

# MULTIVARIABLE DATA ANALYSIS (MVA) FOR MORE STATISTICAL METHODS IN THE SAME TIME INTERVAL

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**Abstract** - By implementing the system analysis and monitoring of water resources would allow an easier way of getting accurate, timely and reliable data related to water resources. With the help of this system enabled easier way of supplementing the database obtained from the fieldwork and processing of the office. Video monitoring is a major step in the monitoring of water resources especially in periods when there is increased water level so there is a danger of flooding. The data is processed by using this computer system may be used by other institutions, but still need their approval. With the help of new modern technologies and use the applications easily enables data to be modified, supplemented and stored.

The program for statistical analysis Minitab is composed of one main menu which offers a huge range of tools for statistical analysis. The study of the decision other than numerical, tables can be displayed graphically. This program is utilized in order to calculate factor analysis and to show Final Solutions.

In order to analyze multiple scenarios used multivariable data analysis (MVA) which includes monitoring and statistical analysis of multiple processes are processed in the same time interval. With the help of this analysis all variables are used as independent in order to analyze further alternatives in choice of final conceptual solution. With the help of this analysis to identify and critical parts of the analysis in order to calculate the effects of variables that are used in complex systems. This research used factor analysis for decision. The factor analysis with the help of this program is implemented with the help of scenarios. IT system is assayed with 3 scenarios.

## I. INTRODUCTION

In order to analyze multiple scenarios used multivariable data analysis (MVA) which includes monitoring and statistical analysis of multiple processes are processed in the same time interval. With the help of this analysis all variables are used as independent in order to analyze further alternatives in choice of final conceptual solution. With the help of this analysis to identify and critical parts of the analysis in order to calculate the effects of variables that are used in complex systems. This research used factor analysis for decision. The factor analysis with the help of this program is implemented with the help of scenarios. IT system is assayed with 3 scenarios.

In this project using the program Minitab 17 will be analyzed data on water bodies in the State Macedonia. All water bodies that are analyzed are fictional, and the data used to analyze which would help in the use of these applications that would facilitate the daily work and access to data.

## II. MINITAB SOFTWARE PROGRAM TO FACTOR ANALYSIS

In order to realize the phases of the factor analysis will be used software program Minitab. Minitab has been created by Barbara Ryan, Thomas Ryan and Brian Joyner of Pennsylvania State University in the US in 1972. Today, the commercial product is distributed by Minitab Inc and has great use.

The advantages offered by this software program are:

- Easy to use and use - the use of Minitab is not necessary knowledge of a complex language. All regular statistical functions can be performed using Minitab with one or a few clicks of a drop-down menu. In addition, the menu is organized in a very good intuitive way, so it's hard to remember what is where. All these features make Minitab available for those customers who first time use;
- Great functionality - a large amount of statistical functions can be performed with this program, including all basic simple statistics, to more complex data. However this program contains many tools that can be used to control the process, including methods of analysis, graphics, design of experiments, etc. Also the use of this software is great by many companies worldwide and across all industries and
- An accurate display of output data - most Minitab users are particularly impressed by the graphics output of this program. Minitab can create many types of graphs

and statistics are easily displayed and pictorial results after processing.

The following figure shows the layout of the software program:



Figure 1. Minitab

This program for statistical analysis Minitab is composed of a main menu offers a large selection of tools for statistical analysis. The display solution than numerical, tabular can display and graphics. This program is used to calculate the factor analysis and display finishing solutions.

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*A. Scenario 1 - Analysis of financial feasibility*

In this part of the project to analyze all the data and factors related to finance.

Analyze the following 7 variables:

1. Costs for implementing the system;
2. Testing of the system and its use;
3. Monitoring and its implementation;
4. Connect the system and its financing;
5. Additional costs;
6. Utilization of the system;
7. Recovery use.

The table that is needed for the analysis of all the features of information system, analyze all these variables with characteristics 1-5. 1 is a minimal assessment of the situation (poor), while 5 is the largest and best value in the assessment

(excellent condition). The analysis is made for one year (12 months).

- 1 alarming situation;
- 2 Unsatisfactory condition;
- 3 Good condition;
- 4 Satisfactory condition
- 5 Excellent condition.

TABLE 1. ANALYSIS OF FINANCIAL FEASIBILITY

Month	V1	V2	V3	V4	V5	V6	V7
1	4	3	1	3	2	1	3
2	2	3	2	4	4	1	3
3	3	3	1	3	2	1	3
4	4	2	3	4	5	2	4
5	5	3	2	4	5	2	4
6	3	2	1	4	5	2	5
7	2	4	2	3	5	3	5
8	1	4	1	2	4	2	2
9	2	2	3	4	5	2	1
10	2	2	3	3	4	2	2
11	3	3	3	4	3	3	3
12	4	4	1	2	4	3	4

The table with the help of the program are analyzed 3 main factors that will be used in further financial part of implementation, such as:

- 1) Timing of implementation;
- 2) Application of new methodologies and
- 3) financial savings.

The obtained results multivariable analysis are shown in the following table:

TABLE 2. RESULTS FROM SCENARIO 1

Variable	Factor 1	Factor 2	Factor 3
C1	0,099	-0,133	-0,544
C2	-0,397	0,131	0,006
C3	0,283	0,233	0,220
C4	0,389	-0,024	0,162
C5	0,102	0,442	-0,010
C6	0,139	0,534	0,023
C7	-0,071	0,157	-0,512

With correlation of data for the first factor No. 1 timeline for implementation, the greatest value is obtained when analyzing the variable number 2 Testing of the system and its use -0.397. To test the system and its successful use requires a period of time that would meet required goals and thus would and spend more money. Factor No. 2 Application of new methodologies is the largest variable number 6 Utilizing the system and amounts to 0.534. If the system is used correctly it

is possible to implement new application systems and technologies more advanced and proper distribution of data. Financial savings of implementing the system mostly depends on the variable number 1, costs of implementation. The factor number 3 is -0.544. If we reduced costs for this system so the savings will be greater.

The period of time for implementation, and saving the system depends on the period of testing and use. The application of new methodologies dependent on the utilization of the system and its daily need and if we have lower costs will have more savings from the system.

*B. Scenario 2 - Computer System for Water Resources Management*

In order to analyze all types of water resources and to monitor their status Monitoring analyzed factors that would affect the implementation of a computer system. In this scenario analyzed 6 variables that are associated with the computer system and are used to implement:

- Availability of the system and its use;
- Period of utilization;
- Daily use;
- Quality in using the system;
- Video surveillance and
- Availability of data.

Matrix factor analysis of the lights is shown in the following figure:

TABLE 3. COMPUTER SYSTEM FOR THE ANALYSIS OF WATER RESOURCES

Month	V1	V2	V3	V4	V5	V6
1	4	2	5	3	2	3
2	3	2	5	3	4	2
3	5	2	5	3	2	4
4	4	3	4	3	5	4
5	4	3	4	4	5	3
6	5	4	3	5	5	4
7	4	4	4	5	5	3
8	5	5	3	5	4	4
9	3	3	5	5	5	5
10	2	3	5	3	4	5
11	2	2	3	3	3	4
12	1	2	5	3	4	5

Correlation factors used three months of the year are chosen at random. Here we are used three factors needed for multivariable analysis as follows:

- 1) Data transfer and exchange;
- 2) critical points for the detection and

3) Field analysis of monitoring sites.

The obtained results multivariable analysis are shown in the following table:

TABLE 4. RESULTS FROM SCENARIO 2

Variable	Factor 1	Factor 2	Factor 3
C1	0,441	0,290	0,259
C2	0,300	-0,139	-0,106
C3	<b>-0,442</b>	-0,188	0,170
C4	0,178	-0,274	-0,011
C5	-0,314	<b>-0,792</b>	0,147
C6	0,174	0,178	<b>-0,892</b>

From the resulting factor analysis can be noted that the transfer of the data and their timely delivery depends on the use of various places and institutions (daily use) -0.442, monitoring data and water resources is needed most critical points for monitoring and analysis - factor -0.792. The availability of data that can be used in this system depend from the field analysis of the sites and the availability of places in the analysis - 0,892.

*C. Scenario 3 – Opinion of citizens in Macedonia- Survey*

The latter scenario which analyzes the project involves examining the opinion of the population of Macedonia. Placed 6 issues for which 10 citizens give opinions related to water and water resources in Macedonia. The assessment of the replies and opinions of the citizens is the same as in the previous scenarios, with a limit of 1 to 5. The questions that are posed to the survey are:

- Do you need IT system for management of water resources?
- How do you assess the current state of water?
- How do you assess the quality of the water supply?
- Your assessment of health services?
- Is protected water and its quality?
- The required water monitoring?

All replies received from 10 polled are shown in the following matrix.

TABLE 5. SURVEY

Month	V1	V2	V3	V4	V5	V6
1	4	2	3	3	3	4
2	5	1	3	3	4	4
3	4	2	4	3	3	4
4	5	1	3	2	3	5
5	5	2	3	2	3	5
6	4	1	2	3	3	4
7	5	1	3	2	2	5
8	4	1	2	2	3	4
9	5	2	2	2	3	4
10	3	2	2	3	3	5

3 months of the year are used to analyze factors. We used three factors, namely:

- 1) Water purification stations;
- 2) Uniform distribution of water resources and their supervision and
- 3) Protection of nature and environment.

The obtained results multivariable analysis are shown in the following table:

TABLE 6. RESULTS FROM SCENARIO 3

Variable	Factor 1	Factor 2	Factor 3
C1	-0,062	-0,519	-0,326
C2	0,178	0,490	-0,301
C3	-0,025	0,030	-0,787
C4	-0,282	0,326	-0,061
C5	-0,505	-0,143	-0,070
C6	0,469	0,091	-0,070

According to respondents purification stations for water needed for better protection and water treatment -0.505, IT system is needed to ensure an equitable distribution of water resources and their detailed supervision -0.519 and environmental protection would have better water quality and its pollution would be less -0.787.

### III. SWOT ANALYSIS

- **Benefits** - By implementing the system analysis and monitoring of water resources would allow an easier way of getting accurate, timely and reliable data related to water resources. With the help of this system enabled easier way of supplementing the database obtained from the fieldwork and processing of the office. Video monitoring is a major step in the monitoring of water resources especially in periods when there is increased water level so there is a danger of flooding. The data is processed by using this computer system may be used by other institutions, but still need their approval. With the help of new modern technologies and use the

applications easily enables data to be modified, supplemented and stored.

- **Weaknesses** - disadvantages that may arise in the implementation of the system would be mostly financial perspective. If institutions are planned to use the system are not able to support the system with data exchange, permission to access or CCTV then be a problem in its proper use. All institutions need to cooperate for the timely exchange of data and upgrading. Also part of the staff who would work on this system from different institutions in the country should be trained in its proper use. As long as some employees do not gain retail experience can be lost in time.
- **Opportunities** - The opportunities offered by this system is the easy access to information that can be entered from the field, modifying their timely exploitation. This system would have devoted more attention to water resources and their distribution and monitoring.

Staff working in this area have the opportunity to use new applications and to use new tools.

- **Threats** - threats that may emerge in the modernization of this system are: blockade of the system and its availability (system crash), lack of access to data, sites inaccessible terrain, time delay in implementation.

### IV. OPPORTUNITIES OFFERED BY THE SYSTEM

- Ability to analyze water bodies
- Possibility to change the attributes in the database
- Data entry and changing them
- Monitoring of monitoring sites
- Easy access to the database login
- Ability to print the data
- Setting the pictures of measuring points and their printing
- Display coordinates of locations
- Identification of parameters
- Search Data

### IV. CONCLUSION

In order to analyze multiple scenarios used multivariable data analysis (MVA) which includes monitoring and statistical analysis of multiple processes are processed in the same time interval. With the help of this analysis all variables are used as independent in order to analyze further

alternatives in choice of final conceptual solution. With the help of this analysis to identify and critical parts of the analysis in order to calculate the effects of variables that are used in complex systems. This research used factor analysis for decision. The factor analysis with the help of this program is implemented with the help of scenarios.

#### REFERENCES

- [1] MINTAB Handbook: Update for Release, by Barbara Ryan, Brian Joiner, Jonathan Cryer,
- [2] Applied Regression Analysis and Other Multivariable Methods, by David Kleinbaum, Lawrence Kupper, Azhar Nizam, Eli Rosenberg
- [3] Data Mining and Analysis: Fundamental Concepts and Algorithms, by Mohammed J. Zaki, Wagner Meira, Jr