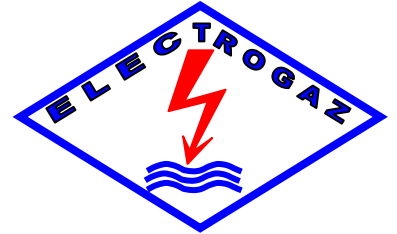


REPUBLIC OF RWANDA.



MINISTRY OF THE INFRASTRUCTURE.



RESIDENTIAL CUSTOMMER LIGHTING SURVEY

**Prepared with the Support of the World Bank Group,
Carbon Finance Assist.**

Kigali Rwanda, February 2008.

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0. OVERVIEW OF THE SURVEY.

In the framework of the greenhouse emission gas reduction relating to the the Clean Development Mechanism Projects of the Kyoto Protocol, the Government of RWANDA through the Ministry of the Infrastructure has decided a massive countrywide distribution of Compact Fluorescent Lamps (CFLs), commonly known as “Energy Savers” in the near future to help electricity consumers to save money on their electricity bills, as well as the electricity and therefore, contribute to the reduction of the energy deficit and the frequent electricity supply interruption.

Electrogaz, a Rwandan utilities public company is entrusted the distribution of these lamps and the other relevant activities.

In preparation of this program, a study on Residential Customer Lighting was conducted in Kigali, the capital of Rwanda representing more than sixty percent of Rwandan electricity customers, to establish the following:

1. The types and nature of residential lighting presently used,
2. The electricity consumer’s categories and their level of consumptions,
3. The normal lighting practice,
4. The extend of consumer awareness of energy savers that are now available in the market.

The results of this survey are intended to help the Rwandan Government and ELECTROGAZ to understand how electricity is used and this would enable them to introduce energy conservation programs that would help consumers save money on their electricity bills , reduce the energy deficit as well as the frequent power blackouts. In a medium and the Long term, the highly expensive electricity generating sources could be avoided.

1 IMPLEMENTATION

1.1. Survey Sample

A sample of 200 customers were chosen among Kigali electricity customers who have not benefited from the 50 000 compact fluorescent lamps distributed during the period June-August 2007.

The distribution of ELECTROGAZ electricity customers is as follows¹:

- Total number of electricity customers country wide : 85 322.
- Kigali city electricity customers 51 892 less 301 big and special customers different from households = 51591.
- Customers having benefited of two compact fluorescent lamps each : 24 414.
- Number of customers among whom the survey sample was chosen : 27 177

The distribution of the sample on the different districts of Kigali city is as follows:

Nyarugenge District : 75

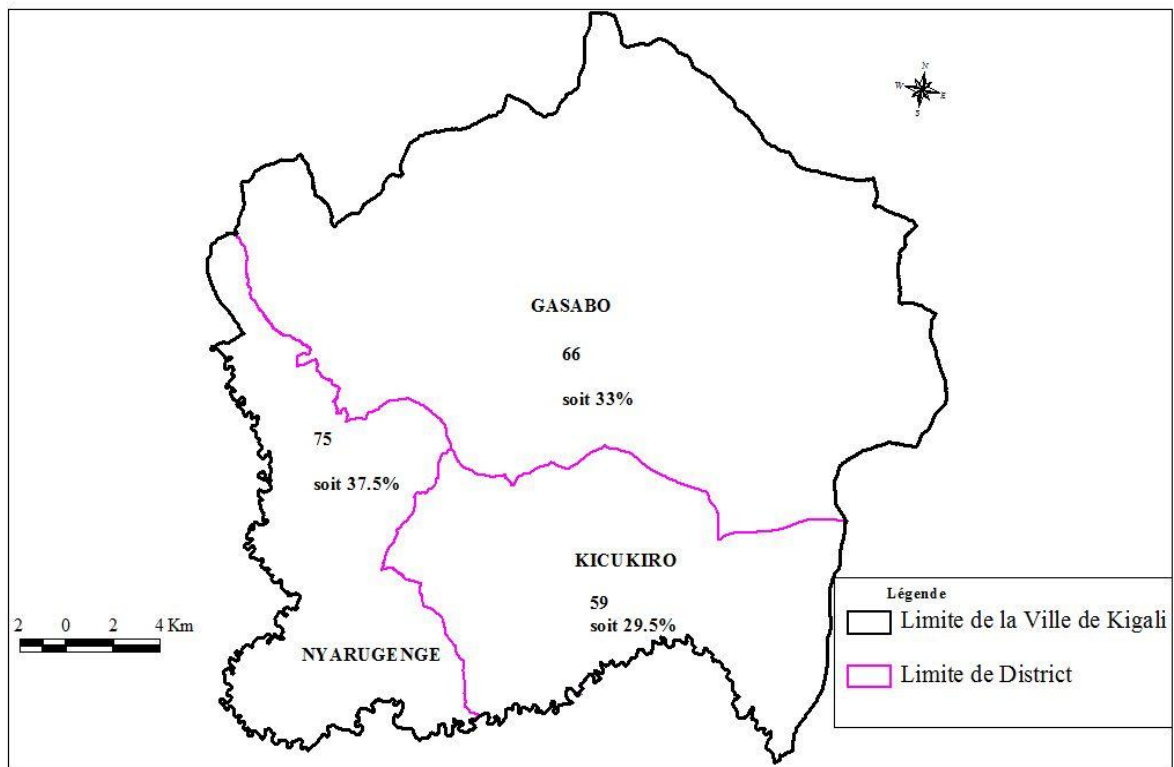
Kicukiro District : 66

Gasabo District : 59

The card below shows the sample distribution.

***KIGALI CITY ADMINISTRATIVE CARD SHOWING THE LIMIT OF ITS
THREE DISTRICTS.***

¹ Commercial department, Annual report 2007, data closed 31 december 2007, Marketing section.



1.2. Questionnaire Design

A comprehensive questionnaire provided by the World Bank was tailored to suit the local conditions and focuses on the following variables:

- The Customer identification comprising the connection number, the house occupational status and the building type.
- The General information including the number of dependents, rooms, type of metering and the electricity monthly consumption level.
- The lighting including the types of lamps, their location, the knowledge of economic lamps, the source of information, the purchasing place and the price proposal, the purpose of preferring or not of the economic lamps.
- The other electrical equipment use in the households.

The questionnaire is attached in the annex.

1.3. The Survey

The survey was conducted within a time frame of one week. At least 200 households each of the three divisions of KIGALI City were visited. A structured interview approach with the questionnaire was used. The survey team comprised of ten persons and two, one from ELECTROGAZ, the second being the Consultant from IMANZI Sarl, the winner of this market. Each surveyor was assigned 20 from all the chosen areas (Local administrative entities).

The respondent were ranked into four economical and social categories namely:

- The low income holders named WORKERS(ouvriers) group in this work,
- The Civil servants
- The private sector employees (including those working for themselves).
- The unemployed and retreaded ones.

1.4. Data Collection and Analysis

The data were collected by the interviewees on site from the talking with the costumers making the sample in compliance with the preestablished questionnaire.

Answers/responses were grouped and analyzed using SPSS programs. The information grouped under excell tables format was interpreted both quantitatively and qualitatively.

1.5. The Time Schedule.

According to the contract relevant to this work, the working period was sixty days starting 2008-01-01. Meanwhile, the work was urgent and the soon achieving would be better. The time schedule was forecoasted as follows:

- 27th – 28th December 2007 : Interviewers training /initiation and pre-test
- 31 decemer 2007 : Pre-test data analysis and reporting.
- 2nd – 04th January 2008 : Survey preparation : Interviewers cards, Public announcement of the visit to some custommers from choosen areas, Other relevant logistics.
- 7th – 11th january 2008 : Data collection through Interview.
- 14th - 24th january 2008 : Data Writing/posting in SPSS program.
- 25th january – 08 fevr 08 : Data arrangement, and posting cheiking.
- 9th february – 14 february : Data Analysis.
- 14 february – 22 february : Data intrepretion and final report.

2. RESULTS INTERPRETATION.

As said above, a total sample of the 200 households were surveyed, of which 75 clients representing 37,5% are from NYARUGENGE District, 66 clients representing 33% are from GASABO District, and 59 representing 29,52% are from KICUKIRO.

The results were grouped according to customer category and the number of replaceable lamps in each category was indicated, as well as the percentage number of incandescent bulbs that are used for 2 or more than 4 hours per day as shown below in Table 1.

Table 1. Key Results of the Survey

Customer category	no. of HH in sample	Lamps per HH	Average number of Incandescent lamps per HH	% number of incandescent bulbs by average hours of use /day	
				> 4	2 to 4
Workers	35	4,97	2,86	30,2	69,8
Civil servant	65	6,14	3,29	47,0	53,0
Private sector	59	5,63	3,12	50,9	49,1
Unemployed /retr	41	6,32	3,54	53,3	46,7
TOTAL	200				

The highest percentage of households (32,5%) are medium income residential customers.

The relatively high residential income customers known as Private sector employees are 29,5 %. 17,5% of the households are the lower income residential customer category, and 20,5 % are under the unclassifiable source of income.

For each category, the average number of incandescent lamps held is at a higher rate than other categories of lamps used. It is also noted that around 45 % incandescent lamps are used more than 4 hours a day, whereas about 55% are used between 2 and 4 hours per day.

Table 2 below indicates the number of lamps each category of household sampled.

Table 2. Grouping of Lamps in Households

Customer category				Cust categ and Lamps in HH (Grouped)					TOTAL
	Description	No. of HH	% No. of HH	1 - 2	3 - 5	6 - 8	>8	Not Specified	
Tier 1	Workers	35	17,5	26	5	0	0		31
Tier 2	Civil servant	65	32,5	61	10	0	0		71
Tier 3	Private sector employee	59	29,5	48	6	0	0		54
Tier 4	Unemployed or retreated	41	20,5	39	5	0	0		44
	Total	200	100	174	26	0	0	0	200

With reference to the customer categories, the sample distribution shows 32,5 % of civil servant considered as the medium income owners, 29,5% of private sector employees who generally have the relatively high income, 20,5% unemployed and retreated whom the income resource is not well defined and 17,5 workers who have lower income.

According to our questionnaire model and the relevant data posting in SPSS program, no place was provided to the number of lamps per household.

In order to find data to complete with the table, we have computed the average number of lamps per room per household.

So, the figures in the table above do not represent the number of households with 1-2; 3-5; 6-8 and >8 lamps in all the houses, but they represent an average lamps per room per customer category.

The rooms said in this survey as provided in the questionnaire are:

The bedrooms, - the kitchen, -the family rooms, -the dining and living rooms, - outside and the bathrooms. From this table, we note that the higher number of customers (86%) have an average 1- 2 lamps per room each, and the civil servant are dominants at 35% .

No respondent has more than 5 lamps per room.

The tables under number 3 summarize the Residential status and the monthly electricity billing or purchase.

Table 3: RATES OF RESIDENTIAL STATUS, MONTHLY ELECTRICITY BILL OR PURCHASE

(3.1.) RESIDENTIAL STATUS

Owner	Tenant	Other
65,5%	33,5%	1%

(3.2.) ELECTRICITY BILL OR PURCHASE

Monthly bill/purchase	1000	1000-5000	5000-10000	> 10000	Unknown
Electricity purchase	1%	33%	34%	31%	2%
Electricity bill	75%	4%	11%	7%	4%

As we can see from table 3.1., the household owners represent 65,5%, when tenants and other categories represent respectively 33,5% and 1%.

From the table 3.2., 65% of customers using prepayment meters pay from 5 to >10000 rwf per month of electricity consumption, 33% pay between 1000 and 5000rwf per month, 1% pay only 1000rwf, and 2% do not know exactly what they pay.

The billing level is quite very different from the purchase on prepayment.

75% of the respondent pay only 1000rwf per month, 11% pay between 5000 and 10000 per month, 7% pay over 10000rwf, 4% pay between 1000 and 5000 rwf, the last 4% do not know their monthly bill.

For other main variables used to conduct the survey, the tables below evolving from number 4 to number 9 explain more.

● **Number of Dependent and number of rooms per household.**

The tables under number 8 show that, an average number of dependents **is 7 per** household, when an average number of rooms **is 8**.

On a total sample of 200 household, a lower number of 7 households have only one dependent each, and 8 others have 2 dependents each.

The higher number of dependents (around 87% or 173 of 200) are concentrated between 3 and 10 per household. 12 households have from 11 to 20 dependents.

The households with one room house are 3, and 2 of them are the workers. An important number of customers have a number of rooms between 4 and 10 each.

● **Number of lamps - types of lamps per location , and the fittings.**

- As presented on the table 5, the important number of lamps are used in the bedrooms(23,5%), followed by the dining room(19,25%) and the family rooms. The distribution of types of lamps shows an important number of incandescent lamps at 56,7%. An other type of lamps mostly used after the incandescent lamps are the fluorescent lamps on a rate of 23,9%. The other types of lamps reach together a rate of 19%, which is very low.

- The fittings (table 6) used are mainly the **sochets** at 82 %, when reglettes for tubes come on a second position at around 18%.

● **Wattage and average use hours per day.**

- According to the lighting grouping in the table 6, the big number of the lamps used by most of the respondents are the incandescent bulbs around 82% as we have seen from the previous table.

In this group, the higher rate of wattage grouping is comprised between 60 and 100 watts at 52,9%, followed by a group between 20 and 60 watts at a rate of 41,5%.

The other types of lamps have a high rate of wattage between 20 and 60 watts, these are the fluorescent longs (72%) and the fluorescent shorts (71,5 %).

About 6% have over 100w.

- The hours of use per day (table 8) in table 8 indicate that all the types of lamps are used at a high rate. The incandescent lamps representing about 56% of all the lamps are used over 4 hours a day at 28,5%, and 31,6 of incandescent lamps are used between 2 and 4 hours a day.

The compact fluorescent are used over 4 hours at 35,2%, when the fluorescent long and short are used over 4 hours per day at 56,8% and 61,3 respectively.

Table 4 : AVERAGE NUMBER OF DEPENDENTS AND ROOMS/HH

4.1. NUMBER OF DEPENDENTS

	Workers	Civil servant	Private sector employee	Unemployed or retired	TOTAL	REAL TOTAL
1	2	2	3	0	7	7
2	3		2	3	8	16
3	2	4	6	1	13	39
4	2	8	4	4	18	72
5	4	6	9	3	22	110
6	6	12	13	6	37	222
7	7	12	2	9	30	210
8	3	5	6	6	20	160
9	1	5	2	2	10	90
10	5	6	8	4	23	230
11			1	1	2	22
12				1	1	12
13	1		1		2	26
14	1				1	14
15		2			2	30
16			1		1	16
19	1				1	19
20			1	1	2	40
TOTAL	35	65	59	41	200	1335
	AVERAGE NUMBER OF DEPENDENTS/HH					7

4.2 NUMBER OF ROOMS PER HH

	Workers	Civil servant	Private sector emplo	Unemployed or retired	TOTAL	REAL TOTAL
1	2		1		3	3
2	2	1	3	1	7	14
3	3	2	1	1	7	21
4	5	8	7	1	21	84
5	5	8	5	9	27	135
6	3	11	2	4	20	120
7	2	9	4	5	20	140
8	4	5	13	3	25	200
9	1	3	1	2	7	63
10	6	12	11	9	38	380
11			3		3	33
12	1	2	2	2	7	84
13		2			2	26
14		1	1		2	28
15	1			2	3	45
16		1	1		2	32
17			1		1	17
18			1		1	18
20			2	2	4	80
TOTAL	35	65	59	41	200	1523
	AVERAGE NUMBER OF ROOMS/HH					8

Table 5. Total Number of Lamps in different Locations and Total type of Lamps

Customer type	Bedroom	Kitchen	Family room	Dining Room	Outside	Bathroom and other	not specified	Total Lights	Total Incandescent	Total Compact Fluorescent	Total Fluorescent Long	Total Fluorescent Short	Total Fluorescent Circular	Total Other
Workers	72	23	53	67	30	32		276	147	76	22	27	0	4
Civil servant	143	85	115	123	95	81		642	348	146	78	55	2	13
Private sector employee	158	87	113	114	78	83		632	360	184	35	48	1	4
Unemployed or retreated	92	48	92	76	55	61		424	264	66	34	56	1	3
Total	465	243	372	380	258	256		1974	1119	472	169	186	4	24
Percentage	23,55	12,29	18,87	19,25	13,09	12,96			56,69	23,91	8,56	9,42	0,20	1,22

Table 6. Total Number of Lamps with sockets/Reglettes Fittings

Customer type	Total Lights		Total Incandescent		Total Compact Fluorescent		Total Fluorescent Long tubes		Total Fluorescent Short tubes		Total Fluorescent Circular		Total Other	
	Sockets	Reglettes	Sockets	Reglettes	Sockets	Reglettes	Sockets	Reglettes	Sockets	Reglettes	Sockets	Reglettes	Sockets	Unspecified
Workers	227	49	147	0	76	0	0	22	0	27	0	0	4	
Civil servant	509	133	348	0	146	0	0	78	0	55	2	0	13	
Private sector employee	549	83	360	0	184	0	0	35	0	48	1	0	4	
Unemployed or retreated	334	90	264	0	66	0	0	34	0	56	1	0	3	
Total	1619	355	1119	0	472	0	0	169	0	186	4	0	24	
Percentage	82,02	17,98	69,12		29,15			47,61		52,39	0,25		1,48	
Sockets + Reglettes	1974		1119		472		169		186		4		24	
Grand Total	1974		1119		472		169		186		4		24	

Table 7. Total number of Lamps in Different Wattages

Customer	Description	Incandescent (W)				Compact Fluorescent (W)				Fluorescent Long				Fluorescent Short (W)				Other lamp types (W)				
		[10-20]]20-60[[60-100]	>100	5-9	10-20	20-60	60-100	10-20	20-60	60-100	>100	<10	10-20	20-60	60-100	>100	<10	10-20	20-60	60-100
Tier 1	Workers	9	50	106	1	12	16	19	18	2	15	3	0	0	8	10	4	0	0	2	2	4
Tier 2	Civil servant	29	177	139	3	10	18	82	16	2	61	11	0	1	5	36	5	3	0	0	13	6
Tier 3	Private sector employee	5	144	198	3	6	25	105	23	5	27	10	2	0	2	35	2	3	1	1	0	2
Tier 4	Unemployed or retreated	12	93	148	0	0	8	35	18	7	21	6	0	0	0	27	10	0	0	0	4	4
	<u>Total</u>	55	464	591	7	28	67	241	75	16	124	30	2	1	15	108	21	6	1	3	19	16
	<u>TOTAL GEN</u>	1117				411				172				151				39				
	<u>Percentage</u>	4,9	41,5	52,9	0,6	6,8	16,3	58,6	18,2	9,3	72,1	17,4	1,16	0,66	9,9	71,5	13,9	3,9	2,5	7,6	48,7	41,2

T.G. all lamps 1890

Table 8. Total number of Lamps by Different Average Hours of Use per Day

Customer	Description	Incandescent			TOT INC	Compact fluoresc			TOT CF	Fluorescent Long			TOT FL	Fluorescent short			TOT FC	Other types of lamp			TOT OTH	TOTAL GENER
		< 2	2 to 4	> 4		< 2	2 to 4	> 4		< 2	2 to 4	> 4		< 2	2 to 4	> 4		< 2	2 to 4	> 4		
Tier 1	Workers	51	67	29	147	35	16	25	76	4	7	11	22	3	8	16	27	0	0	4	4	276
Tier 2	Civil servant	150	105	93	348	62	33	51	146	12	19	47	78	10	15	30	55	0	8	7	15	642
Tier 3	Private sector employee	132	112	116	360	93	30	61	184	6	7	22	35	7	10	31	48	0	3	2	5	632
Tier 4	Unemployed or retreated	114	70	80	264	22	15	29	66	12	6	16	34	7	12	37	56	0	0	4	4	424
	<u>Total</u>	447	354	318	1119	212	94	166	472	34	39	96	169	27	45	114	186	0	11	17	28	1974
	<u>Percentage</u>	39,9	31,6	28,5	56,7	44,9	19,9	35,2	23,9	20,1	23,1	56,8	8,6	14,5	24,2	61,3	9,4	0,0	39,3	60,7	1,4	100

3. LESSONS LEARNT

- Previous information to the customers through the radio announcement has played a key role to facilitate surveyors easy access to the information. Meanwhile, we have noted that some respondents need to be informed on the exact time surveyors intend to reach their household so that they suspend other activities to be available at home and supply fully the required information. The survey during the weekend should be preferable by many customers because more available at their homes.
- The surveyors' cards with ELECTROGAZ logo and the mention SURVEYOR as well as the surveyor's key personal data (identification) were very useful to avoid to the respondents the confusion between the wrong surveyors probably with bad personal mission and the real ones. Respondents were more securised and trusted to the consistency of the survey.
- The public information through the radio reached the local authorities and some of them offered their cooperation. Better the basic local authorities should be specifically informed, met and sensitised to the full cooperation to this work, since they know more their population and could help to the sampling without time losing.
- Surveyors training played a key role as well as to have associated them to the survey planning. They knew better the scope of their work and their activity field, and were consequently committed with full awareness of the mission they were assigned to. Possible difficulties on the ground were identified before the survey starting, discussed and proper strategies were set up.
- Some surveyors do not complete well the survey forms, the forms checking always after the data collection was necessary to correct all wrong information and call to attention of the surveyors making mistakes. The daily sharing of field experience was important in the way that all inconsistencies were rectified on time and proper strategies were set up to avoid the same scenario for the next day of work.
- The consensus on the questionnaire setting before survey starting has helped to set the data posting design. Meanwhile, we have noted that the best setting of posting design depends mainly of the required survey reporting model.
- The pictures of the lamps concerned by the survey have helped to guide both surveyors and respondents to identify the lamps during the interview.

4. CONCLUSIONS

- The survey was conducted in KIGALI City representing 61% of the country wide ELECTROGAZ customers connected to Electricity network. The sample was 200 household.
- Incandescent bulbs take the largest percentage of use in the households. 1974 lamps were found, of which **1119 representing 56,7%** were incandescent bulbs, **23.9%** were compact fluorescent lamps low quality (quite different from those distributed by ELECTROGAZ), **17,98%** were fluorescent tubes (long and short grouped) and **1.42%** were other lamps.
- A total average lamps per household are around **6**, of which an average of **3,2** are the incandescent bulbs.
- The sockets are the main number of fittings representing 82,02% in the households. Reglettes are 17,98%. Incandescent bulbs take 69,12% of the total sockets, when compact fluorescent lamps have 29,15%. The other lamps less the fluorescent with reglette fittings are 1,42 sockets fittings.
- 40W, 60W, 75W, 100W and >100w are predominant sizes of incandescent bulbs found covering **95,18%** of them. **52,91%** of the incandescent bulbs are between **60w and 100W**, **41,54%** are between 20 and 60w, meaning **40w** bulbs, **4,92%** are between 10 and 20 bulbs, meaning 20w bulbs.
- The awareness level of energy saving by use of the compact fluorescent lamps is higher in the Private sector and the Civil servant groups than the two other groups, namely the Unemployed or retreaded and the workers. Meanwhile, the rate of 23,91% (ranked second) on the total lamps used by the total number of respondents who have not benefited of compact fluorescent lamps from ELECTROGAZ is an evidence that compact fluorescents are already well known by many customers.
- The lamps purchase from local store remain higher for all the customer categories :
 - The incandescent lamps are purchased at 79,7% , workers represent among them 88,9% - The fluorescent lamps are purchased at 57,8% ; compact fluorescent at 49,5%.
- Many of the households do not prefer to buy the economic lamps because of the higher price . 71% of all the respondents to this question confirm this reason. On an other side, 86,8% prefer the economic lamps because of their low price of use; 62,4% prefer economic lamps because of the environment protection and 54,5% prefer them because of the quality of light.
The results show also the preferred price of the economic lamps is between 200 and 500rwf at a rate of 68,5%. The 31,5% propose more than 500rwf per economic lamp.

5. RECOMMENDATIONS

With consideration of the results and conclusions drawn from the survey, the following are some general recommendations to be considered when developing the implementation strategy for the CFL program in Rwanda:

1. According to the survey, the average of lamps per household are 6, of which 3,2 are incandescent bulbs. From this statement, an urgent replacement of the incandescent bulbs requires about **3,2x 85322(normal customers countrywide) = 273030 compact fluorescent lamps.**

Since the other lamps used by ELECTROGAZ customers are low quality despite the low electricity consumption of some of them, they need to be replaced by about other **240 000 good** compact fluorescent lamps in the near future.

2. Since the survey was conducted only to the households, the needs in economic lamps from the industrial sector and other big customers are not well known. These information should be collected as well as the annual growth rate of ELECTROGAZ customer number, for a good forecast of compact fluorescent lamps purchase.
3. For the purpose of reporting clarity, the client reporting model before survey starting is a must. The changes after the data posting in the survey program leads to an enormous work of adaptation and therefore, to some complications and risk of report delaying.