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ON LINE DATA COLLECTION

2011 Census in Portugal: development of the e-Census system

Note by the Statistics Portugal

I. INTRODUCTION

1. For the first time ever, the Portuguese population will be given the opportunity of answering Censuses online (e-Census). This decision posed a challenge to the organisation of the next Population and Housing Censuses (2011 Census), to be held in 2011, and made more demanding the whole forecast preparation programme.

2. This document presents a summary of the work undertaken by Statistics Portugal to develop the e-Census system, to be adopted in the 2011 Census. It focuses on the e-Census development strategy, its supporting technological infrastructure, the impacts on fieldwork organisation, the results of e-Census use in experimental operations and the respective conclusions.

II. OVERVIEW

3. Statistics Portugal conducts Population and Housing Censuses every 10 years. This is the most important statistical operation carried out in the country. In 2001, 5 million dwellings and 10.3 million people were enumerated, and around 20 thousand enumerators were involved in the fieldwork.

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4. In preparing for the 2011 Census there was a clear objective to modernise collection methods and processes and to reap the benefits of the use of information and communication technologies. The possibility of answering the 2011 Census online poses the main challenge. Portugal has been adopting policies that foster internet use as a preferred platform for the relationship of public administration with citizens and enterprises. As of 2008 enterprises were required to submit their tax return electronically. In 2009 over 3.7 million (around 80 per cent) electronic tax returns of natural persons were submitted.
5. Answering the 2011 Census online will make it possible to cope with society's new demands, with the internet becoming a platform for data collection from households. Since 2007 Statistics Portugal has been developing a work programme targeted at preparing and developing an e-Census system, to enable online responses to the 2011 Census.
6. Within the scope of this programme, Statistics Portugal conducted two test surveys in 2008 and 2009, with samples of around 7,000 and 17,000 dwellings respectively. In the 2008 test, the sample was selected from areas with the highest online answering potential among the population, whereas in the 2009 test the sample represented the average profile of the Portuguese population. Online data collection only covered the population residing in conventional dwellings,¹ composed of a single household (corresponding to approximately 98 per cent of the population enumerated in 2001).
7. In the tests performed, the population had two modes of response options available:
 - a) The traditional one , by filling in the paper questionnaire themselves, with subsequent collection and checking by enumerators;
 - b) The online form (e-Census), with recourse to a secure authentication system. Upon distribution of the questionnaires, the enumerator left a closed envelope containing the access codes to the online form.

III. DEVELOPMENT OF THE E-CENSUS

8. The strategy for developing the e-Census system has been oriented towards providing users with an easy, secure and beneficial system. The goal was to draw in as many users as possible, regardless of their IT knowledge. 5 specific areas have been identified for the implementation of this strategy:
 - a) Online form;
 - b) Online validation rules;
 - c) Authentication and security;
 - d) Notification of enumerators;
 - e) Communication/Helpline.

¹ A conventional dwelling is a permanent structure intended for habitation by one household

A. Online form

9. The development of online forms was a key concern when implementing the strategy. The intention was to capture users from the early stages onwards and to minimise their abandonment of the on line form due to the system being complex, poorly functioning and time-consuming. Form development relied on the following principles:

- a) User friendliness;
- b) Similarities at web navigation level with other websites;
- c) Similarities with the paper questionnaire.

10. The graphic design, question organisation and the positioning of data on the screen have met criteria aimed at drawing the respondents' attention to the actions they are expected to carry out. Hence, the website's functionalities were limited to what was absolutely necessary, which permitted to reduce the complexity and increase user friendliness.

11. Form completion is mostly through tick-box responses and, where necessary to a listbox (e.g. to select a country). The whole online form was designed to comply with Level Double-A Conformance to Web Content Accessibility Guidelines 1.0. These guidelines make the form able to be used by people with special needs.

12. Users log into the website with an internet address, duly identified in the paper questionnaire. Through this address, they access the website's public area (welcome page). The website's private pages (second screen) are accessed via an authentication system. The location and design of the reserved area for authentication are similar to those used in other websites (such as gmail), which makes this process user friendly.

13. Once they are successfully authenticated, users log into the website's private area and enter the dwelling's geographic identification code. Thereafter, users access the Census form and may start completing it. Navigation around the form is as follows:

- a) Forward: allows for access to the next screen when all answers in that screen are filled in correctly;
- b) Back: goes back to the previous screen;
- c) Save and return later: makes it possible to interrupt form completion by saving data and allowing users to resume it later;
- d) Summary: allows for the visualisation of data already completed;

14. To render completion easier, users may access each question's instructions through a window system.

B. Online validation rules

15. The introduction of validation rules in the online form is based on a commitment between easy completion by users and quality standards for answers. Validation rules and warning/error messages were kept to a minimum. This is designed for more effortless completion and to avoid user dissatisfaction and website abandonment.

16. Messages appearing during form completion are posted on the top of the page. They pop out when users move to the next screen and only report situations related to completion on that specific screen, never identifying cases requiring users to move to other screens. The purpose of this was to draw users' attention, by guiding them towards correcting their answers with minimum effort.

17. The following types of validation were implemented in the online form:

- a) Compulsory responses – All questions are mandatory;
- b) Absence of multiple responses – No multiple responses are permitted. There is only one type of answer for each question;
- c) Navigation and skip rules – Navigation and skip rules have been implemented. Questions are posed according to answers given in previous questions. Skips will be automatic, thereby allowing for a personalised completion of the form and avoiding unnecessary questions;
- d) Validation rules based on the age variable – Age is the only variable giving rise to cross-validation in various questions (e.g. ever resided abroad and year of arrival in the country, educational attainment, marital status).

C. Authentication and security

18. The absence of a dwellings file required the development of authentication /authorisation system to ensure secure responses and the registration of the dwelling's geographic identification code. Accessing the website's private area is made by entering two codes: an access identifier (ID) – an 8-character numeric set – and a pin code (PIN) – an 8-character alphanumeric set, no distinction being made between upper and lower case. In order to minimise digit swaps, this code does not include, for example, number 0 (zero) and the letter "O". Enumerators distribute these codes in a closed envelope (similar to a bank code). Validation of the ID/PIN pair allows for a subsequent registration of the dwelling's geographic identification code (composed of 17 characters). Once this code is entered, users may start completing the online form. For enhanced system security, no information is stored in the computer. In addition, the following functionalities are available:

- a) Users may change the PIN code;
- b) Access is blocked after three failed attempts at entering the ID/PIN code;
- c) Time-out – A mechanism which automatically interrupts the session after 20 minutes of inactivity;
- d) There is a limitation on the maximum number of active sessions, configured to 100 in the second test, in order to maintain service quality for active users while filling in the questionnaire.

19. When distributing questionnaires, enumerators copy the ID to the building's auxiliary form. Hence, a link is assured between the dwelling's geographic identification and the ID. ID/PIN codes may also be supplied via helpline, whenever requested by respondents, through a secure procedure, which was defined by the BackOffice sub-system.

D. Notification of enumerators

20. Online responses introduced the need to create a mechanism that would allow for the control of responses over the internet, in order to prevent enumerators from having to return to the dwellings and reduce any inconvenience to households. A response notification system via Short Message Service (SMS) was implemented for enumerators. Furthermore, such information is available for consultation to the whole field team, in the Fieldwork Control System or via email. This system has allowed for a daily control of online responses, with consequent better management of fieldwork for enumerators.

21. Data on completed questionnaires are grouped and SMS messages sent twice a day, at 12 a.m. and 9 p.m., which was considered an appropriate number of SMS messages, i.e. not too high, but at the same time assuring that information was up-to-date. A telecom operator service provider was engaged for the sending of SMS messages. A number of tests were previously performed through other solutions, by resorting to specific software and hardware, but they proved unsatisfactory.

E. Helpline

22. A free telephone answering service to help and clarify the population was deemed to be essential to provide greater user comfort and satisfaction. Defining the answering period has taken into account the times when the population would be most likely to use this service. The Helpline service was available uninterruptedly (with no breaks) between 9 a.m. and 8 p.m.

23. The Helpline provided to the population clarification and help with regard to online form completion. Helpline operators had at their disposal the instruments necessary to effectively provide such a service, including the possibility of viewing the completed form online, which enabled them to provide personalised help. Users also had a help form at their disposal (it includes pre-defined help options), which is associated with an automatic solving and forwarding system via email. This component is associated with the BackOffice module, which is a key integral part of the whole e-Census system functioning.

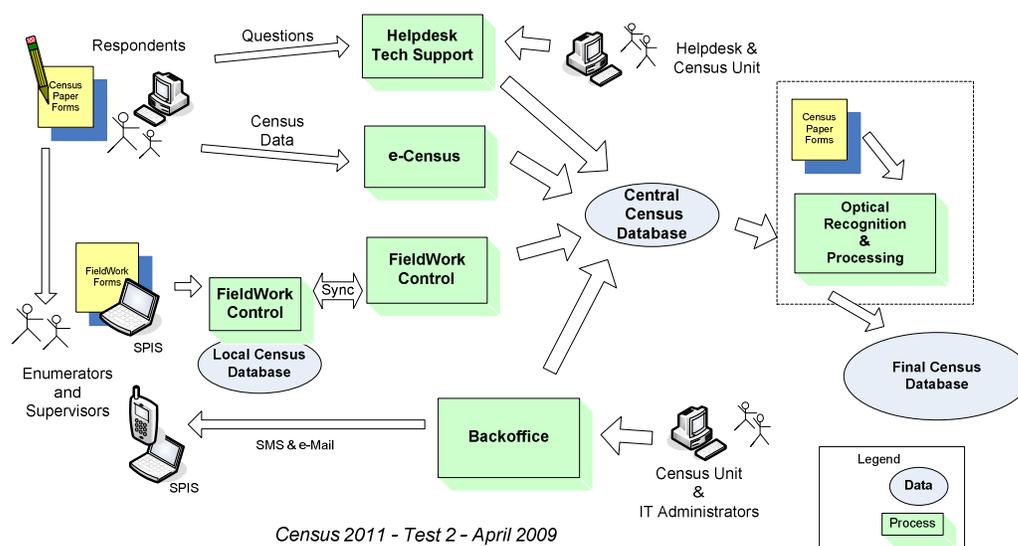
IV. TECHNOLOGICAL INFRASTRUCTURE

24. The collection system for the 2011 Census is composed of the following sub-systems:

- a) e-Census or Web Collection Sub-system (Portuguese acronym: SRW) which allows users to complete the 2011 Census questionnaire online. It makes a public access area available, with auxiliary information for questionnaire completion, a help form and a private area that can be accessed through credentials produced for that purpose;
- b) Fieldwork Control Sub-system (Portuguese acronym: SCTC), which makes available functionalities to support the organisation and control of the various tasks performed during the operation of the 2011 census. This sub-system was made available at national level, centralised at Statistics Portugal servers and with preferential online access, only a few modules being available offline. It renders works related to the registration, consultation, organisation, control and extraction of data easier for all

- those intervening in the executive structure of the 2011 Census fieldwork, with pre-established access permissions;
- c) Management and Operations Sub-system – the BackOffice, which ensures the carrying out of all activities related to the configuration and management of tasks performed by enumerators and other experts in the field. It guarantees operational feasibility, including functionalities for SCTC synchronisation, initial installation and updating of local applications. These functionalities are accessed by the Census Office and IT teams;
 - d) Helpline Sub-system – the Helpdesk, which is the technical support that channels, registers and actually replies to the help requests of respondents to the e-Census questionnaire and members of the executive structure involved in the fieldwork.

Fig. 1 - Data Capture System for Census 2011



25. The application solution was intended to be as modular and flexible as possible, and be able to adapt to the different types of organisation of data collection teams in the field. An external company was engaged to develop applications, based on the functional and technical specifications set out by Statistics Portugal.

A. Application collection system

26. The different sub-systems have been developed to be executed within a browser environment (intranet and internet), through 3-tier implementation. The Web Server does not have direct access to the Database Server, this connection is always made through the Application Server. In the development of several application layers, due care was taken to

ensure that the final result of the 2011 Census collection system would be a swift, robust, reliable and highly available solution. Applications were designed and built for scenarios allowing for the use of load balancing mechanisms (e.g. physical Web Farm or through software). The purpose was to obtain web applications for high levels of availability, with adequate responses in the event a number of services are interrupted.

27. With regard to the visual design, the whole solution has been developed to reap the full potential of the reuse of templates, Cascading Style Sheets (CSS) or other components, in order to visually incorporate all sub-systems and modules integrating the application solution. According to the accessibility requirement, all techniques deemed adequate to the development of the e-Census were applied. Users may choose a set of alternative CSS (default version, linear high-contrast version and linear high visibility version).

28. All pages present content with technical solutions that assist specific screen readers for users with special needs, such as direct links to the first questions of each page or a direct link to its contents. The development process implemented the reuse of components from core to local applications, whenever these shared the same functionalities.

29. A series of application parameters were incorporated, making it possible to configure applications with no need to conduct a new deployment of pages or components, namely to put websites under maintenance, reply start and end dates, as well as information messages on various events related to user actions.

B. Physical architecture of the application collection system

30. The application collection system is distributed into two distinct web environments:

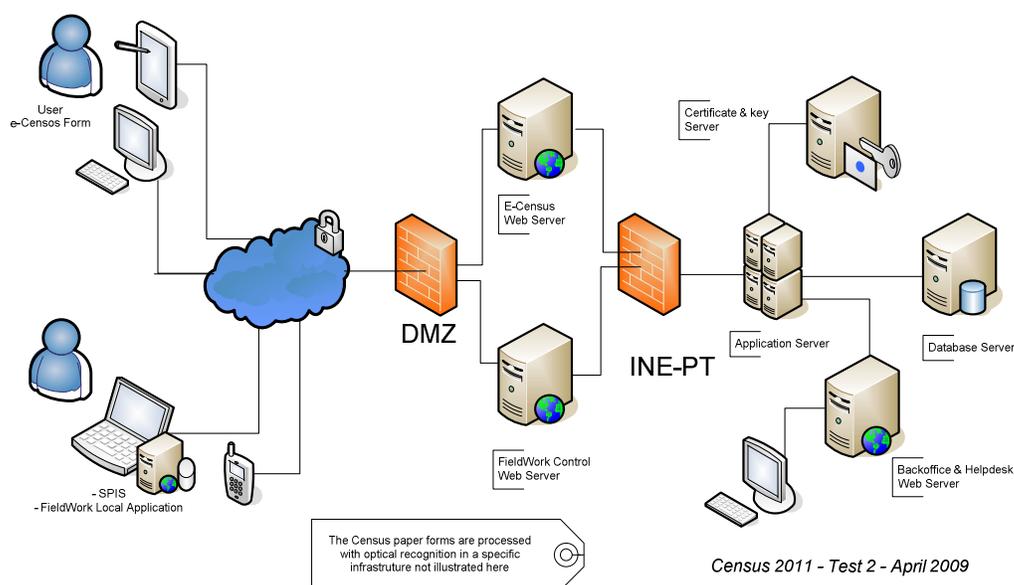
- a) Central environment, located at Statistics Portugal, where all e-Census website sub-systems are installed, as well as the main Fieldwork Control website, the BackOffice sub-system and the support for functionalities such as updating applications versions, synchronising and integrating locally recorded data;
- b) Local environment, installed in laptops for the members of the structure in the field (civil parish coordinators and municipal delegates). Local Fieldwork Control website used a local database, for reasons of speed and to ensure operational conditions for the above-mentioned stakeholders in locations with less reliable communications. This environment can only be installed in portable equipment that has been previously configured for that purpose.

31. Statistics Portugal has in place a system, the so-called SPIS (Secure and Integrated Portable System), currently used in portable equipment to support interview surveys. This system, in addition to other functionalities, makes it possible to block user access to the operating system, install and update applications with version control and personalise the equipment specifically to previously characterised users. The personalised configuration in the portable equipment is done automatically supported by an OpenLdap infrastructure. Local environment applications are running in this SPIS environment.

32. The different sub-systems that have already been identified are distributed through the two environments as follows:

- a) Core environment: e-Census form website; main Fieldwork Control website; internal website for the BackOffice and Helpdesk; Functionalities for Fieldwork Control synchronisation and for the initial installation and updating of local applications.
- b) Local environment: Local Fieldwork Control, functioning both online and offline, SPIS system and respective modules.

Fig. 2 – Architecture of Data Capture System for Census 2011



33. In local environment applications, use has been made of a number of rules that contributed to minimise problems stemming from synchronisation between the two environments. An authentication mode is required for the use of local environment application functionalities. Data whose last change date is after the date on the portable equipment cannot be changed. Local databases are protected from undue use. These data may only be accessed through the installed application. All screens show the user access level and the respective identification.

34. In addition to the possibility of an internet cable connection, 3G mobile communications were also used to connect local and core environment applications. Through the contracted service a Virtual Private Network (VPN) was established between portable equipment installed with SPIS and the main Fieldwork Control application.

35. Respondents access the e-Census website through a browser, on a secure address (HTTPS/SSL). In turn, the server supporting the e-Census website only has access (through the firewall) to the application server, when the required rules are implemented on the firewall. Only authorised servers have direct access to the application server.

36. An identifier blocking process was implemented in the validation process, so as to protect the database from possible attacks and to have control over the maximum number of active sessions, thereby assuring a minimum level of quality for the service to be provided to respondents filling in the online form. The implemented authentication process is broadly based across the different existing application layers:

- a) Page validation – mandatory completion of both fields, as well as the size and type of data contained therein;
- b) Web server validation – sizes, numeric and alphabetic ID and PIN sets, with a checking of special characters used in the most common attacks (Sql Injection, etc...);
- c) Application server validation – checking of the status of inhibition of the ID/PIN;
- d) Database server validation – validation of the ID/PIN pair and checking if the identifier is active;
- e) Access control validation – checking of the maximum number of active sessions on the e-Census website.

C. Security

37. Security is one of the key aspects in the design and architecture of the various sub-systems. Several restrictions have been implemented in the connection to the database, such as no direct access to tables, no connections string in plain text, not using the owner at application level. Keywords used in authentications are encrypted. Connection pool mechanisms have been used that allow for enhanced system performance. Security mechanisms were implemented in services, especially those used in external components. The authenticity of requests is checked and the confidentiality ensured as regards data sent and received between the web server, the application server and the database server, through certificates and public/private key mechanisms.

38. In the various sub-systems, errors/exceptions were masked through specific pages, and thus no detail of the exception was presented to users. At the internal level, the detail of the exception was kept, and so was other contextualised information for subsequent analysis. Independent transactions and asynchronous calls were used to resort to methods linked to the exception log – seen as accessory – so as not to disrupt the functioning of the web applications that are customers of this service. Audit log mechanisms were implemented, allowing for control at the level of database transactions and registration, so as to identify the user code responsible for the operations. In the event of serious system errors or anomalies, a standardised email or SMS messages can be sent to the support team.

39. The various input fields were validated on the server side, in order to prevent special characters from being entered, thereby jeopardising the smooth functioning of the system. The application is thus protected against the most common attacks: remote code execution, SQL/Code injection, format string vulnerabilities, cross website scripting (XSS) and username enumeration. Web Fieldwork Control, BackOffice and Helpdesk applications are authenticated over Open Ldap.

V. ORGANISATION AND FIELDWORK

40. The census day was 7 April for the 2008 test and 20 April for the 2009 test. Questionnaire distribution started about two weeks before these dates. Where possible, enumerators established direct contacts with the population to deliver the paper questionnaire, the envelope with access codes for the e-Census system and an explanatory leaflet with instructions. The work of enumerators was instrumental to encourage and clarify the population with regard to online responses. Enumerators were motivated to raise population awareness and this was decisive for the outcome. The website was open to responses for 3 consecutive weeks from the census day, every day, 24 hours a day.

41. The management and monitoring of the operation was conducted through the Fieldwork Control application, developed to facilitate the management, organisation and control of the many tasks and documents used in the fieldwork. Focus was given to online access to the system, so as to ensure real-time information updating. However, given that national mobile network coverage was not uniform throughout the country and in a few locations there were communication difficulties (and sometimes total absence of network) offline access was also developed (local environment). This application only allowed for the loading of information, which was copied to central databases through synchronisation processes.

42. Fieldwork Control application access permissions have 7 levels, corresponding to the hierarchy of the executive structure of fieldwork stakeholders. Changes by higher hierarchical levels cannot be modified by dependent hierarchies. Data loadings and changes made will, as a whole, be associated with the respective users, and this information will be filed in the system.

43. Data collected through the e-Census considered necessary by the Fieldwork Control application fed the system automatically, while those collected in paper have been loaded by authorised users, mainly the Civil Parish Coordinator and the Municipal Delegate.

44. The Fieldwork Control application was structured into a number of modules:

- a) Human Resources – Includes information on all human resources involved. The basic unit is the individual. It contains identification data, assessment results, information on tasks, work assigned, work produced, participation in meetings, etc. It allows for co-worker and work area management;
- b) Data – Repository of all data collected in enumerated statistical units. The basic unit is the statistical sub-section;
- c) Control – Repository of control information. It enables access to work in progress of co-workers and statistical units (at civil parish level). It also allows for access to fieldwork control and the analysis of deviations (from forecasts) regarding each statistical unit;
- d) Expenses and payments – Repository of data on payments/expenses. It allows for access to the whole information on expenses and payments per co-worker/ civil parish and municipality;
- e) Results – Preliminary results can be viewed by geographical unit;
- f) Support files – Support repository, composed of base tables and documents (mainly in pdf format) previously loaded into the system;

- g) Synchronisation – It allows for synchronisation of data loaded offline with the central database.

45. Each module aggregates a set of related functionalities, allowing for access to interfaces containing:

- a) Input forms – To load form information;
- b) Options permitting to modify and update already existing information;
- c) Tables – To consult and print pre-defined tables;
- d) Supporting documents – To consult and print system documents in pdf format (e.g. forms themselves).

VI. RESULTS

A. Response rate and population profile

46. The online response rate was 14 per cent for the 2008 test and 9 per cent for the 2009 test. Overall, this rate was lower in rural areas and for elderly population segments with lower educational level.

47. Test results show that the population counted online is relatively young. Persons aged less than 50 accounts for 70-75 per cent of the population covered and those aged 65 and over are between 7-10 per cent. In terms of education, school attendance is higher for those aged 25-49, decreasing in inverse proportion to the age group. Most of the population works and those not working are predominantly students and retired people.

48. Test results show that most household reference persons are male (69 and 72 per cent in the first and second tests respectively), the majority aged 35 to 49 (39 per cent) and 50 to 64 (30 per cent).

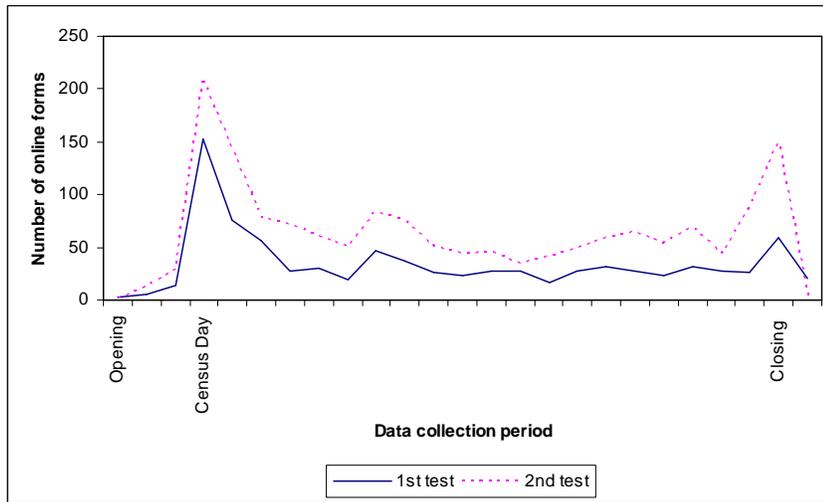
Table 1 – Household reference person according to level of education and age - 1st and 2nd tests for Census 2011 (per cent)

	<i>Total</i>		<i>>=15 – 24 years</i>		<i>25 – 34 years</i>		<i>35 – 49 years</i>		<i>50 – 64 years</i>		<i>>= 65 years</i>	
	1 st	2 nd	1 st	2 nd	1 st	2 nd	1 st	2 nd	1 st	2 nd	1 st	2 nd
Total	100	100	1,3	1,4	16,6	14,5	38,8	38,5	31,0	27,8	12,4	17,7
1st stage of basic education (primary education) or less	14,2	20,8	0,0	0,0	2,5	2,1	7,8	4,5	21,1	26,1	34,5	64,9
2 nd stage of basic education	4,5	7,0	0,0	0,0	5,6	2,6	5,4	9,0	3,4	7,1	3,4	6,3
3 rd stage of basic education	10,1	13,3	0,0	13,6	5,0	12,0	8,0	11,9	11,4	19,0	21,0	8,4
Secondary education	22,0	17,7	25,0	18,4	23,8	18,8	28,4	25,3	16,4	15,2	13,5	3,9
Post-secondary non-tertiary education and tertiary education	49,2	41,3	75,0	68,2	63,1	64,5	50,4	49,2	47,7	32,6	27,8	16,5

B. Website operational period

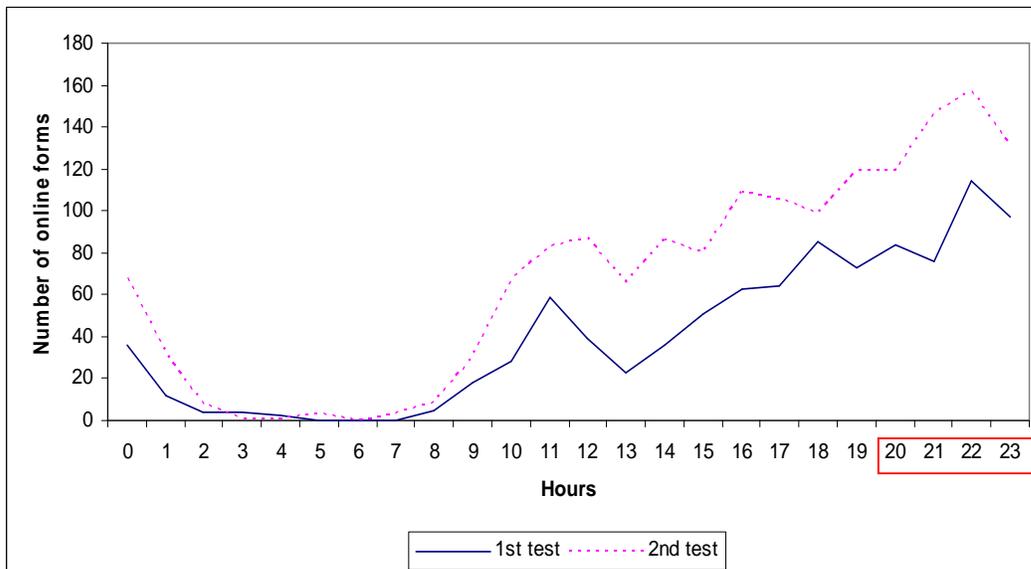
49. The greatest number of daily responses was recorded on the website’s opening day (which coincided with the time of the census) and on the closing day. On the first three days around 30% of total responses were recorded. On the remaining days, with the exception of the last, the number of responses was relatively constant.

Graph 1. Total online forms by day - 1st and 2nd tests for Census 2011



50. The highest number of daily responses occurred after 6 p.m., which shows that forms were filled in at home after work. The time period with the greatest number of responses was between 9 p.m. and 11 p.m., which shows that many households took advantage of a break after dinner to answer the form.

Graph 2. Total online forms by hour - 1st and 2nd tests for Census 2011



51. The average time spent completing the online form was approximately 49 minutes. Most households (83 per cent) filled it in on a single session and the remaining did so in more than one session, by saving it and returning on a later stage. The share of users abandoning the session after concluding the authentication process was less than 4 per cent, which is a positive result.

52. Over the course of the operational period a free telephone answering service was made available, in operation between 9 a.m. and 8 p.m. without interruption. Most calls received on the Helpline were on the website's opening day and on the four following days. The reasons underlying these calls can be grouped into three categories: 60 per cent of them were targeted at obtaining general information on the test and mandatory responses, 13 per cent were related to requests for clarification on the form's questions and 10 per cent resorted to the Helpline due to operational problems related to the e-Census computer application.

C. Online evaluation questionnaire

53. The results of the online evaluation questionnaire show that the overwhelming majority was satisfied with the functioning of the system. 95% of the answers show that respondents considered the online form visually pleasing, easy to respond and browse through. A vast majority claimed to be satisfied with the authentication system, considering it easy and secure.

Table 2. Results of the online evaluation questionnaire- 1st and 2nd tests for Census 2011 (per cent)

		<i>1st test</i>			<i>2nd test</i>		
		Yes	No	NA	Yes	No	NA
The authentication system is secure?		96,3	1,2	2,6	95,0	1,7	3,3
The authentication system is easy?		94,9	3,5	1,7	95,9	1,1	3,0
Questionnaire Design	Well laid out	97,6	1,3	1,2	97,0	1,9	1,1
	Adequate browsing	97,6	0,4	2,1	96,1	0,4	3,6
	Easy to answer	96,4	2,8	0,8	96,1	2,5	1,5
	Lack of internet general functions	9,3	88,2	2,6	10,8	87,2	1,9
In 2011, do you intend to use the internet to answer the Census questionnaire?		98,6	1,0	0,4	98,3	0,7	0,9

D. Quality of responses

54. Test results lead to conclude that the quality of online responses was higher than those given in the paper questionnaire. Errors identified on the internet are virtually residual for all question groups, including those related to the household area, which represents the group of questions with the most errors identified in paper questionnaires.

55. Tests have demonstrated a need to implement effective systems to control duplicate responses or responses resulting from errors in the completion of the dwelling code. Some of the problems identified are due to the absence of a dwelling file that prevents the development of a system to check and validate the dwelling's identification code.

56. Systems that minimise user errors a priori and enable a swift ex post detection and correction must be implemented. An adequate alignment of data consolidation systems in a single database incorporating the different collection methods – internet and paper – is a key aspect for the quality of data collected.

E. Impact on fieldwork organisation and management

57. Tests performed have allowed for an assessment of the impact of online data collection on fieldwork organisation and management, in particular as regards the following:

- a) The simultaneity of collection methods (internet and paper) gave rise to disturbances in the questionnaire collection process. During this period enumerators could not collect paper questionnaires with dwellings that had declared the intention of answering online;
- b) This interfered negatively with the enumerators' work, requiring them to pay a greater number of visits to dwellings, an increase in the time forecast to perform tasks and consequently the need to extend the schedule envisaged for data collection;
- c) Tests have made it possible to identify the need to interlink the collection schedule with the collection method. This led to the identification of 3 stages for data collection: the first stage aimed only at online collection, the second stage for the simultaneous internet + paper collection, and the final stage exclusively targeted at paper collection;
- d) The importance of enumerators as a key vehicle to urge population to answer online implies rethinking payment criteria and the training programme.

F. Implemented architecture

58. Tests performed have permitted the assessment of the architecture of the infrastructure implemented in the e-Census, from the data presentation layer to connections to data access services, with special focus on security. Web pages used components minimising transaction volume, by dividing the questionnaire into various pages of logical and consistent contents, so as to minimise the use of scroll bars. Compatibility with the various browsers was prioritised and so were requests for specific software for citizens with special needs, which led to a very low number of access and navigation errors on the e-Census website.

59. The infrastructure developed in the use of SMS messages for the notification of enumerators proved to be quite effective, and adequately conveyed enumerators, on a timely basis, the necessary information for the alignment between paper questionnaires and responses through the e-Census. The content and structure of messages was clear and concise, indicating the relevant information, and taking advantage of a system which is increasingly essential for our daily lives.

60. The use of bidirectional synchronisation processes between core and local environments in the Fieldwork Control application has shown that critical points emerge in the use of this latter

environment. Highly relevant updating functionalities must not be made available on the local environment, rather only on the core environment.

VII. CONCLUSIONS

61. Tests performed show that online responses to the 2011 Census have a great potential, especially among the younger population with a higher educational level. An adequate advertising campaign will be crucial importance to increase the online response rate.

62. The strategy leading to the development of an easy, secure and advantageous system led to positive results with the population. The level of satisfaction of the population (over 98% of e-Census respondents declared in the tests that they intended to answer the 2011 Census online) and the low website abandonment rate, associated with response rates (the initial forecasts were surpassed, with no advertising campaign), are indicators that allow us to face this challenge with optimism.

63. Data collected online are of a higher quality than those of paper questionnaires, and therefore the challenge posed will be to find adequate processes for data treatment that make it possible to reap such benefit.

64. The notification of enumerators via SMS messages has proven to be an effective method to connect e-Census responses to fieldwork organisation. The possibility of including different types of data may be analysed in the future, namely in relation to the distribution of ID/PIN requests via the helpline.

65. The coexistence of two collection systems – e-Census and paper – entailed the implementation of the online Fieldwork Control application for fieldwork management and control, in order to enable real-time monitoring. Considering in the final operation the high number of Fieldwork Control users with different IT knowledge levels, training in this area is of the utmost importance, in addition to fieldwork tasks in which they will be involved.
