A Multidimensional View Proposal of the Data Collected Through a Questionnaire. Associated Data Mart Deployment Framework

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Beyond the traditional data analysis approaches based on SPSS (or similar statistical software tools), an alternative demarche will be subject of our debate. Performant data analysis can be completed based on a multidimensional view of the collected data. This implies an additional data mart powered with information obtained through an ETL process from the collected data. Measures and dimensions will facilitate a subject-oriented, time-based analysis. The theoretical approach framework for deploying the data mart will ground a multidimensional analysis on „how the different respondents answered to the questions included into the questionnaire?". In addition, a study case was proposed, a questionnaire built and different analyses presented.

Keywords: multidimensional model, questionnaire, data mart, ETL, data analysis

1 Introduction

D. Slesinger and M. Stephenson in the Encyclopedia of Social Sciences define research as "the manipulation of things, concepts or symbols for the purpose of generalizing to extend, correct or verify knowledge, whether that knowledge aids in construction of theory or in the practice of an art."

A research process consists of a number of closely related activities like: (1) formulating the research problem; (2) extensive literature survey; (3) developing the hypothesis; (4) preparing the research design; (5) determining sample design; (6) **collecting the data**; (7) execution of the project; (8) **analysis of data**; (9) hypothesis testing; (10) generalizations and interpretation, and (11) preparation of the report or presentation of the results, i.e., formal write-up of conclusions reached.

Regarding the collection of data, the researcher should select the proper method of collecting the data taking into consideration the nature of investigation, objective and scope of the inquiry, financial resources, available time and the desired degree of accuracy [1]. **Data can be collected:** (a) by observation; (b) through personal interview; (c) through telephone interviews; (d) **by mailing of questionnaires; using another way of distribution; handling web-based questionnaires**; (e) through schedules [2].

A questionnaire is a set of carefully designed questions given in exactly the same form to a group of people in order to collect data about some topics in which the researcher is interested [3]. As with any other branch of science, the validity and reliability of the measurement tool, i.e. the questionnaire, needs to be rigorously tested to ensure that the data collected is meaningful. The design and the administration method of a questionnaire will also influence the response rate that is achieved and the quality of data that is collected. A questionnaire is given out (normally quantitative) to gather statistical data about responses; in some situations it is recommended to do research in more depth by interviewing (normally qualitative) selected members of the questionnaire sample.

Nowadays, web-based questionnaires are a fiable solution, suitable to distribute, and to collect the opinions of a large number of respondents. The data collected is carefully

analyzed and decisions are grounded. Statistical questionnaires serve to understand patterns and to identify trends within the data. Also, by analyzing the data, predictions should be enabled.

Beyond the traditional analysis approaches based on SPSS (or similar statistical software tools), an alternative demarche will be subject of our debate. **Performant data analysis can be completed based on a multidimensional view of the collected data** [4]. This implies **an additional data mart** (Figure 1) powered with information obtained through an ETL (Extract-Transform-Load) process from the collected data. Measures and dimensions will facilitate a subject-oriented, time-based analysis.
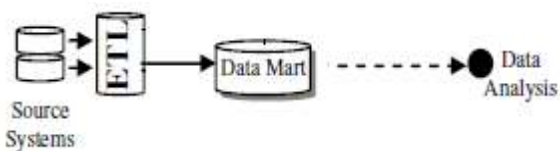
Fig. 1. The data mart environment

2. Approaching questionnaires

2.1 Theoretical background

Looking forward to the desired information and having in mind how data will be collected, questions will be established. Questions can be divided into those **directly related to the research question** (research subject); **filter questions** that explore the characteristics of the different study groups and **'filler' questions** that, although not part of the research question, aid the flow of the questionnaire. Questions can be formulated as **open-ended questions**, where the respondent is free to give her/his own response to the questions, or **closed questions**, where a choice of predetermined answers is given. In both cases, the wording of the questions has an important influence on the responses that are given.

The **layout of the questionnaire** is important not only for ensuring that all the questions are answered, but also for facilitating data coding and analysis. It's important that people's attention is captured and that they are interested in completing the questionnaire.

It is very important to **pre-pilot the questionnaire** for identifying any ambiguities of the questions and the range of possible responses for each question. It is not a formal procedure, more an information-gathering exercise [5]. The next step is to perform a **pilot study to test the questionnaire**, this phase being important for verifying if the data collected from the questionnaire is valid and reliable. At last, but not at least, the **coding schema for questions and answers** will be established. It has a major impact on the ETL process.

2.2 Questionnaire proposal

The Faculty of Economics and Business Administration (FEAA) has a new website – www.feaa.uvt.ro. **We share information with a** wide audience, including academics, researchers, current and prospective students, parents, business environment and media representatives, and many other visitors. Their feedback is important and may conduct to improvements or even to a reengineering of the whole, but with respect to the „spirit of FEAA".

The proposed online questionnaire (Figure 2) basically **manages to collect two categories of data**: (1) feedback regarding the quality of the website, and (2) **consumer demographic data.**

Generally, on-line questionnaires are used by businesses across the globe to survey potential customers, business partners and recent clients. The gathered responses and data interpretation can be invaluable to a marketing campaign or business venture. When users create online questionnaires, they have a number of survey questionnaire templates that they can choose from that will help them launch a professional survey without delay. There are many factors in designing an online questionnaire; guidelines, available question formats,

administration, quality and ethic issues should be reviewed [6].

Our proposed online questionnaire includes mainly closed questions related to: (1) the general impression, 2) the aspect, (3) the content, (4) the layout, (5) ease of navigation, (6) the necessity of displaying commercial advertisements, (7) problems when downloading files, (8) the number of pages accessed, (9) the time spent on the website, (10) if the respondent expectancies were fulfilled, (11) the frequency of accessing the website, (12) the reason for the first visit, (13) either or not a subscription to our University's Press Magazine is wanted, (14) if the subject is a FEAA alumni, (15) if the subject wants to be a part of the FEAA community, (16) the necessity of displaying available jobs, (17) either or not the parents should have access to the students records, (18) a self-evaluation of the subject's skills on browsing the web, (19) age, (20) position, (21) how much time the subject was employed, (22) city, (23) the preferred web browser, (24) the operating system, (25) citizenship and (26) marital status. The date and time when the respondent completed the questionnaire are also recorded.

Three more open-ended questions were added: the e-mail in case the subject wants to receive the results of the study, proposed changes to the website, and what other information/characteristics would she/he like to see on the website.

The responses to the last two questions were recorded and sent to the website developer, but ignored in the study conducted further.

Fig. 2. The proposed questionnaire

A number of 131 responses were recorded, users who accessed the site during two school weeks, taking into account that the questionnaire wasn't mandatory.

3. Multidimensional view of the data collected through a questionnaire
3.1 Data mart/warehouse general considerations
According to McKnight W., establishing the proper data warehouse or data mart architecture is quite challenging [7]. The efficacy of having a centralized data store with quality, integrated, accessible, high performance and scalable data can't be denied, but short term business needs and other interests can conduct to a data mart oriented approach.

The data warehouse/data mart must enclose items/objects of importance to the business as customer, product, time, geography, sales hierarchy and market (referred to as

'dimensions' since they define the context of the business transactions).

Practically, the data warehouse/data mart is a database in which atomic level data from disparate sources is brought together in a structured way creating one multi-subject oriented version of the corporate/department truth, designed to enable timely, accurate decision making in support of strategic and tactical business initiatives.

A **star, snowflake** or **constellation schema**, consisting of facts and dimension tables, will be generated for the data warehouse/data mart, grounding the multidimensional cube deployment process [8].

Having a look at the star schema in Figure 3, the following considerations should be kept in mind:

(1) records in the fact table are often referred to as events, due to the time-variant nature of a data warehouse/data mart environment;

(2) the fact table is linked to all surrounding dimensions;

(3) the primary key of the fact table is defined by the set of foreign keys introduced to join the fact table with all independent dimensions – D_1, D_2, ……, D_n;

(4) the fact table contains the measures of the analysis - M_1, M_2,…., M_p, where M_k = f $(D_1, D_2,…, D_n)$, having k = 1, 2, ….., p;

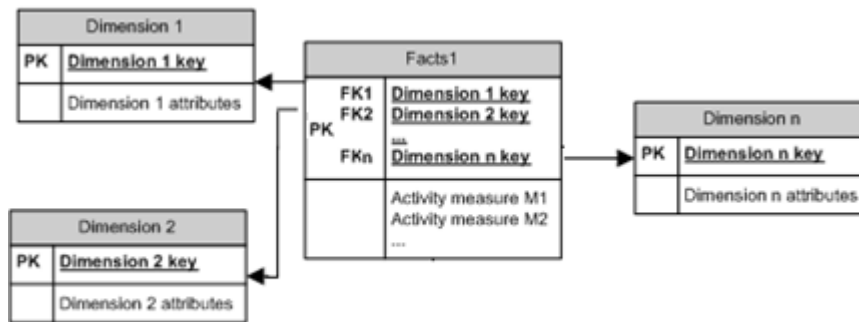(5) dimensional attributes are added to describe dimensional values.

Fig. 3. Data warehouse/data mart star schema

The granularity or data grain of a fact is the level of detail at which the respective fact is recorded (i.e. the level of detail for the measurement) and made available to the dimensional model. Granularity represents a very important aspect in the analysis of data, as it determines the level of available information. For this reason, all recorded data should be kept at a highest granularity level (i.e. highest level of detail) that may be easily changed into a lower level through summarization.

Hierarchies represent the base structures of dimensions and define the relationship between the existing attributes of different levels (Figure 4). They are used for analytical processing in the data warehouse/data mart environment and visualization of data at different aggregation levels.

Dimensional hierarchies will enrich the model and will enable roll-up and drill-down operations on the multi-dimensional cube. The drill-down operation refers to moving downwards along the hierarchical levels of a dimension in order to obtain more details at a lower level of granularity. By contrast, the roll-up operation refers to moving upwards along the hierarchical levels of a dimension in order to achieve less details or a higher level of granularity (i.e. aggregated data).

One dimension can host different hierarchies, all of them starting from the same base level.
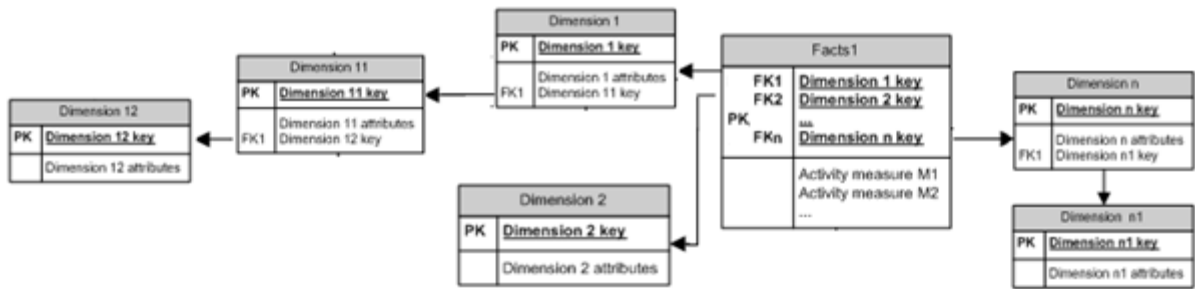
Fig. 4. Data Warehouse/data mart snowflake schema

A complex analysis requires a variety of measures which are depending on different dimensions (Figure 5). These measures are placed in distinct fact tables and are surrounded by the corresponding dimensions.
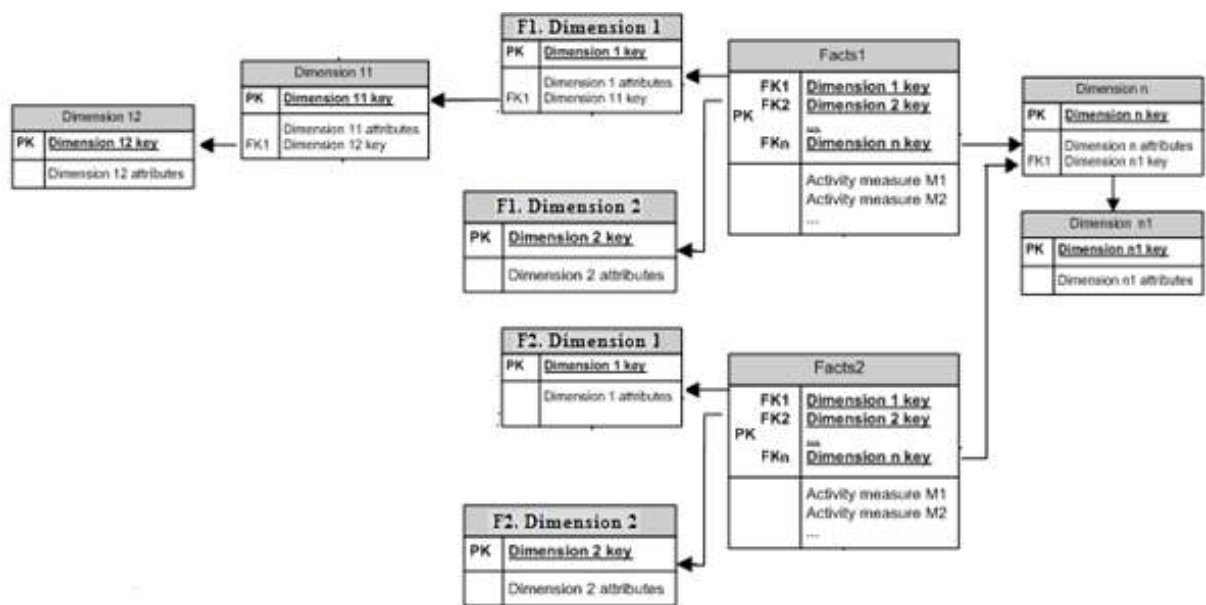

Fig. 5. Data warehouse/data mart constellation schema

There is no direct connection between the facts tables, associations can be made through a common dimension.

3.2 Data Mart Deployment Framework

A general approach framework for the introduced data mart environment (see Figure 1) will be proposed. Conveniently, under **source systems** we understand the database which will store all the answers of the respondents to the different questions ('**n**' questions directly related to the research subject and '**p**' filter questions) included in the questionnaire. Tables like QUESTIONS, VARIANTS, RESPONDENTS and ANSWERS could be part of the database. The following **database schema** is acceptable (Figure 6).
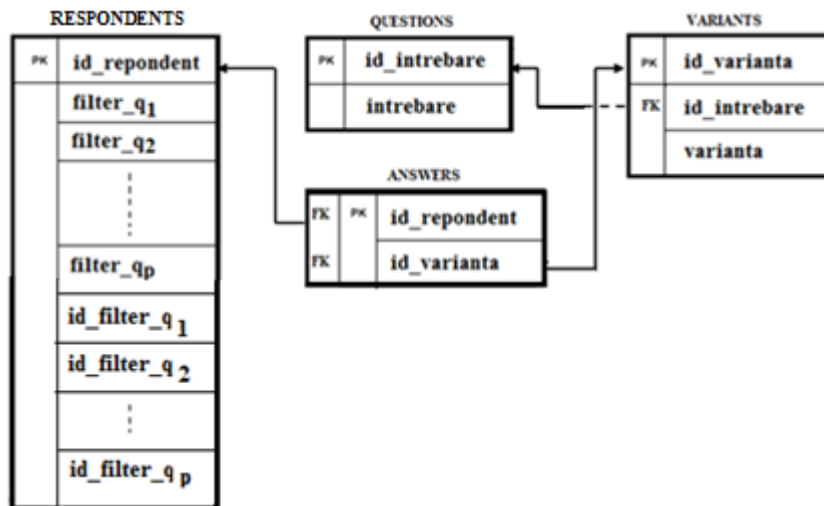
Fig. 6. Source database [4]

(1) **Questions directly related to the research** subject are usually formulated as closed questions and are stored in table QUESTIONS. Answers alternatives are stored in table VARIANTS.

(2) **Filter questions, closed or open-ended**, are exploring the characteristics of the respondents, and therefore will establish the alphanumeric fields filter_q_1, filter_q_2, …, filter_q_p of table RESPONDENTS.

The additionally fields id_filter_q_1, id_filter_q_2, …, id_filter_q_p will facilitate the developing of the data mart (Figure 9) and will be updated during the implementation of the ETL process.

(3) For each filled questionnaire, a new record will be added into table RESPONDENTS and '**n**' records will be added into table ANSWERS.

```
CREATE TABLE QUESTIONS (id_intrebare BYTE PRIMARY KEY, intrebare VARCHAR2 (25));

CREATE TABLE VARIANTS (id_varianta BYTE PRIMARY KEY, id_intrebare BYTE REFERENCES
      questions (id_intrebare), varianta VARCHAR2 (15));

CREATE TABLE RESPONDENTS (id_repondent INTEGER PRIMARY KEY,
      filter_q1 VARCHAR2 (…), filter_q2 VARCHAR2 (…), …, filter_qp VARCHAR2 (…),
      id_filter_ q1 BYTE, id_filter_ q2 BYTE, …, id_filter_ qp  BYTE);

CREATE TABLE ANSWERS (id_repondent INTEGER REFERENCES respondents (id_repondent),
      id_varianta BYTE REFERENCES VARIANTS (id_varianta),
      PRIMARY KEY (id_repondent, id_varianta));
```

According to [4], the data mart will ground a multidimensional analysis on „**how the different respondents answered to the questions included into the questionnaire?**" Developing a data warehouse/data mart is quite challenging, several development methodologies have been identified [9], [10], [11], [12], [13], [14], [15], [16], [17], [18], [19], [20], [21].

The design of a representative dimensional model (i.e. data mart) can be performed within an agile framework (adapted from [22]) (Figure 7).
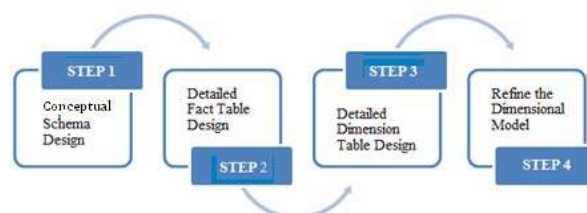

Fig. 7. Data mart agile development framework

STEP1. Conceptual schema design

(1) The variants of the '**n**' questions that are directly related to the research subject will represent dimensional values; i.e. the variants v_{k1}, v_{k2},…, v_{km} of question '**k**' will represent dimensional values on the '**k**' dimension - D_k, $k = \overline{1, n}$.

(2) Consumer demographic data (from the filter questions) will add '**p**' new dimensions into the model d_{q1}, d_{q2},…, d_{qp}.

(3) For each question we will have a distinguished measure (**M_1, M_2, …, M_k,…, M_n**), which will be aggregated taking into consideration the corresponding variants dimension and all dimensions introduced by the filter questions (Figure 8).

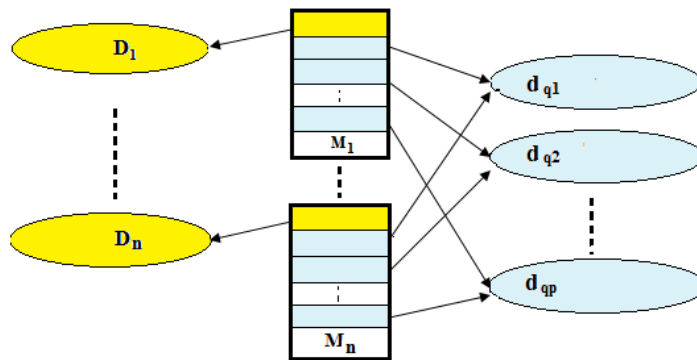$$M_k = f\,(D_k, d_{q1}, d_{q2}, …, d_{qp}),\ k=\overline{1, n}.$$

Fig. 8. Data mart conceptual schema

STEP2. Detailed fact table design

The first step in the design of the dimensional model's fact table consists of determining its key. A defining characteristic of the dimensional model is that the fact table has a non-minimal composite key, comprising all dimension tables' primary keys. Aside from its key, the fact table contains measures or facts that may be analyzed from the various perspectives described by its surrounding dimensions (Figure 9).
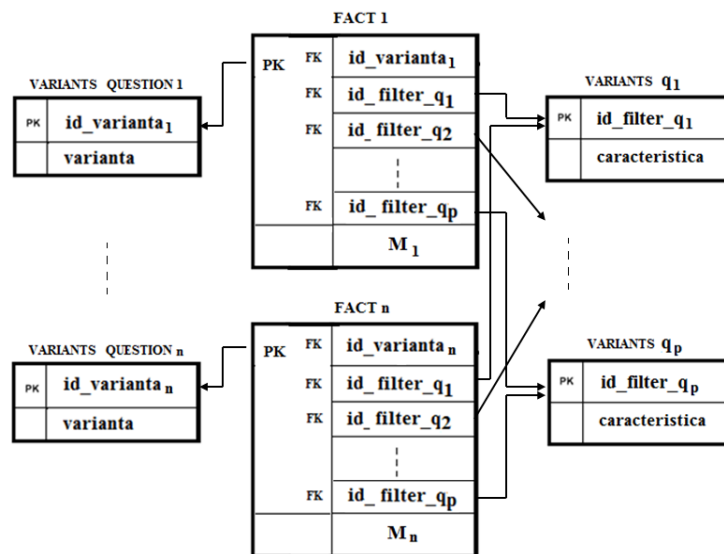

Fig. 9. Detailed data mart schema [4]

STEP3. Detailed dimension table design

An essential aspect in the detailed dimension table design step, and generally in

dimensional modeling, is the identification and representation of hierarchies, which define the basis of the aggregation and the analysis processes.

STEP4. Refine the dimensional model

The dimensional modeling activity has to be accompanied by careful assessment of the end-user informational needs and the underlying data supply. Given these arguments, the model will be refined in order

to enhance the analysis possibilities and provide a better and simpler model for the decision makers to use.

The **effective deployment of the designed data mart** can be realized with the help of some proper Oracle SQL scripts:

(1) one script for creating all the implied tables;

(2) another script (s) for implementing the ETL process.

SCRIPT 1

```
CREATE TABLE variants_question_1(id_varianta_1 BYTE PRIMARY KEY,
      varianta VARCHAR2(…));
…
CREATE TABLE variants_question_n(id_varianta_n BYTE PRIMARY KEY,
      varianta VARCHAR2(…));

CREATE TABLE variants_q1(id_filter_q1 BYTE PRIMARY KEY,caracteristica VARCHAR2(…));
…
CREATE TABLE variants_qp(id_filter_qp BYTE PRIMARY KEY,caracteristica VARCHAR2(…));

CREATE TABLE fact1(id_varianta_1 BYTE REFERENCES variants_question_1
      (id_varianta_1), id_filter_q1 BYTE REFERENCES variants_q1(id_filter_q1),…,
      id_filter_qp BYTE REFERENCES variants_qp (id_filter_qp),
      M1 INTEGER, PRIMARY KEY (id_varianta_1, id_filter_q1,…,id_filter_qp));
…
CREATE TABLE factn (id_varianta_n BYTE REFERENCES variants_question_n
      (id_varianta_n), id_filter_q1 BYTE REFERENCES variants_q1(id_filter_q1),…,
      id_filter_qp BYTE REFERENCES variants_qp (id_filter_qp),
      Mn INTEGER, PRIMARY KEY (id_varianta_n, id_filter_q1,…,id_filter_qp));
```

SCRIPT 2

```
INSERT INTO variants_question_1  SELECT  id_varianta, varianta FROM variants
      WHERE id_intrebare = 1;
…
INSERT INTO variants_question_n  SELECT id_varianta, varianta FROM variants
      WHERE id_intrebare = <value_of_n>;

DECLARE
/* dimension VARIANTS q1 – generating dimensional values */
/* updating field id_filter_q1 in table RESPONDENTS        */
v_q1               BYTE;
v_q1_varianta      VARCHAR2(…);
CURSOR c  IS  SELECT  filter_q1 FROM respondents GROUP BY filter_q1;
BEGIN
      SELECT COUNT (DISTINCT filter_q1) INTO v_q1 FROM respondents;
      OPEN c;
      FOR  i  IN   1.. v_q1 LOOP
           FETCH c INTO v_q1_varianta;
           INSERT  INTO variants_q1  VALUES (i, v_q1_varianta);
           UPDATE respondents SET id_filter_q1 = i  WHERE filter_q1 =
           v_q1_varianta;
      END LOOP;
      CLOSE;
END;
…
DECLARE
/* dimension VARIANTS qp –  generating dimensional values   */
/* updating field id_filter_qp in table RESPONDENTS         */
v_qp               BYTE;
v_qp_varianta      VARCHAR2(…);
```

```
CURSOR c  IS  SELECT  filter_qp FROM respondents GROUP BY filter_qp;
BEGIN
      SELECT COUNT (DISTINCT filter_qp) INTO v_qp FROM respondents;
      OPEN c;
      FOR  i  IN  1.. v_qp LOOP
            FETCH c INTO v_qp_varianta;
            INSERT  INTO variants_qp  VALUES (i, v_qp_varianta);
            UPDATE  respondents  SET id_filter_qp = i  WHERE filter_qp =
            v_qp_varianta;
      END LOOP;
      CLOSE;
END;

/*  determining measure M1    */
SELECT  variants.id_varianta, id_filter_q1,…,id_filter_qp, COUNT(id_repondent)
      FROM  respondents, variants, answers
      WHERE respondents.id_repondent = answers.id_repondent AND
            answers.id_varianta = variants.id_varianta AND id_intrebare = 1
      GROUP BY variants.id_varianta,id_filter_q1,…,id_filter_qp;
…
/* determining measure Mn    */
SELECT  variants.id_varianta, id_filter_q1,…,id_filter_qp, COUNT(id_repondent)
      FROM  respondents, variants, answers
      WHERE respondents.id_repondent = answers.id_repondent AND
            answers.id_varianta = variants.id_varianta AND
            id_intrebare = <value_of_n>
      GROUP BY variants.id_varianta,id_filter_q1,…,id_filter_qp;
```

3.3 Analyzing data collected through the proposed questionnaire

The theoretical approach presented in paragraph 3.2 was applied in order to analyze the data collected through the questionnaire introduced in Figure 2, representing a future step of the researched introduced in [23].

The snowflake schema for analyzing the first question is chosen for detailed exemplification (Figure 10), corresponding information is displayed in Figure 11.
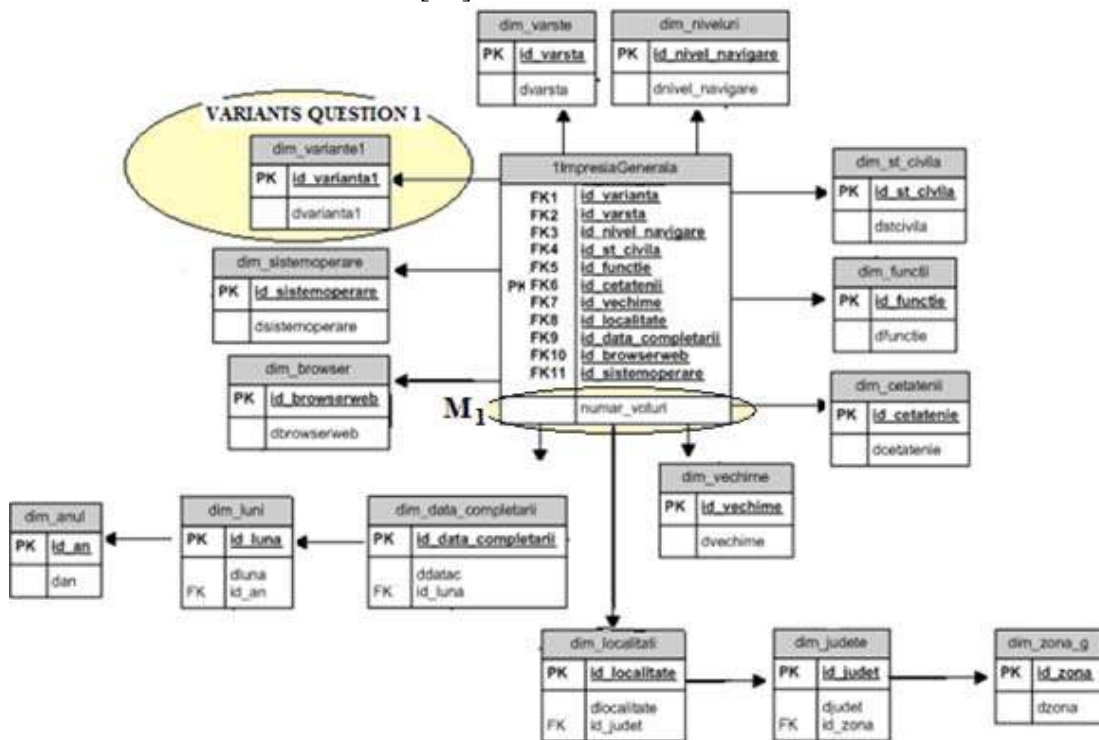

Fig. 10. Sub-schema of the data mart. Analyzing the first question

DNIVEL_NAVIG...	DVARSTA	DSTCIVILA	DFUNCTIE	DCET...	DVECHIME	DLOCALITATE	DDATAC	DBROWSER	DSISTE...	DVARIANTA1	NUMAR_VOT...
bun cunoscator	intre 19 si 23...	necasat...	elev/student	romana	0 luni	Timisoara	22-10-2012	Google Chrome	Windows	bun	2
bun cunoscator	intre 19 si 23...	necasat...	elev/student	romana	0 luni	Timisoara	30-10-2012	Google Chrome	Windows	foarte bun	1
bun cunoscator	intre 19 si 23...	necasat...	elev/student	romana	sub 1 an	Dr.Tr.Severin	18-10-2012	Mozilla Firefox	Windows	bun	1
bun cunoscator	intre 35 si 49...	necasat...	profesor	romana	peste 10 ani	Timisoara	18-10-2012	Google Chrome	Windows	bun	1
expert	intre 19 si 23...	necasat...	elev/student	romana	0 luni	Timisoara	19-10-2012	Mozilla Firefox	Windows	foarte bun	1
expert	intre 24 si 34...	necasat...	manager	romana	intre 5 si 10...	Timisoara	20-10-2012	Google Chrome	Windows	destul de bun	1
bun cunoscator	intre 19 si 23...	necasat...	elev/student	romana	sub 1 an	Timisoara	20-10-2012	Mozilla Firefox	Windows	bun	1
expert	intre 19 si 23...	necasat...	elev/student	romana	sub 1 an	Sofronea	20-10-2012	Google Chrome	Windows	bun	1
expert	intre 19 si 23...	necasat...	specialist IT	romana	sub 1 an	Timisoara	21-10-2012	Mozilla Firefox	Windows	destul de bun	1
bun cunoscator	intre 19 si 23...	necasat...	elev/student	romana	0 luni	Timisoara	22-10-2012	Google Chrome	Windows	foarte bun	2
expert	intre 19 si 23...	divortat	economist	alta ...	intre 1 si 3 ani	Timisoara	22-10-2012	Google Chrome	Windows	bun	1
expert	intre 19 si 23...	necasat...	economist	romana	sub 1 an	Timisoara	23-10-2012	Google Chrome	Windows	bun	1
incepator	sub 15 ani	necasat...	elev/student	romana	intre 5 si 10...	Oradea	23-10-2012	Internet Explorer	Windows	foarte bun	1
expert	intre 24 si 34...	necasat...	altceva	romana	intre 3 si 5 ani	Timisoara	28-10-2012	Google Chrome	Windows	destul de bun	1
bun cunoscator	intre 24 si 34...	necasat...	specialist IT	romana	sub 1 an	Timisoara	28-10-2012	Opera	Windows	destul de bun	1
bun cunoscator	intre 19 si 23...	necasat...	elev/student	romana	intre 1 si 3 ani	Timisoara	17-10-2012	Mozilla Firefox	Windows	destul de bun	1
bun cunoscator	intre 19 si 23...	necasat...	elev/student	romana	0 luni	Ineu	18-10-2012	Google Chrome	Windows	bun	1
bun cunoscator	intre 19 si 23...	necasat...	elev/student	romana	0 luni	Satu Mare	18-10-2012	Google Chrome	Windows	bun	1
bun cunoscator	intre 19 si 23...	necasat...	elev/student	romana	sub 1 an	Timisoara	19-10-2012	Google Chrome	Windows	foarte bun	1
bun cunoscator	intre 19 si 23...	necasat...	elev/student	romana	sub 1 an	Timisoara	20-10-2012	Opera	Windows	foarte bun	1
incepator	intre 24 si 34...	necasat...	economist	romana	intre 5 si 10...	Valcea	20-10-2012	Mozilla Firefox	Windows	bun	1
bun cunoscator	intre 19 si 23...	necasat...	elev/student	romana	0 luni	Marga	20-10-2012	Google Chrome	Windows	destul de bun	1

Fig. 11. Visualization of the integrated data

The predominant response for the first question is that the general impression regarding our faculty's web site is good or very good (79%).
In the following analysis, the dimensions took into account are: the preferred operating system and the preferred browser, with the alternatives: very good, good, pretty good and poor. The responses can be easily depicted as a list or as a chart – Figure 12.
Most of the respondents use Windows as an operating system (97%), 2 respondents use IOS and 2 respondents prefer Android. From the Windows users, 101 respondents out of 131

think that our faculty's web site is very good or pretty good, more than 78%.
From the majority „Windows users", 68 respondents prefer the web browser Google Chrome, this being the overall preferred choice.
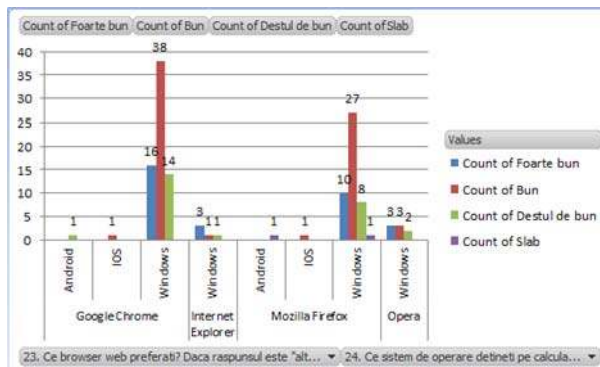

Fig. 12. Responses for question1, the general impression of the web site, taking into consideration the preferred operating system and the preferred browser

Regarding the displaying of commercial advertisements, 62% of the respondents think that this is a good choice. The majority of the

respondents are still students (70%) and the result regarding the necessity of commercial advertisement is in agreement with our

policy – Figure 13. Because it is considered a quick way to visualize the analysis, forceful (it emphasized the main point), convincing (proves a point) and because of the enhanced flexibility, results were displayed as charts from now on.
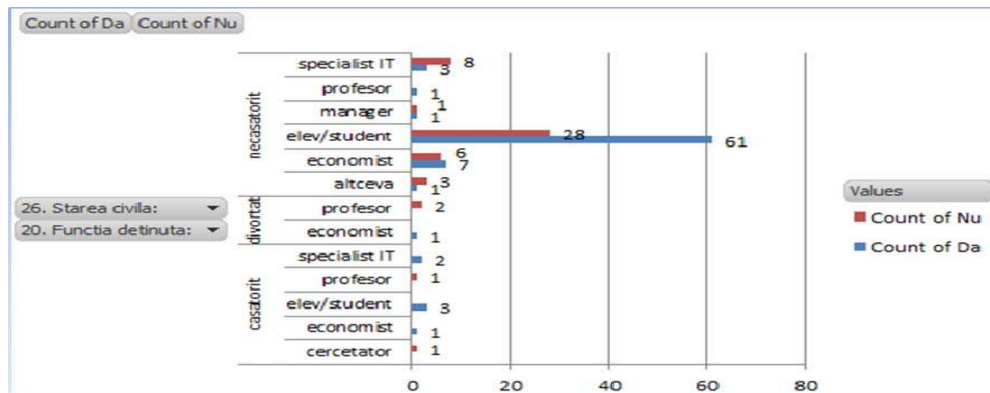

Fig. 13. Responses for question 6, the necessity of displaying commercial advertisements, taking into consideration the marital status and the position

The following analysis regards **whether** or not parents should have access to the student's records, and the result is in favor (60%). The dimensions took into account are the age and the residence geographical area. Most of the respondents live in Banat (101 persons), 41 of them with ages between 19 and 23 – Figure 14. From the Banat respondents, 58% think that the parents should have access to their academic records. The geographical location hierarchy was used, rolling up from the city in order to display the geographical area. There were no respondents with the ages between 15 and 18 in the time slot took into consideration.
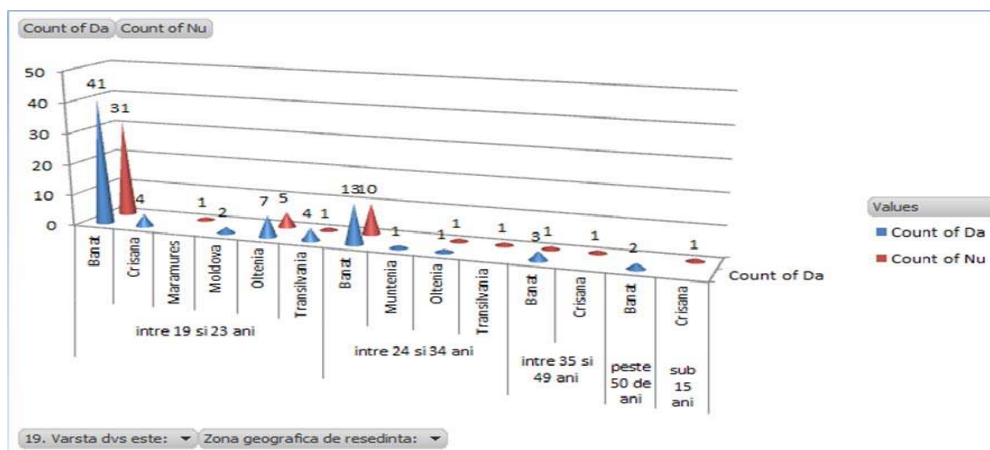

Fig. 14. Responses for question 17, weather or not parents should have access to the students records, taking into consideration the age and the geographical area

The questionnaire was completed during two school weeks. The first day was 14th of October and the last day 30th of October. Some days like 19th of October 2012 were more productive than the others (34% of the total responses). The following analysis is about the time a respondent spend on our faculty's web site. The result shows that most of the respondents usually spend between 0 and 15 minutes on our web site (67%), or between 15 and 30 minutes (28%) – Figure 15.
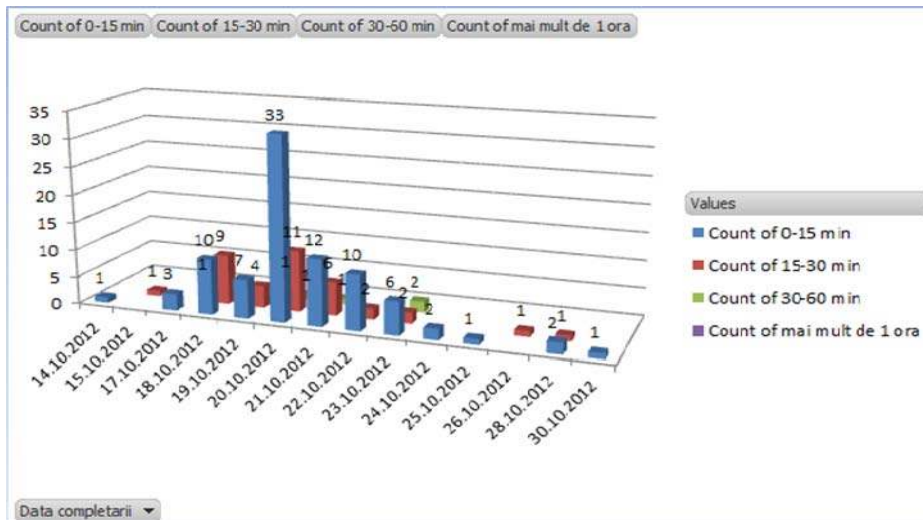
Fig. 15. Responses for question 9, the time that the respondent spent browsing for information on the web site, taking into consideration the date when he/she completed the questionnaire

55% of our respondents want to be informed using the University's Press Magazine. From the Romanian citizenship with good browsing the web skills, 52 want to be subscribed to our University's Press Magazine and 36 don't. At the expert level, the result is irrelevant – figure 16.

Regardless of the citizenship, most of the respondents have good navigation skills (70%) and 28% of them consider themselves experts.
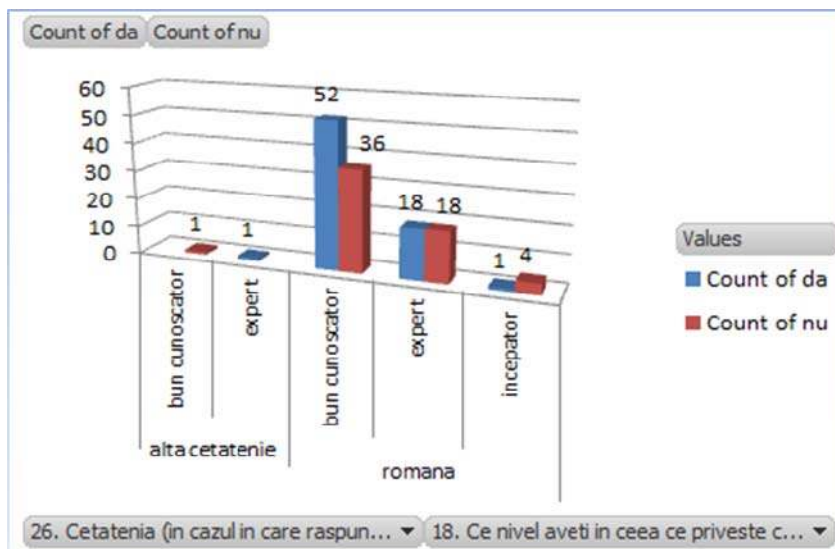

Fig. 16. Responses for question 13, if they want to be subscribed to the University's Press Magazine, taking into consideration the citizenship and the browsing the web skills

5 Conclusions

Questionnaires are common used data gathering tools for collection of primary data in surveys, analysis or to corroborate other research findings. Analyzing the data is a task that requires good analytical skills, the results and conclusions implying further decisions and strategies.

Base data analysis can be made i.e. with MS Excel Data Analysis – Descriptive Statistics and Pivot Table, but to obtain more value from the data, statistical software i.e. SPPS is recommended. Detailed, valuable information about the attitudes and behavior of the questionnaire respondents is extracted.

Beyond these traditional approaches, the data collected through a questionnaire can be transposed into a multidimensional data model. The model is built around measures that are aggregated according to the introduced dimensions. Time and/or spatial dimensions are typically dimensions within the model. According to the identified multidimensional model, a corresponding data mart will enable further advanced analyses. The proposed agile development framework enables the rapid deployment of the data mart taken into consideration its environment.

Additionally, a study case was proposed, a questionnaire built and different analyses presented.

Further research might go deeper into modeling the data mart environment, enabling various views of the collected data and extending the data analysis capabilities.

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