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Census methodology

Enumeration via internet - Estonian experience[1]

Note by Statistics Estonia

Summary

The census of 2010 wave was organized in Estonia using an innovative combined methodology, consisting of self-enumeration via internet (e-enumeration) and traditional face-by-face interview by laptops.

The results of the e-enumeration were quite good: 67% of the population participated in the census via internet, more than half of them entered into the enumeration environment first-hand. Only about 1% of questionnaires filled in by internet needed correction by interview.

This paper gives an overview of the first enumeration via Internet in Estonia.

[1] Prepared by Diana Beltadze.

I. Introduction

1. Statistics Estonia started the preparations for the 2010 round of censuses as early as in 2006. The first question that needed answering was whether it was possible to organise the census without fieldwork, relying solely on the existing national registers. However, an initial analysis indicated in 2008 that Estonia's registers were not yet ready for a successful conduct of a population and housing census.

2. By the way the demand for census statistics was increased. The reason thereof lies in the smallness of Estonia, incl. the smallness of its rural municipalities and cities. Estonian state registers were good but not as detailed as to enable to draw sufficiently accurate conclusions about the size and geographical location of population, gender- and age-specific structure, migration, employment, and about the family and household compositions as well as the living conditions and dwelling stock of people.

3. The Census Committee of the Government of the Republic approved a combined methodology as the method to be used in 2010 census round. Mainly for people it meant combined data collection methodology. All previous censuses from the year 1881 in Estonia have been conducted using paper questionnaires or census sheets (Ene-Margit Tiit 2011).

4. Considering the fact Statistics Estonia developed the strategy "From data collector to information service provider for the period 2008 -2011(T.Sillajõe 2012).Following the strategy, it was a continuous movement towards higher efficiency of processes and partnership with data suppliers during census preparatory work and as well census enumeration period. Statistics Estonia looked for efficiency gains from wider use of electronic data collection. The progress has been due to constant analysis of the office's actions and trying new ways of communication with respondents. In the implementation of central data collection, Statistics Estonia has changed its habits many times in order to encourage respondents to change their habits and switch over to electronic channels. The method and the software were tested in the Pilot Census in 2009 and used for the first time for the Agricultural Census in 2010.Besides that Statistics Estonia introduced two new technical solutions during the Census: self-completion of questionnaires on the internet and entry of answers directly in laptop computers during census interviews. The option of using paper questionnaires was kept as a backup for emergency situations. The possibility of telephone interviews was also foreseen for particularly exceptional circumstances, especially in cases when there was a need to specify the answers to a questionnaire or a census location was extremely difficult to access (e.g., on a small island).

5. The goal of the new solutions was to ensure a bigger coverage for the Census and a better quality faster publication of results. In these days it was important to foresee that population accounts need corrections and e-Census gave Estonia a possibility to get data on the residents who temporarily reside abroad (D.Beltadze 2012).

6. This paper gives an overview of the first enumeration via Internet in Estonia.

II. No previous e-Census experience–only lessons learned from the pilot census

7. The data collection of the 2011 Population and Housing Census was planned as a two-step process – the first stage was web-based self-enumeration (for the first time in Estonia) and the second stage (after an interim period for initial data processing) was a classical interview census with the help of laptop computers. The relation between the two variants was estimated with the help of a statistical model compiled based on the pilot

census data as well as on the basis of expert evaluations and the experience of other countries. Most of the estimations remained around 25–30%, which was also supported by the relatively conservative estimation used while calculating the activity plans and number of enumerators–25% of all persons subject to enumeration will enumerate themselves online fully and correctly.

8. The results of the pilot census led to a number of changes in the census plan, even though the basic concept remained unchanged. The initial schedule was modified: as the activity decreased significantly in the middle of the e-Census period in the pilot census, it seemed practical to reduce the time of the e-Census to one month (Ene-Margit Tiit, Diana Beltadze 2010). The data correction period between the e-Census and census interviews was extended to two weeks and the period of census interviews was extended to one and a half months. Several suggestions for improvement were submitted to software developers to increase user-friendliness of the on-line census environment. As both the questionnaire and software underwent significant modifications after the pilot census, the instrument needed another test. This 'mini pilot census' took place in September 2010. For that purpose, a simulated dataset was generated according to a test plan, prescribing various problematic data combinations and situations. The analysis of the results of the mini pilot census indicated that the instruments were ready for the Census.

III. The period of the census – start with Notification

9. Throughout 2011, the communications group of the census team kept the Estonian population informed about the goals and procedures of the upcoming population and housing census. The members of the census team gave press conferences, wrote articles in the media and prepared special advertising products (publications, outdoor posters, promotional clips). Monthly surveys indicated a gradual increase in public awareness and motivation to participate in the census. "Everyone counts!" was selected as the slogan of the census. One of the key questions concerned the selection of subjects of the census (the definition of a permanent resident) as well the need to state the actual place of residence, not the officially registered place of residence. The communications also thoroughly explained the definition of pendulum migrants and of those who are considered to have left Estonia.

10. The features of e-census (especially the options for signing in the census environment) were presented immediately before the census, and people were asked to wait with the filling out of the questionnaires beyond the first day of the census.

11. In the period before the Census, an intensive publicity campaign was launched, the first stage of which paid great attention to self-enumeration possibilities online and motivated the population to use this opportunity. For this time the results of participation in e-Census had been found out in several countries (Latvia, Lithuania, Bulgaria, South Korea and Canada), which all surpassed the level planned in Estonia. A sociologist Juhan Kivirähk was the first one to formulate the aim of the Census before the beginning of e-Census – to achieve the world record result within the sense of share of e-enumareted population.

12. To get a good contact with the population and to ensure the transparency of the Census, information about conducting the Census was put on the Population Census website. It contained the total number of correctly completed personal questionnaires and its relation to the number of population in the whole country as well as in counties. This indicator turned out to be a powerful means of stimulation. Although the Census team kept a relatively low profile with regard to record results and pointed out that the submitted number of personal questionnaires does not indicate the exact number of enumerated

persons, a nationwide synergy arose during the.Census, inducing the share of enumerated people to grow to nearly 2/3 of the estimated population number. Even if a certain amount of submitted e-questionnaires needed to be specified afterwards, the share of initially predicted persons participating in e-Census was surpassed manifold.

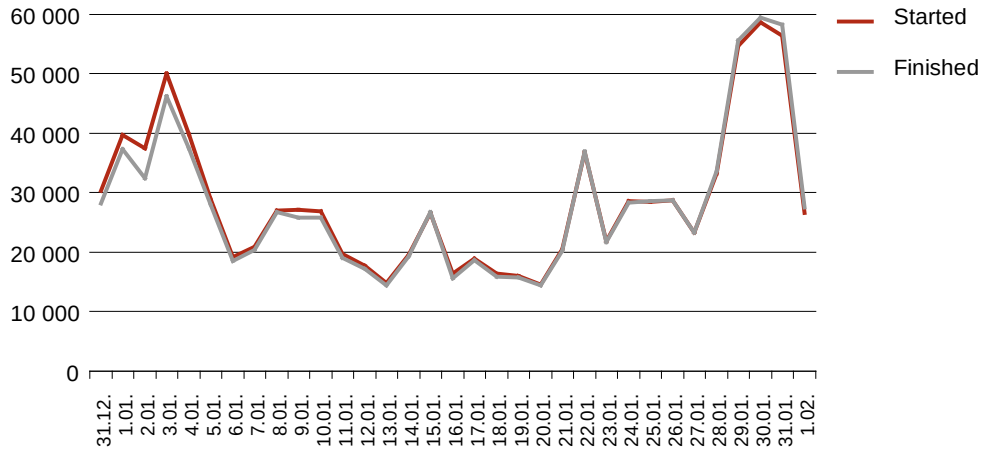
13. The information and motivation campaign was repeated during the period of the census: notification e-mails on enumeration options were sent to known e-mail addresses ten days before the expiry of the e-census period, and notifications with the slogan “Do not be left out of the picture!” were distributed two weeks before the end of the census.

IV. E-census

14. The e-census started on New Year’s Eve 2011. The first and second day of the census were calm (weekend and a public holiday). The situation completely changed on 2 January. The use of online enumeration rose to unexpected levels.The time required for responding was doubled compared to previous days, further exacerbating the congestion. The customer support was unable to answer all the incoming questions and there was even a service interruption, which fortunately only lasted for half an hour. The measures taken were efficient and the situation improved significantly on the following day. There were no further major technical setbacks in the e-census, despite the number of users being even higher in the final days than at the start of the e-census. The extremely intense start of the census, when ca 50,000 persons started to fill out questionnaires in one day, was followed by a rather quiet period of two weeks, with about 20,000 questionnaires being filled out per day (see Figure 1).

Figure 1

Number of started and finished personal questionnaires during the e-census per census days



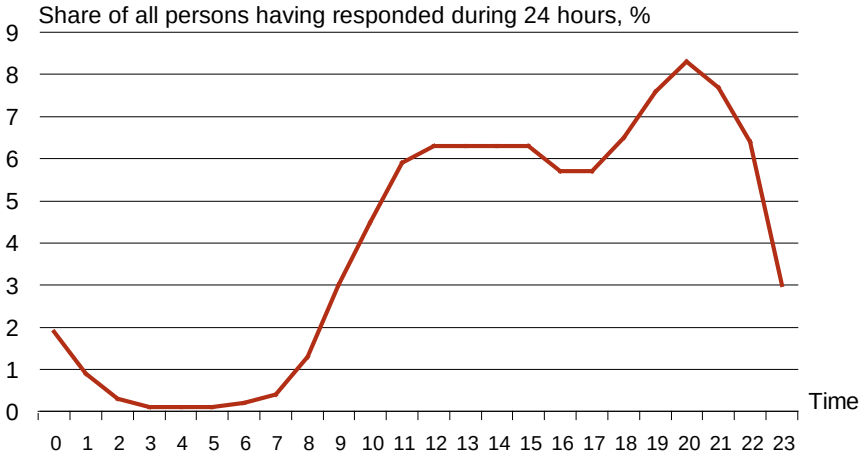
15. The activity increased in the last ten days. An important factor was the generally positive attitude of the population and a desire to achieve the target created during the census period (to beat the world record in terms of the share of persons participating in the e-census). It excited potential respondents and was supported by continues updates on the website. Although at the end of the e-census the number of enumerated persons amounted to 60,000 per day, there were no further setbacks. As questionnaires were being filled out at a high rate even in the last days of January, the census team decided to extend the census period by one day: 1 February was added to the e-census period and the online census environment was closed on 2 February 2012 at 2:00.

16. The contribution of the support team was crucial for the success of the e-census: the users filling out the questionnaires had access to both telephone and e-mail assistance and advice. Even though there was a queue of users needing assistance during the highest-intensity days, almost everyone was given the required assistance and there were no complaints.

17. Opportunities for online enumeration were also created in public libraries and internet cafés to enable participation in the e-census for those who did not have a computer or internet connection at home or at workplace.

18. During the preparation period when the necessary resources were allocated, there was a need to predict the share of respondents who will opt for the e-census. A rather conservative estimate had been made on the basis of the pilot census, assuming that the participation rate in the e-census will not exceed 25%. However, the volume of communication channels was dimensioned for a higher participation rate, with 40% and 60% as possible options. The actual e-census participation rate, however, even exceeded those projections, reaching almost 67%. It was initially assumed that people would mostly fill out the questionnaires at work, i.e., during working hours. However, it turned out that the peak period of filling out the questionnaires started at 18 o'clock and lasted almost until 22 o'clock (see Figure 2). The activity of participation in the e-census was not particularly dependent on weekdays.

Figure 2
Intensity of the e-census over 24 hours



19. There were some differences between counties in terms of participation in the e-census but they were not excessive, which was also a nice surprise. The ratio of difference between the counties with the lowest and highest e-census activity was less than 1.6. The age distribution of online respondents indicates that men and women of up to 45 years of age are proficient internet users.

20. All enumerators received work lists of all dwellings within the enumeration area (addresses and spatial coordinates).However, even if the work lists were relatively accurate before the e-census, this was not the case afterwards, because nearly 2/3 of the population enumerated themselves online. If a dwelling, household and all members of the household had been enumerated online, the enumerator no longer had to visit that dwelling and the respective address had to be deleted from the work list.

V. Data collection tools for e-census

21. During a census, data are collected with questionnaires on each person enumerated, each dwelling and each household in a dwelling (if the dwelling is occupied). The Estonian PHC 2011 questionnaire is relatively detailed and includes, in addition to the questions required for the mandatory output, a number of further questions, based on the tradition of previous censuses or added at the request of interest groups to cater for new research needs. The questionnaire was prepared by the census team of Statistics Estonia, relying on both: international requirements and recommendations as well as the experience of previous censuses and users' needs, which were identified in a user survey. Individual questions and response options were discussed at an experts' workshop, with the final versions of census questionnaires approved by the Scientific Council.

22. The total number of questionnaire versions used in the census was relatively high. Each household (even if it had only one member) had to complete a set of questionnaires, including the dwelling and household questionnaire (technically, two separate questionnaires) and a personal questionnaire for each member of the household. All questionnaires could be completed by a household member of at least 15 years of age. If the household also owned seasonally used or unoccupied dwellings, a dwelling questionnaire had to be completed on such premises as well. If the dwelling of a household included temporary residents, a personal questionnaire had to be filled for them as well, but it included fewer questions than the regular personal questionnaire. The questionnaire also included a question on any close relatives who had moved abroad within the past 12 years. A short questionnaire was filled out on such persons as well. If there were no permanent residents in a dwelling, the questionnaire on the dwelling was filled out by the enumerator. If a dwelling was occupied by several households, the set of questionnaires was completed for each household. A slightly different set of questionnaires was used in case of institutional households and homeless persons who did not have a regular dwelling.

23. Depending on the method of surveying, three different sets of questionnaires were created: online, laptop and paper questionnaires. Even though the contents were the same, they differed from each other in some technical respects. One of the main differences was due to the fact that filling out the online questionnaire started with the identification of the person enumerated (on the basis of an ID card or bank access codes). Such an identification was not required if the questionnaire was filled out by an enumerator, and then interviewing started with identification of the dwelling, using the address and spatial coordinates. Paper questionnaires, designed similarly to electronic ones, had to be used only in case of problems with the laptop and only for as long as the laptop was repaired or replaced. It turned out that in real enumeration process the paper questionnaires were used less than in 0,1% cases. A large number of help texts (incl. multi-level texts) and (soft and strict) logical controls were used in electronic questionnaires, enabling to prevent or highlight the majority of logically impossible responses.

24. The questionnaires were published in three languages – in Russian and in English in addition to Estonian. The help texts were also provided in the corresponding languages. A language could be selected before starting with a questionnaire, but it could also be changed in the course of filling-out the questionnaires.

25. Some of the indicators subject to census can be found in Estonian registers. The indicators of sufficiently high quality (coverage, reliability, accuracy) were used for pre-filling the questionnaires, i.e., they were entered on the questionnaires before the survey and the respondents only had to verify the accuracy of data and correct them if necessary. Due to data protection requirements, the pre-filled data were only shown to the person enumerated, not to his or her household members.

VI. Experience of Estonia in conducting Internet-based self-enumeration

26. In Estonia the 2011 Population and Housing Census was organised partly as self-enumeration or e-Census via the Internet. The number of participants in e-Census surpassed the expectations nearly 2.5 times

27. Co-operation with banks in authorisation as well as guiding to the Population Census via e-services was one of the factors, which ensured the success of the e-Census, because Estonian people (including also retired pensioners) are accustomed to make bank operations via internet. Another authorisation possibility, using the ID-card, that demands some additional hard- and software was not used much.

28. It is not possible to achieve higher response rate without additional efforts, either with rendering telephone service of client support or with organising a media campaign for stimulating e-Census. Surely the participants in the e-Census need instructions how to ensure security in operating with the Internet. The organisers of the Census wanted to be sure that also in public places providing Internet access the enumeration should be secure and when a person ends the e-Census session, it would be impossible for the next user to see the data entered by the previous user by chance by chance.

29. Compared to paper questionnaires, e-Census enabled a person to obtain many additional materials. If a respondent had doubts about something, he/she could turn to the Contact Centre of respondents of Statistics Estonia by phone or e-mail.

30. The majority of phone calls to the Contact Centre of respondents were answered during the period 31 December 2011 until 1 February 2012, from Monday till Sunday at 8:00–22.00. Of all incoming calls the Contact Centre of respondents answered to 63% of calls, the average duration of a call was four minutes. The number of incoming calls was the highest on 2–4 January. It accounted for 21% of all calls made in the period of e-Census. Respondents to the e-Census also sent e-mails to the Contact Centre of respondents. The activity was smaller at weekends and in the evening, except the last weekend of the Census. The problems with which the people turned to the Contact Centre of respondents can be divided into three categories:

(a) questions about address search: a person could not find his/her address from the address search or could not mark the place of residence on the map;

(b) questions about household members: who is a household member and who is not. The concepts of household and family were mixed up;

(c) questions about logging in with the ID-card: a person could not log in as the necessary safety level necessary software (safety level) was missing in their home computer.

VII. Data quality of e-Census and problems related to it

31. The reliability of the data collected during the Population Census is always problematic, but theoretically the respondents do not have a motive to lie: the data are not transferred to other authorities; the answers do not have a direct impact on a person. But a part of the population do not realise it and that is the reason why the data quality of the interview census (the interviewer communicates with the respondent face-to-face and specifies the question if necessary) is considered the best. However, the primary data processing of the Census data finished in Estonia does not confirm that statement: one can be more satisfied with the data quality of the e-Census .At the same time, during the data

correction period when mistakes were noticed, the data quality could be improved during the interview census. A part (1—2% from all questionnaires submitted by e-Census) were deficient or incomplete questionnaires and were corrected during the interview census.

32. Data collection via Internet is only one way of data collection; it is compatible with the face-to-face interview: the questions are similar, the help texts are available. The questionnaire with help texts is available in three languages. The majority of persons participating in e-Census were given the possibility to complete the questionnaire in their mother tongue or domestic language. In Estonia 76% of respondents completed the e-Census questionnaire in Estonian, 23% in Russian and 1% in English.

33. Electronic questionnaire enables the persons to answer to only those questions via self-enumeration, which are meant only for him/her, i.e. the previous responses of the person are taken into account. To ensure the data coherence, there are logical data controls in the questionnaires.

34. The improvement of data quality was contributed by the fact that the most of logic controls are activated already while a person is completing the questionnaire and the contradictions that occurred could be corrected by the person himself/herself at once. The respondent was also reminded when some question was left unanswered.

35. In conclusion it can be said that the e-Census was a success – it was contributed by the good attitude of the population and following the new data collection method. The general attitude to the Census indicated a high estimation to it. (Faktum and Ariko 2012). Thanks to the e-Census the workload of interview census decreased.

VIII. People enumerated via Internet by gender, age

36. The distribution of persons completing e-questionnaires observes rather well the age distribution in the total population. The share of persons enumerated online is the highest – 75% and over –among children, but also among persons aged 30–40. Slightly lower is the respective indicator among young working-age persons (aged 15–25 and starts to fall continuously since the age of 45. The distribution of males and females among persons enumerated via e-Census is also close to their distribution in the total population. This fact also confirms the uniform spread of e-literacy by gender and age distribution of the population, whereas a relatively big amount of pension aged persons also could enumerate themselves online (Ene-Margit Tiit 2012).

37. It must still be taken into consideration that all the persons participating in e-Census via Internet did not complete their Census questionnaires themselves. The Census questionnaire could be completed by at least 15-year-old respondent by entering the Census environment by himself/ herself or with the help of a household member. The questionnaire could be completed by a person himself/herself or let some household member do it for you. In case of children aged less than 15 it is natural that their questionnaires were mostly completed by parents, but also participation of other household members is possible.

38. Over 60% of respondents aged 25–60 entered the Census environment by themselves, there were those persons also among older respondents. Somewhat unexpected is the low rate of self-entering the Census environment among persons aged 15–19 – it can be assumed that the reason was not low computer literacy, but rather small citizen activity maybe, less expertise in using bank accounts.

39. The questionnaire of temporary resident was prevalently completed for young people. Evidently people who studied away from home understood well the recommendation to mark their parents' home as their temporary place of residence. The

number of temporary residents, for men as well as for women, was the highest among persons aged 15–34, which is the age of studying (Ene-Margit Tiit 2012).

40. If among temporary residents the number of enumerated persons was the biggest in the age group 20–24 (typical time for studying in colleges and universities), then the number of persons having left Estonia was the highest among persons aged 25–29, i.e. persons who have finished their education are leaving (have left) Estonia. But it must be taken into account that we have to deal with retrospective statistics: these persons might have left Estonia also some ten years ago. The gender distribution of the persons having left is also worth mentioning: the number of women among the people who leave Estonia is significantly bigger compared to men (D.Beltadze 2012).

IX. Time spent on completing the Personal Questionnaire

41. The average time spent on completing the Personal Questionnaire was 14.3 minutes, but only on 2 January it was twice as long – then there were bigger problems in the system. The fluctuations in the remaining periods were occasional, whereas during the last days with the biggest load the duration of completing the questionnaire did not grow, but rather slightly decreased. The time spent on the completing of the questionnaire did not depend on the time when a person started to complete it: on the contrary to assumptions filling in the questionnaire at night did not take less time than during the day's rush hour (Ene-Margit Tiit 2012).

42. The duration of filling in the questionnaire depended to a great extent on the age of the respondent, but also on the persons who is completing the questionnaire. It took only on average 4.5 minutes to complete a child's questionnaire, as children need not answer the questions about education and working life. Completing the questionnaires of elderly people also took less time as they need not give information about working life (Ene-Margit Tiit 2012).

43. Remarkable is also the dependence of time spent on completing the questionnaire on the fact whether a person completed his/her own or other household member's questionnaire. It could be expected that filling in a person's own questionnaire goes faster, as a person knows all data concerning him/her by heart. But the real situation was the opposite. If a respondent himself/herself entered the Census environment, it took him/her on average over 19 minutes to complete the questionnaire, but if some other household member entered the Census environment, it was possible that it took less than 11 minutes to fill in the Personal Questionnaire. The reason probably lies in the fact that a person entering the Census environment himself/herself also got acquainted with the questions of the questionnaire, but while filling in or helping to fill in a household member's questionnaire he/she already had read the questions and possible answers and consequently the time spent is shorter.

44. As the questionnaires of temporary residents or persons who had left Estonia included fewer questions than the questionnaires of permanent residents, it also took less time to complete them. A permanent resident spent on average 14.3 minutes on completing the questionnaire, filling in the Personal Questionnaires of temporary residents or persons who had left Estonia took 3.9 and 2.4 minutes, respectively. Among personal residents, men were somewhat faster in completing Personal Questionnaires than women: it took them on average 14.3 minutes against 15.1 minutes spent by women.(Ene-Margit Tiit 2012).

X. Completing household and Dwelling Questionnaires

45. Dwelling Questionnaires were submitted in the e-Census in general they were filled in correctly, only 0.6% of questionnaires were incomplete. The reason here lies probably in the simplicity of Dwelling Questionnaires. Different from Personal Questionnaires, separation of duplicates of Dwelling Questionnaires was more complicated, because, in spite of the valid address standard, it is not easy to find uniform spelling for the addresses.

46. Completing the Dwelling Questionnaires was performed quite fast, in spite of the question about the floor area of the dwelling, which caused problems to some of the respondents. Four minutes on average was spent on filling in the Dwelling Questionnaire. The time spent on completing the Dwelling Questionnaire depends on the type of the dwelling. It turned out that completing the apartment questionnaire took about a minute less time than filling in the private house questionnaire. The reason may lie in the fact that apartment owners can tell their dwelling's floor area faster than owners of private houses.

47. The household questionnaire included a relations matrix where for all pairs of household members their relation should be marked. It is understandable that the more members, the more complicated and time-assuming was its filling in. Among the households enumerated in the e-Census the share of households with one member is the largest, and although there are also big households, their share in all households is marginal. It turns out that among persons enumerated in the e-Census, the number of persons living in households with three members is the biggest, the number of persons in two- and four-member households is more or less equal and people living alone are in the fourth place only. It took on average 12.4 minutes to complete the Household Questionnaire (D.Beltadze, Ene- Margit Tiit 2012).

48. Besides completed questionnaires there are also incomplete questionnaires that have to be completed during the interview census in average less than 1 %(Ene-Margit Tiit 2012).

49. The number of Personal Questionnaires of persons having left for abroad is smaller than expected, although among these questionnaires there are relatively many duplicates as could be assumed (the person having left for abroad could be marked by several close relatives).

50. There is a reason to assume that during the e-Census there are more or less deficient addresses (incl. especially those where the person lives according to the Population Register). There are almost no possibilities to check these addresses. As a result the persons, who actually live at these erroneous addresses, could be left out of the Census, as there is no need to visit them during the interview census.

XI. Conclusions

51. The specific features of the E-Census compared to the previous censuses are the following:

(d) for the first time self-enumeration was applied;

(e) a very thorough questionnaire was used, which included besides internationally harmonised questions also a number of questions characteristic of Estonia; and which attracted attention of scientists and interest groups;

(f) the exact location of a dwelling was specified on the basis of address data system (ADS)(in case of need electronic digital map was used).

52. The new software was successfully used for the Population and Housing Census 2011. The participation rate in the e-Census was over 66%. It was the first totally paperless census in Estonia.

53. A new data collection system was developed which can be used as a generic system for other statistical domains, but ensures cost-efficiency even if used only for data collection for PHC 2011(Tuulikki Sillajõe 2012). The real cost per enumerated person was approximately 10,4 euros. But it was at least twice as small as it would have been if PAPI had been used; and it was at least 25% lower than predicted for use of the new method of data collection. So, efficiency has been reached. The main reasons for lower costs of data collection during PHC 2011, compared to PHC 2000, were as follows:

(g) There were no special data entry costs;

(h) Automatic checks diminished mistakes during interviewing in both cases (CAWI and CAPI);

(i) Less time was required for interviewing than planned, and therefore fewer enumerators were hired;

(j) Printing, communications and archiving costs were considerably smaller;

(k) Management of data collection was much cheaper because much fewer employees were needed, thanks to the universal management module of the new software.

(l) One of the considerable achievements was the participation rate in the e-Census. It could not been achieved without the widespread use of Internet in Estonia, but was significantly influenced by the well-planned, strictly targeted and executed public campaign. The public campaign was deeply integrated and coordinated with the data collection activities. A special awareness survey was launched about a year before actual data collection started. Based on that survey, the PR activities were corrected and targeted. So, in February 2012, after the e-Census, awareness of the census among the population aged 15–74 was 99%, compared to 98% in January 2012 and 57% in August 2011. At the same time, 95% considered the census necessary (72% answered ’necessary’ and 23% ‘quite necessary’); 90% considered their knowledge about PHC ‘good’ or ’very good’, compared to 45% in August 2011. Already in November 2011, 60% of the respondents planned to participate in the e-Census (Faktum and Ariko 2012).

54. One of the communication activities during PHC 2011 was reporting about the progress of the Census on the web site of Statistics Estonia. The number of enumerated persons in total and by county was updated hourly. This information was highly appreciated and widely discussed by the society as a whole, especially in the media. The comparison of counties started to serve as an additional driver, motivating people to enumerate themselves online.

55. The social media also played an important role. During the data collection period, Statistics Estonia’s Census PR staff worked on Facebook virtually for 24 hours per day. Information was quickly disseminated. People’s questions were answered when the lines of the Contact Centre were busy or e-mails were not answered as fast as expected.

56. Efficiency has been found with the help of close cooperation between the data collection and dissemination functions and cooperation with banks.

57. Statistics Estonia was able to successfully conduct PHC 2011 at a two times lower cost per enumerated person than the use of the method of the previous census would have allowed. It was achieved due to the change of method and implementation of newly developed software.

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