Valuation of factors that affect employment in the albania banking system: An analysis based on design of experiment (DoE) method

Ëngjëll Pere
Faculty of Economy & Information Technology, EUT

Elvin Meka
Faculty of Economy & Information Technology, EUT

Abstract

Design of Experiments (DOE) is a statistical method well known in assessing the quality of products and services. The particularity in this work consists in the use and design of DOE to assess factors that affect employment in the banking system in Albania. Typically, this paper aims to design DOE in the view of analyzing different factors that affects employment, particularly young people, in the banking system. In this regard, a survey was conducted with heads of key departments at various banks in Albania, heads of human resource departments included, trying to evaluate different factors that are considered more important in the employment process. Furthermore, an orthogonal matrix is created for proper data processing, by using a standard matrix of Taguchi L28. The analysis has estimated the impact and weight of factors taken in study, which resulted more significant in employment of young graduated people into the banking system in Albania. The paper aims to improve orientation in high education studies, particularly in economic and financial faculties, in view of labor market.

Key words: Employment, DOE, banking system.

1. Introduction

Nowdays, employment is one of the main social and economic issues of every society, especially of our society. The problem is even thorny when discussed about the youth group, which according to the standard UN definition refers to young people as those belonging to the 15-24 age-group (O'Higgins 2004), where the unemployment rate as is known is even higher than the average level of the population as a whole. The main reason of the generally worse youth labour market performance with respect to adults is related to the lower level (and/or different quality) of human capital (and productivity), which – ceteris paribus – makes employers prefer adult people to young (Choudhry et.al.2012). In the frame of such issue, knowing the key aspects and demands of labor market is of particular importance. In this perspective, a special attention is paid to the formation of young people in higher education institutions, their preparation with necessary labor market needs and knowledge.

In this regard, this paper focuses on identifying the requirements and factors affecting the employment of young people in the Albanian banking system, after the completion of their higher studies. A unique feature of this paper is the use of the "Design-of-Experiment" method, in assessing various factors that affect such employment.

2. Methodology

As regards the methodology, we have constructed the matrix 7^2 according to the Taguchi model ("Design-of-Experiment" method), i.e. a matrix of 7 factors, each of which is considered in two levels (1 and 2). Some 25 interviews (questionnaires) were conducted, at 10 commercial banks in Albania, mainly with heads of human resources, risk management and finance departments. Based upon the model, we have identified the most influent factors in terms of young age group (up to 27 years) employment, within the Albanian banking system.

Design of experiment (DoE) and its use in the employment analysis

The DoE model (Design of Experiment) is a well-known model, primarily and initially used in the quality analysis of industrial products, driven by the influence of particular factors in this quality. The feature of this paper is the use of such model to study the particular factors affecting the employment of young people

in the Albanian banking system. Thus, the "product" in the model is considered "employment" and factors influencing the "quality" of this "product" are considered, as follows:

1. Graduated in Bank & Finance.
2. Grades obtained at university.
3. Study in a public university.
4. Gender
5. Personal recommendation or personal recognition
6. Experince in bank system (CV)
7. Age (under 27 years)

Based on these factors, some 25 interviews were conducted with heads of human resources, risk management and finance departments, at 10 commercial banks. Suring the interviews each of the above factors is considered at two levels 1 and 2, where: 1 - means that the factor is not taken into account for employment, and 2 - means that the factor has been taken too much into consideration for employment.

Given the above seven factors and their two levels, we would normally have 128 different combinations of factors, (2^7), which would complicate the factors' impact analysis. In this respect, the Taguchi 7^2 orthogonal matrix comes of help. This represents an 8 different combination variants' matrix, according to their two levels (1 and 2) – as it appears in Table 1. In our case, the Taguchi 7^2 matrix is displayed in Table 2, based upon 7 factors taken into the analysis.

TABLE 1 (Taguchi 7^2)

	A	B	C	D	E	F	G
1	1	1	1	1	1	1	1
2	1	1	1	2	2	2	2
3	1	2	2	1	1	2	2
4	1	2	2	2	2	1	1
5	2	1	2	1	2	1	2
6	2	1	2	2	1	2	1
7	2	2	1	1	2	2	1
8	2	2	1	2	1	1	2

TABLE 2

Variants	Has been graduated in Bank & Finance	Grades obtained at university	Has studied in a public university	Gender - Male	Personal recommenda-tion or personal recognition	Has had an experience in bank system (CV)	Has been under 27 years old
1	1	1	1	1	1	1	1
2	1	1	1	2	2	2	2
3	1	2	2	1	1	2	2
4	1	2	2	2	2	1	1
5	2	1	2	1	2	1	2
6	2	1	2	2	1	2	1
7	2	2	1	1	2	2	1
8	2	2	1	2	1	1	2

The interviewed respondents within the banking system have individually evaluated each of 8 above presented variants, through a scoring system from 1 to 6. This scoring assumed:

1. The variant has occurred in very few cases
2. The variant has occurred in few cases
3. The variant has occurred in some cases
4. The variant has occurred normally
5. The variant has occurred in many cases
6. The variant has been happening nearly all time.

In order to process the obtained results, the scoring system 1 to 6 is further converted in the following way:

1	10%
2	20%
3	40%
4	60%
5	80%
6	100%

The obtained results from interviews are shown in Table 3.

TABLE 3

Variants	Has been graduated in Bank & Finance	Grades obtained at university	Has studied in a public university	Gender - Male	Personal recommendation or personal recognition	Has had an experience in bank system (CV)	Has been under 27 years old	Estimation of experts (1 to 6) average	%
	A	B	C	D	E	F	G		
1	1	1	1	1	1	1	1	1.42	15.8
2	1	1	1	2	2	2	2	2.46	30.4
3	1	2	2	1	1	2	2	3.77	55.8
4	1	2	2	2	2	1	1	3.04	42.3
5	2	1	2	1	2	1	2	3.04	41.9
6	2	1	2	2	1	2	1	3.04	40.8
7	2	2	1	1	2	2	1	4.42	68.5
8	2	2	1	2	1	1	2	3.50	50.0

3. Results and factors' analysis

The descriptive analysis of factors, by respective levels

The results obtained from interviews were processed with MINITAB, which is quite suitable for the variation analysis, in case of DoE and the Taguchi method. This analysis is based on three main indicators:

- Means of Means analysis
- SN Ratios analysis
- Standard Deviation analysis

In the "Mean" model the average value of the respective factor is presented, for each respective level (i.e. 1 or 2). Given that we are interested for a greater impact of the factor in the results, namely the employment, the fact that there will have a greater deviation from the mean for the two levels, 1 and 2, will be considered as the most important. Not the result. MINITAB processing shows the following data of means (averages), by factors (Table 4 and Graph 1). Here we see that the most important factor for employment is: "grades obtained at university" where delta of this factor (the difference of factors for level 1 and 2 of the factor) is 21.93. Then, the second most important (considered) factor is whether s/he "has been graduated for Bank & Finance", and in furtherance, whether s/he "has had

an experience within the banking system, or not" and spo forth. In Graph 1, such factors' influence and rankings are presented through factors' mean, compared to the Means of Means.

TABLE 4

Taguchi Analysis: C9, C10, ... versus Has been gra, Grades obtai, ...

Response Table for Means

Level	Has been graduated in Finance &	Grades obtained at university	Has studied in a public univers	Gender - Male	Personal recommendation or pers
1	36.07	32.21	41.15	45.48	40.58
2	50.29	54.14	45.20	40.88	45.78
Delta	14.22	21.93	4.05	4.61	5.20
Rank	2	1	6	5	4

Level	Has had an experince in bank sy	Has been under 27 years old
1	37.51	41.84
2	48.85	44.52
Delta	11.34	2.68
Rank	3	7

GRAPH 1

Main Effects Plot for Means
Data Means
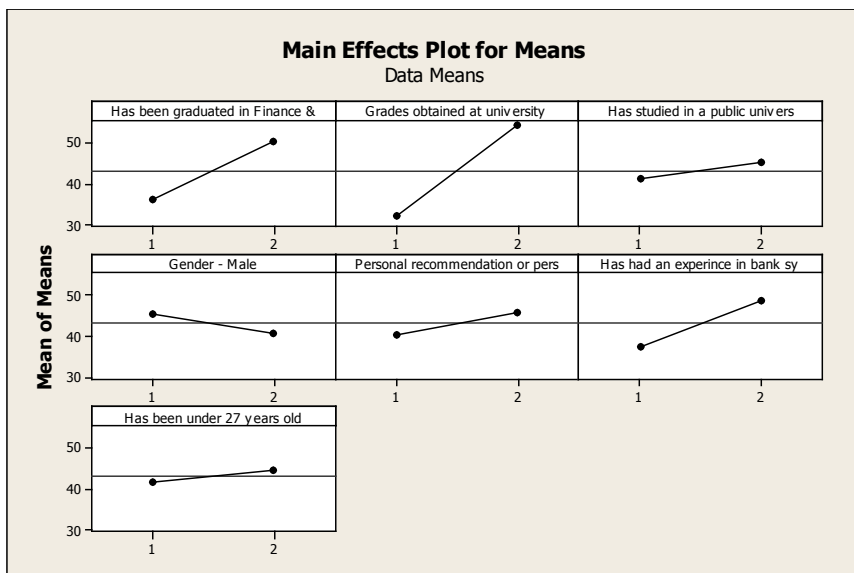
In Taguchi DoE, another important indicator of the analysis is that of the "signal-to-noise-ratio" (SN ratios). This indicator is based on the assumption that two sets of factors can be included in the experiment: factors that can be controlled by the user and indicators which, although affecting the result, cannot be controlled by the user (noise factors). One of the goals of DoE analysis is to determine such factors that ensure a smaller impact of "noise" factors, with the aim to reduce the variation in the result. Precisely, this is the purpose of calculating the SN ratio indicator. Factors that result with greater SN ratio are considered factors that minimize most the impact of noise factors. The results for the presented model are showed in Table 5 and Graph 2. The data show that the most reduction of the effect of unchecked factors in the system is provided by the factor "Has been graduated in Bank & Finance", or not, with a delta of 8.09 and "Has had an experience in bank system" with a delta of 6.68.

TABLE 5

Taguchi Analysis: C9, C10, ... versus Has been gra, Grades obtai, ...

Response Table for Signal to Noise Ratios
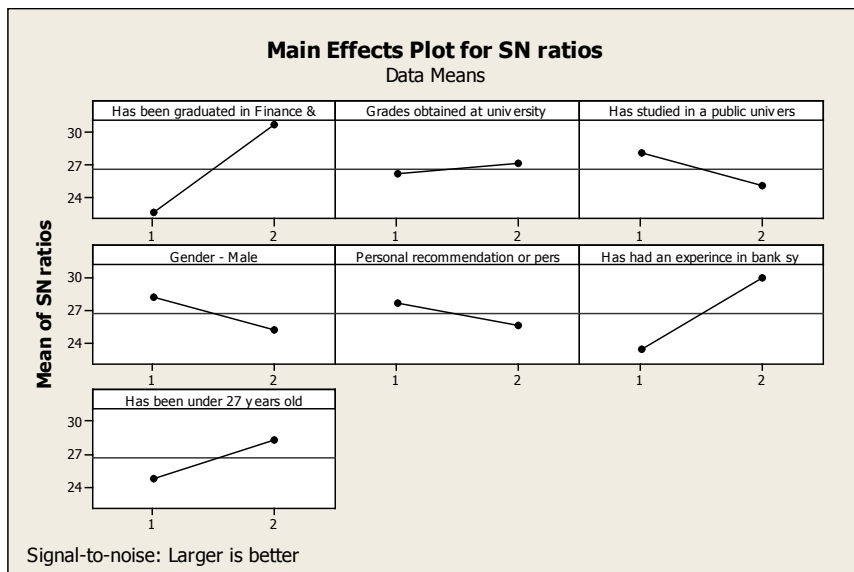Larger is better

Level	Has been graduated in Finance &	Grades obtained at university	Has studied in a public univers	Gender – Male	Personal recommendation or pers
1	22.58	26.17	28.13	28.12	27.65
2	30.66	27.07	25.11	25.12	25.59
Delta	8.09	0.90	3.02	2.99	2.05
Rank	1	7	4	5	6

Level	Has had an experince in bank sy	Has been under 27 years old
1	23.28	24.88
2	29.96	28.36
Delta	6.68	3.49
Rank	2	3

Standard Deviation is another indicator, used in assessing the factors' impact in the final result. In the Taguchi model the Standard Deviation characterizes the result's variation (in our case "the employment"), as a result of the "noise" factors. Since the influence of these factors should be minimized, then the model intends to determine those factors that maximize the standard deviation. Through the calculations in the minitab, the standard deviation is determined as a result of each

GRAPH 2

Main Effects Plot for SN ratios
Data Means

Signal-to-noise: Larger is better

TABLE 6

Taguchi Analysis: C9, C10, ... versus Has been gra, Grades obtai, ...

Response Table for Standard Deviations

Level	Has been graduated in Finance &	Grades obtained at university	Has studied in a public univers	Gender – Male	Personal recommendation or pers
1	20.45	15.97	17.91	20.12	21.32
2	19.92	24.41	22.47	20.25	19.05
Delta	0.52	8.44	4.56	0.12	2.26
Rank	5	1	2	7	4

Level	Has had an experince in bank sy	Has been under 27 years old
1	20.37	18.60
2	20.01	21.77
Delta	0.36	3.16
Rank	6	3

factor considered in the analysis. The results are presented in Table 6 and Graph 3. Here we see that the standard deviation is greater for the factor "Grades obtained at university" –with a delta of 8.44 and "Has studied at a public university", or not – with a delta of 4.56.

GRAPH 3
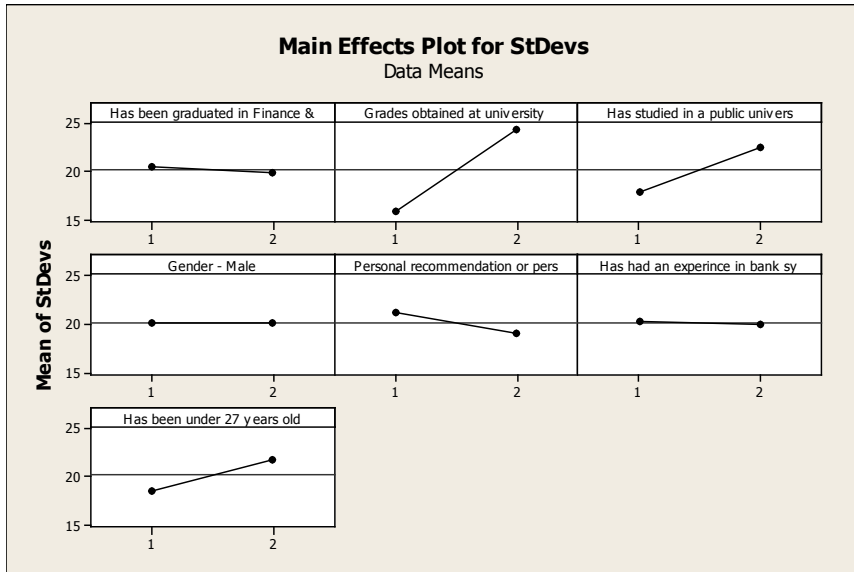
Analysis of Variation, ANOVA

Further analysis of factors' influence continues with ANOVA. Data processed in MINITAB are showed in Table 7.

TABLE 7

Factors		f	S	V	F	P
Has been graduated in Bank & Finance	A	1	404.5	404.5		22.9%
Grades obtained at university	B	1	962.1	962.1		54.4%
Has studied in a public university	C	1	32.8	32.8		1.9%
Gender - Male	D	1	42.4	42.4		2.4%
Personal recommendation or personal recognition	E	1	54.1	54.1		3.1%
Has had an experince in bank system (CV)	F	1	257.0	257.0		14.5%
Has been under 27 years old	G	1	14.4	14.4		0.8%
Other / Error	e	0	0	0		
Total		7	1763.3			100.00%

f – Degrees of freedom –DOF/ S –sum of squares/ V – Variance – mean of square/ P – Percentage of contributions in the assessed output./ F – Factor ratio (an indicator for assessing factor's statistical significance)

In this table, the most important is the P indicator. This indicator shows that the factors with the most significant impact are "Grades obtained at university" - 54.4% and "Has been graduated in Bank & Finance" - 22.9%.

However, in assessing the variation, S_e, V_e, and F indicators (the second last row) are also important, which relate to the assumed error in the model, as well as with the statistical significance of each factor. Such indicators, in Table 7, result in 0, which does not allow for further assessment. For this reason, factors that have a small percentage of impact on the outcome (result) are therefore eliminated. In our case such factors are: "Has been under 27 years old" (G) and "Has studied in a public university" (C). In this way, the recalculated coefficients S_e, V_e and F will receive a value different from zero. The calculations are presented in Table 8.

TABLE 8

Factors		f	S	V	F	P
Has been graduated in Bank & Finance	A	1	380.9	404.5	17.2	21.6%
Grades obtained at university	B	1	938.5	962.1	40.8	53.1%
Gender - Male	D	1	18.8	42.4	1.8	1.1%
Personal recommendation or personal recognition	E	1	30.5	54.1	2.3	1.7%
Has had an experince in bank system (CV)	F	1	233.5	257.0	10.3	13.2%
Other / Error	e	0	0	23.6		9.3%
Total		7	1602.2			100.0%

The most important thing behind these calculations is the assessment of factors' significance. According to the Taguchi method, this is analyzed by comparing the F factor (factor ratio) of each factor with the values calculated in the standard tables, according to the given confidence level. In order to consider a statistically significant factor, it is required that the F value of the factor in the experiment to be greater than the tabular value.[1]

The last column in Table 8 shows the extent of the employment impact of each factor. As it may be seen, the greatest impact comes from "Grades obtained at university" (53.1%) and whether "Has been graduated in Bank & Finance" (21.6%).

MINITAB calculations for ANOVA produce the results of Table 9. It is seen that R-Sq is high (97.33%), indicating that these factors explain, almost completely the outcome in employment. On the other hand, the P coefficient, for two factors: "Gender-Male" and "Personal Recommendation", or "Personal recognition" is significantly greater than 0.05; which means that the influence of such factors cannot be considered as statistically significant. On the other hand, with the safety level P <0,1the factors: "Grades obtained at university" (P = 0.024), "Has been

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[1]   Tabular values are determined by the confidence level, as well as by factor's DOF and DOF of error term.

graduated in Bank & Finance" (P = 0.054) and "Has had an experience in banking system" (P = 0.81), can be considered as statistically significant. These assessments may be carried out based upon the value of F for the factor. For a 95% confidence level, the DOF of factor = 1 and the DOF of the error term = 2, the tabular value of F, for which the factor is considered as significant, is 18.513, i.e. the F factor must be F > 18.513. Alternatively, for a 90% confidence level, the value of F for the factor should be F > 8.5263, in order to be considered as statistically significant.

TABLE 9

General Linear Model: Ratio versus Has been gra, Grades obtai, ...

```
Factor                               Type    Levels  Values
Has been graduated in Finance &      random      2   1, 2
Grades obtained at university        random      2   1, 2
Gender - Male                        random      2   1, 2
Personal recommendation or pers      random      2   1, 2
Has had an experince in bank sy      random      2   1, 2


Analysis of Variance for Ratio, using Adjusted SS for Tests

Source                            DF   Seq SS  Adj SS  Adj MS      F      P
Has been graduated in Finance &    1   404.48  404.48  404.48  17.15  0.054
Grades obtained at university      1   962.09  962.09  962.09  40.79  0.024
Gender - Male                      1    42.43   42.43   42.43   1.80  0.312
Personal recommendation or pers    1    54.12   54.12   54.12   2.29  0.269
Has had an experince in bank sy    1   257.03  257.03  257.03  10.90  0.081
Error                              2    47.17   47.17   23.58
Total                              7  1767.32


S = 4.85631   R-Sq = 97.33%   R-Sq(adj) = 90.66%


Term                               Coef  SE Coef     T      P
Constant                         43.178    1.717  25.15  0.002
Has been graduated in Finance &  -7.111    1.717  -4.14  0.054
Grades obtained at university   -10.966    1.717  -6.39  0.024
Gender - Male                     2.303    1.717   1.34  0.312
Personal recommendation or pers  -2.601    1.717  -1.51  0.269
Has had an experince in bank sy  -5.668    1.717  -3.30  0.081
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Regarding coefficients, ANOVA produces the value of factors for level "1" ("less") and "2" ("most"). In this regard, the dependence of output (Y) (employment) form factors taken into consideration, for their both levels, may be written down as the following equation.

$$Y=43,178+(-7.111+7.111)A+(-10.966+10.966)B+(-5.668+5.668)F$$

In the equation, we see that the factors that produce the most impact in the employment are considered: "Grades obtained at university" (B), "Has been graduated in Bank & Finance" (A) and "Has had an experience in bank system (CV)" (F).

4. Conclusions

In methodological view, this paper proposes an alternative method for analyzing the factors affecting employment of young people in the Albanian banking system. The paper shows how the Design of Experiment Method (DoE) can be used for a more complete analysis of this aspect. The main advantages of the method relate with the fact that through a limited number of experiments/interviews (as is the case in concern), we may draw important conclusions about the impact of different factors in employment in the banking system. In this view, the paper uses the orthogonal matrixes, as proposed by Taguchi.

In a practical aspect, the paper shows step by step how we can use the DoE method to perform a descriptive and analysis of variation. By focusing in employment of young people in the Albanian banking system, the paper shows that among the seven factors taken in consideration, the most important are:

(i)   the level of performance of studies, ("Grades obtained at university"), which has 53.1% of the total impact factor;
(ii) graduaded in bank & finance ("Has been graduated in Bank & Finance"), with 26.1% and
(iii) experience in the banking system ("Has had an experince in the banking system") with 13.2% of total.

The paper shows that other factors, which are gender, age, graduated in a public or private university, or personal recommendation (reference), have no important impact in employment, or are statistically not significant.

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Questionnaire on assessing the employment in the banking system

Position in the banking system (1 "Human Resources", 2 "Head of Division/Unit", 3 "Head of Sector"), put X

| 1 | 2 | 3 |

In the table below there are 7 criteria which are considered as important in assessing employment in the banking system. They are placed by columns (A, B, C, D, E, F, G), and considered at two levels: 1 and 2: Level 1 - means that the factor is not taken into account for employment, and Level 2 - means that the factor has been taken too much into consideration for employment and therefore it has positively impacted the employment. Variants are a combination of various criteria (please read the note and request).

Questionnaire on assessing the employment in the banking system

Variants	Has been graduated in Bank & Finance	Grades obtained at university	Has studied in a public university	Gender - Male	Personal recommendation or personal recognition	Has had an experience in bank system (CV)	Has been under 27 years old
	A	B	C	D	E	F	G
1	1	1	1	1	1	1	1
2	1	1	1	2	2	2	2
3	1	2	2	1	1	2	2
4	1	2	2	2	2	1	1
5	2	1	2	1	2	1	2
6	2	1	2	2	1	2	1
7	2	2	1	1	2	2	1
8	2	2	1	2	1	1	2