	4
4	3
4	4
4	5
4	4
4	5
5	4
5	4
5	5
5	3

Table 21 – Variable x7 for the construction of the Simple Liner Regression Model



Picture 9 – Scatterplot and trend line for variable x9

By selecting the values given in Table 21, the scatterplot shown in Picture 9 is created. This scatterplot shows a linear relationship and a strong correlation between the variables, the value of R^2 is significant.

This means that the relation between the independent variable x9 and the dependent variable Y is strong, and x9 will stay in the model at the next step.

To verify and be sure of this previous result, the parameters of the simple liner regression are calculated.

n	Y	x9	xy	x^2	y^2
1	2	1	2	1	4
2	2	1	2	1	4
3	2	2	4	4	4
4	3	4	12	16	9
5	3	2	6	4	9
6	3	2	6	4	9
7	3	4	12	16	9
8	4	3	12	9	16
9	4	5	20	25	16
10	4	5	20	25	16
11	4	4	16	16	16
12	4	3	12	9	16
13	4	4	16	16	16
14	4	5	20	25	16
15	4	4	16	16	16
16	4	5	20	25	16
17	5	4	20	16	25
18	5	4	20	16	25
19	5	5	25	25	25
20	5	3	15	9	25
20	**74**	**70**	**276**	**278**	**292**
	5476	**4900**			

m=	0,515151515
b=	1,896969697
r=	0,693675343
R^2=	0,481185481

Table 22 - Calculation of the Simple Liner Regression Model's Parameters for x9

The coefficient of determination R^2 is 48,11%. This means that around 50% of the variation in the dependent variable is explained by this independent variable.

The correlation coefficient r is 0,69. This means that the reliability of the linear relationship between Y and x9 is very good.

This results confirm that the independent variable x9 will stay in the model at the next step.

After individual regression analysis of each independent variable, only a few factors show a significance for the model and will be part of the multiple regression analysis.

The variables that will be selected are x2, x5, x8, and x9, respectively, high remuneration, access to innovation, equal attitude towards employees, and freedom to make work decisions. The details about factors are given below:

High remuneration implies that he remuneration will evolve and get higher according to the evolution of the results obtained at work. Access to innovation means that the employee can have access to the latest innovations in the IT world. Equal attitude towards employees implies that top management shows respect and apply equal treatment of employees at all levels. And freedom to make work decisions means the ability to make changes to business processes and offer improvements to the product or service being produced.

A multiple regression analysis will be applied to those factors.

PART 3.2

Algorithms of the multiple regression analysis of motivation factors

Multiple regression analysis is used to explain the relationship between one dependent variable and independent variables. In general, the multiple regression equation of Y on $X_1, X_2, \dots, X_k$ is given by:

$Y = b_0 + b_1 \times x_1 + b_2 \times x_2 + \cdots + b_k \times x_k$

The general multiple regression model is given by:

$y = \beta_0 + \beta_1 \times x_1 + \beta_2 \times x_2 + \cdots + \beta_k \times x_k + \varepsilon$

Where, y is the dependent variable, x_1, x_2, x_k are the independent variables, β_0 is the intercept; β_1 is the parameter associated with x_1, β_2 is the parameter associated with x_2, and so on. Since there are k independent variables and an intercept, the equation contains k unknown parameters.

The independent variables have been analyzed, in order to get the best possible model. The equation of the simple liner equation is given by $y = mx + b$. Where b_k (slope) = m = $\frac{n(\sum xy) - (\sum x)(\sum y)}{n(\sum x^2) - (\sum x)^2}$ and b_0 (intercept) = b = $\frac{\sum y - m(\sum x)}{n}$.

For each variable, the simple liner equations are:

For x_1: $y = -0{,}1666x + 4{,}2$, $r = -0{,}21$, $R^2 = 0{,}0457$

For x_2: $y = 0{,}6306 + 1{,}6504$, $r = 0{,}77$, $R^2 = 0{,}6063$

For x_3: $y = 0{,}0504x + 3{,}5613$, $r = 0{,}06$, $R^2 = 0{,}0041$

For x_4: $y = -0{,}4806x + 4{,}7093$, $r = -0{,}57$, $R^2 = 0{,}3274$

For x_5: $y = 0{,}35x + 2{,}65$, $r = 0{,}36$, $R^2 = 0{,}1346$

For x_6: $y = 0{,}1666x + 3{,}3666$, $r = 0{,}19$, $R^2 = 0{,}0366$

For x_7: $y = -0{,}1213x + 4{,}0580$, $r = -0{,}12$, $R^2 = 0{,}0153$

For x_8: $y = 0{,}2894x + 2{,}6578$, $r = 0{,}32$, $R^2 = 0{,}1049$

For x_9: $y = 0{,}5151x + 1{,}8969$, $r = 0{,}69$, $R^2 = 0{,}4811$

According to those results, only the dependent variables x_2, x_5, x_8, and x_9 are selected for the multiple regression analysis.

The objective is to explain the variation in work motivation, using the variation in the independent variables.

n	Y	x2	x5	x8	x9
1	2	2	2	3	1
2	2	1	2	5	1
3	2	1	1	2	2
4	3	3	2	2	4
5	3	3	3	2	2
6	3	2	4	4	2
7	3	3	4	4	4
8	4	4	5	4	3
9	4	4	3	2	5
10	4	3	2	3	5
11	4	4	4	5	4
12	4	3	2	5	3
13	4	2	3	3	4
14	4	5	3	4	5
15	4	3	3	4	4
16	4	5	5	3	5
17	5	4	3	5	4
18	5	5	3	5	4
19	5	4	3	3	5
20	5	4	3	4	3

Table 23 - The Data set of motivational factors

The results of the regression analysis performed by MS Excel appear as follows:

Regression Statistics	
Multiple R	0,844471193
R Square	0,713131596
Adjusted R Square	0,636633355
Standard Error	0,589972031
Observations	20

Table 24 – Regression Statistics

As seen from Table 24, the multiple correlation coefficient is 0.8444. This indicates that the correlation among the independent and dependent variables is positive. This statistic ranges from -1 to +1 and is given by the equation:

$r = \frac{Cov(X_i Y_i)}{S_x S_y}$.

The coefficient of determination R^2 is 71,31%. This means that about 71% of the variation in the dependent variable is explained by theses independent variables. This statistic is the quotient of the variances of the fitted values and observed values of the dependent variable, and is given by the equation: $R^2 = \frac{\Sigma(\hat{y}_i - \bar{y})^2}{\Sigma(y_i - \bar{y})^2}$

The adjusted R-square, a measure of explanatory power, is 0.6366. This statistic determines how well a multiple regression equation "fits" the sample data, and is given by the equation: $\bar{R}^2 = 1 - (1 - R^2) \times [\frac{n-1}{n-(k+1)}]$. It shows the goodness of fit of the model.

The standard error of the regression is 0,5899, which is an estimate of the variation of the observed motivation at work about the regression line, and is given by the equation: $\sqrt{\frac{SSE}{n-k}}$

The "observations" line corresponds to the number of observations used in the regression (n).

The second parts of the results of the regression analysis performed by MS Excel are as follow:

ANOVA					
	df	*SS*	*MS*	*F*	*Significance F*
Regression	4	12,97899505	3,244748762	9,322195989	0,000543614
Residual	15	5,221004952	0,348066997		
Total	19	18,2			

Table 25 – Analysis of Variance

The ANOVA Table splits the Sum of Squares into its components. The SS Regression is the variation explained by the regression line; SS Residual is the variation of the dependent variable that is not explained. It indicates the goodness of fit of the model.

The Mean Square regression regroup the Mean Sum of Squares and the Error Mean Sum of Squares.

The F-statistic is calculated using the ratio of the mean sum of square (MS Regression) to the error mean sum of square (MS Residual). It gives the overall F-test of H_0: $\beta_2 = 0$, $\beta_5 = 0$, $\beta_8 = 0$, $\beta_9 = 0$, versus H_1: at least one of β_2, β_5, β_8, β_9 does not equal zero.

Significance F is the significance associated to P-Value. Comparing this value with 5% indicates the rejection or no of the null hypothesis. Since the p-value $0{,}0005 < 0{,}05$, the null hypothesis is rejected, some variables of the model are related to the level of motivation in IT companies.

The second part of the ANOVA table is given by:

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95,0%*	*Upper 95,0%*
Intercept	0,7617	0,6418	1,1867	0,2537	-0,6063	2,1299	-0,6063	2,1299
x2	0,4060	0,1899	2,1375	0,0494	0,0011	0,8109	0,0011	0,8109
x5	-0,0902	0,1607	-0,5611	0,5830	-0,4329	0,2525	-0,4329	0,2525
x8	0,2454	0,1335	1,8378	0,0859	-0,039	0,5300	-0,0392	0,5300
x9	0,2873	0,1542	1,8630	0,0821	-0,0413	0,6161	-0,0413	0,6161

Table 26 – Estimated regression line

The results of the estimated regression line include the estimated coefficients, their standard error, the t-statistic, the corresponding p-value, and the bounds of the 95% confidence intervals.

According to Table 26, among all the variables, the less significant independent variable is $x_5$because the t-statistics are lower than the estimated coefficient. Furthermore, the independent variable that is statistically the most significant in explaining the variation in the motivation at work is the high remuneration. Indeed, the P-value for x_2 is less than the significance level of 5%.

Table 26 also allows to estimate the fitted line, here the multiple regression equation is: $0{,}7617 + 0{,}4060_{x_2} - 0{,}0902_{x_5} + 0{,}2454_{x_8} + 0{,}2873_{x_9}$.

But overall, the Excel program has a few limitations when it comes to multiple regression analysis. For example, in the program, standard errors, t-statistics and p-values are based on the assumption that the error is independent from the constant variance, and there are no alternatives to this problem, heteroscedasticity robust solutions are not available. Thus, a more specialized software is needed, such as SPSS or STATA.

Thus, the conclusion of this multiple regression analysis is that among four factors, namely high remuneration (x_2), access to innovation (x_5), equal attitude towards employee (x_8), and ability to make decisions in the work environment (x_9), the access to innovation factor is not particularly significant, when the high remuneration factor is the one that affects the most the level of motivation in IT firms.

PART 3.3

Forecasting of motivation systems for the IT market

Work motivation is not consistent over time, meaning, the factor which motivates an individual today will most likely not be the same motivational factor a year from now. It is clear that personal circumstances will have an impact on employee motivation (Singh, Tripathi, 2016).

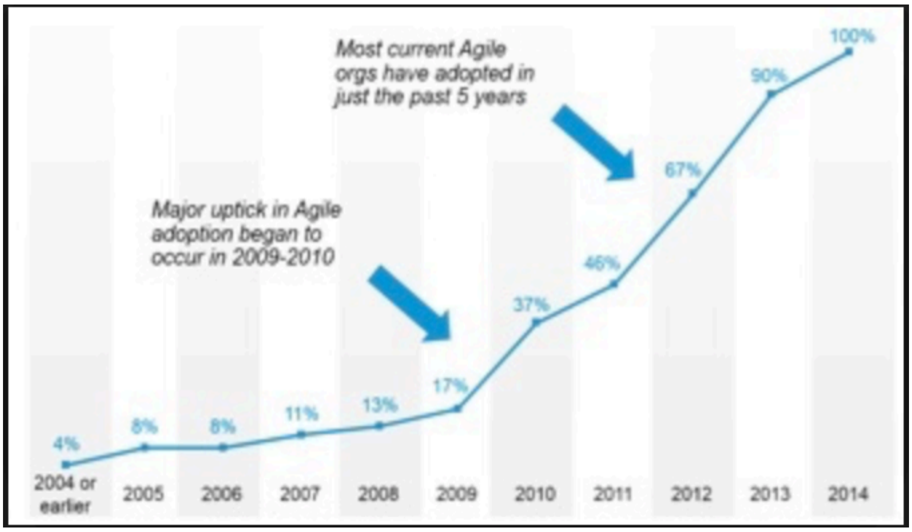
However, it is possible to say that new approaches to management involving new methods and tools of motivation that increase team development, self-management, flexibility and minimize the official bureaucracy, can have a positive impact on employee motivation in IT companies.

To improve global motivation for the future in IT companies, different systems are experimented such as team coaching and self-training. Team coaching focuses on the group, not on the individual, and helps teams improve its internal processes, as well as interaction with other teams and external factors. Team coaching allows teams to have a stronger desire to accomplish common goals, to resolve conflicts more effectively, to learn how to have constructive dialogues within teams, to express doubts and fears, and to work on empathic decision concerning team problems. [14] In spite of these facts, team coaching is not a solution to all of the problems of the team.

In addition to team coaching, another tool that has an impact on staff motivation is self-training of employees. This method is extremely important for the IT industry, as this area of activity is constantly evolving and innovations can disrupt the entire system in a very short time. Therefore, it is very important to have a team that aspires to knowledge, follows changes in the industry, and build a self-learning company.

The companies using these new techniques of management that goes towards an improvement of motivation are considered to be practicing holacracy. Holacracy aligns the explicit structure of an organization with its more organic natural form, replacing artificial hierarchy with self-organizing teams (Robertson, 2017). More and more, holacracies are using Agile systems, and the emergence of agile techniques fundamentally shook the world of software development (Robertson, 2006).

Thus, if companies practicing holacracy are improving the motivation level of their employees, and are also using Agile systems, it is possible to consider that a modification in the quantity of companies using Agile, will also represent a modification in the global level of employee motivation.

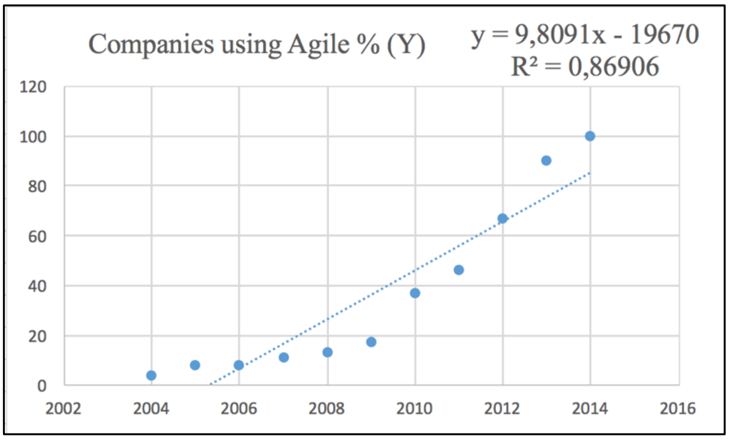


Picture 10 – Agile adoption over time (TechBeacon, 2015)

According to the numbers of Picture 10, obtained through a survey, it is possible to create a forecasting data set of employee motivation.

Year (x)	Companies using Agile % (Y)
2004	4
2005	8
2006	8
2007	11
2008	13
2009	17
2010	37
2011	46
2012	67
2013	90
2014	100

Table 27 - Time-series simple liner model



Picture 11 – Trend line

	Equation	Forecast
2015	95,3365	95,30909091
2016	105,1456	105,1181818
2017	114,9547	114,9272727
2018	124,7638	124,7363636
2019	134,5729	134,5454545
2020	144,382	144,3545455

Table 28 - Prediction of the independent variables by using time-series equations

Thus, we obviously see a positive trend in the use of Agile systems for the next few years (see Appendix 1), this kind of systems becoming more and more popular, especially in the IT sector. We can relate this increase in the use of Agile to an increase of the practice of holocracy, and thus, to an increase in management systems encouraging motivation. A positive trend is thus imaginable for work motivation in IT companies.

CONCLUSION

As a result of this study, a few conclusions are noted.

The goal of this study was to analyze the impact of independent factors on employee motivation in Information Technology companies. Those factors are flexible work schedule, high remuneration, advanced training, access to innovation, medical insurance, popularity of the company, appreciation of work and efforts, equal attitude towards employees, and freedom to make work decisions. Thus, the dependent variable in this study is IT companies' employee motivation, and those factors are the independent variables.

First of all, we analyzed regression analysis as a powerful tool used for predicting the unknown value of a variable from the known value of two or more variables.

Secondly, analyzing the dynamics of development of motivational approaches in IT companies around the world, we found that the most developed countries in this area are the United States, Great Britain, Japan, India, China and some other countries of Western Europe. Comparing the indicators of these countries with the situation in the Russian market, we can conclude that the country has room for development, as well as the potential to become an innovative country in the field of staff motivation.

We also explained that motivation of the staff plays a huge role in the development of each individual organization and economies of the countries. Motivation is a driver that stimulates employees of any sphere to perform their tasks as efficiently as possible and be productive.

Finally, we conducted a regression analysis with figures collected from a survey poll, explaining the relation between motivational factors and job motivation.

The results of the analysis showed that one particular factor has an effect on motivation, fair remuneration.

Moreover, by conducting a forecasting analysis, with subjective data, it is possible to imagine that the global rate of motivation in IT companies has a growing trend. Especially, because new innovative strategies, theories and models of development are emerging, particularly in the IT industry. This sphere is the most progressive and innovative among various fields.

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APPENDIXES

x	Y	Equation	Forecast
2004	4		
2005	8		
2006	8		
2007	11		
2008	13		
2009	17		
2010	37		
2011	46		
2012	67		
2013	90		
2014	100		
2015		95,3365	95,30909091
2016		105,1456	105,1181818
2017		114,9547	114,9272727
2018		124,7638	124,7363636
2019		134,5729	134,5454545
2020		144,382	144,3545455

Appendix 1 – Forecasting table about companies using Agile systems