

1. The evolution of electronic communications services and consumption of electronic communications services - integrated perspective

The following chapters present the situation of electronic communications services in 2009. The report's structure is based on regulatory definitions of the services. However, these services are increasingly being produced, distributed and consumed in conjunction. The format of presentation favoured in this report might possibly conceal this fact.

To avoid any partial interpretations of the available information, the overall development of electronic communications is outlined below in broad and approximate terms and in an integrated manner. Likewise, an overall characterisation is made of the electronic communications user¹.

1.1. Main aspects

- Mobile accesses account for about 64 % of total accesses, while the traditional fixed network represents almost 12 % of the total. Cable TV distribution networks (CATV) are responsible for about 6 % of all accesses.
- Since 2000, the number of physical resources used by consumers to access electronic communications services has grown on average about 6.2 % per year, reaching 21.7 million accesses in 2009. This development was mainly determined by the growth of mobile networks (growth of 10.5 % per year). The traditional fixed network has seen its weight contract - between 2000 and 2009, it declined on average about 3.5 % per year and in 2009, the decline was 4 %.
- It is noted that despite the decline seen in the fixed network, optical fibre networks (FTTH) have grown, and were particularly driven by a number of policy initiatives and regulatory and financial measures taken to promote the development of next generation networks (NGN). At year end there were about 35 thousand clients supported by this form of access. Likewise, the next generation networks supported over CATV networks have grown significantly and at the end of the year they were used by about 56 thousand customers.
- Voice services are responsible for about 72 % of all customers of electronic communications services. The relative weight of the voice has, however, been declining slowly. The services experiencing a higher level of growth are data services (fixed and mobile), which grew about 31 % on average annually, reaching about 17 % of all customers at the end of the period. Subscription TV services represent 10 percent of the total.
- In 2009, the number of subscriptions to bundled offers (according to definition of European Community (EC)) grew by 25 %, reaching 899 thousand subscribers. This development was mainly driven by triple play offers which grew by 41 %, now representing 52 % of the total of such offers. According to available information, the penetration of multiple play in Portugal is still lower than that reported in the European Union (EU).
- The combinations of the most used service among the residential population refer to four electronic communications services in use simultaneously, specifically, mobile telephony, fixed telephony, fixed broadband and subscription TV (M+F+FBB+TV) and to the exclusive use mobile telephone service.
- Three profiles have been identified for users of electronic communications services²:
 - The first of the identified groups refers to users who prefer the fixed telephone service (F, M+F, M+F+TV), as well as to individuals who do not use any service. The members of this first group belong to smaller sized households (1-2 individuals), which include elderly residents and residents of a lower social class (D). The fact of being retired, of older age (65 years or over) and with a lower level of education (up to primary) appears to be determinant for classifying this type of user.
 - A second group is comprised of users of mobile telephone services as an exclusive service or in conjunction with the subscription TV service. In this group, use of the mobile phone service stands out. These individuals tend to belong to larger households (three or more individuals) and lower social classes (D and E). This group comprises working aged adults (35-64 years) with a low education level (up to primary level) and who are employed or inactive (not retired or students).
 - The third group of electronic communication users is comprised by those who use different services in an integrated manner, specifically, fixed and/or mobile telephone service, fixed broadband and subscription TV, as well as combining other less usual services including

¹ There is no intention to anticipate or advocate any decision regarding the definition of relevant markets of electronic communication services.

² According to cluster analysis using K-means method.

mobile Internet or narrowband Internet. Among these individuals the Internet access service predominates. This type of user tends to belong to larger households (three or more individuals) with children.

- Among small and medium enterprises, the combination of services most commonly used consists of fixed and mobile telephone services, in conjunction with fixed broadband (M+F+FBB). Multiple play subscription is lower among corporate customers, compared to residential customers. Note is made of the predominance of the double play bundle consisting of fixed telephone and Internet service.
- The number of services which a company has tends to increase in line with its size. Among large companies, the number of services used is greater than or equal to 4, with the telephone and Internet access services predominating for the two types, fixed and mobile (M+F+FBB+MBB).
- The combination of fixed and mobile telephone services, together with fixed broadband (F+M+FBB) is most common in small and medium enterprises (SMEs) of the construction and real estate subsectors and of other services (transport, communication, cinematographic activities, radio and television).
- Among SMEs, exclusive use of fixed telephone service is most evident in the retail subsector and in companies with less than 25 years of existence. The companies of this same subsector and of the manufacturing industry with 25 or more years of existence tend to combine the two telephone services (fixed and mobile).

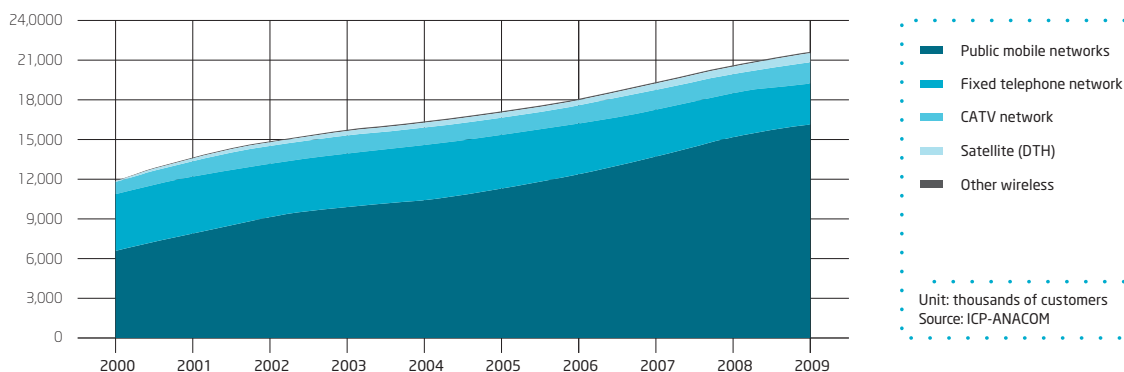
1.2. Overall development of electronic communications

An approach is taken in this section considering electronic communications as being comprised of voice services (fixed and mobile telephone services), data (mainly Internet access) and subscription TV. These services are, in turn, distributed across multiple access networks, including: mobile, fixed telephone network, cable TV distribution networks, satellite and other wireless means.

1.2.1. Means of access to services

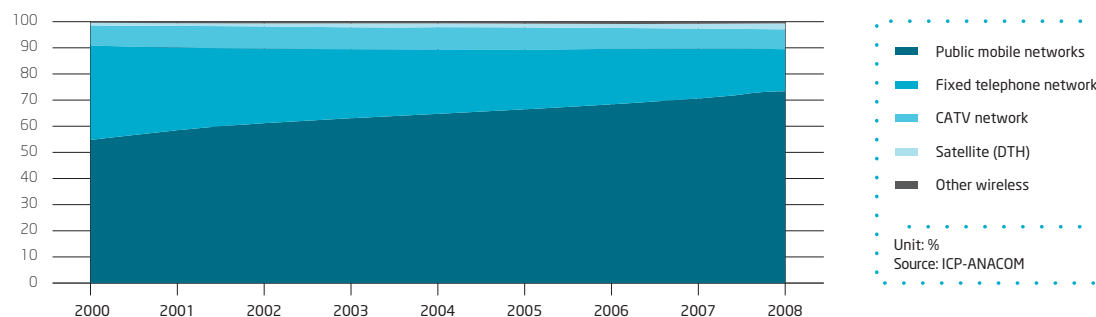
Overall, since 2000, the number of physical means used by consumers to access electronic communications services has grown on average at about 6.2 % per year, reaching 21.7 million accesses in 2009. This evolution was mainly determined by the growth of mobile networks and, up to 2003, albeit to a lesser extent, by cable TV distribution networks. Satellite TV distribution networks likewise contributed to the growth seen over this period.

Mobile networks have reinforced their dominance as a means of accessing services, growing on average by about 10.5 % per year. The traditional fixed network has seen its weight fall – declining on average by about 3.5 % per year between 2000 and 2009 and by 4 % in 2009. Cable TV distribution networks have grown by about 5.6 % per year, maintaining their relative weight. Satellite networks, despite having grown annually by 19 % on average since 2000, represent only 3 % of all accesses.

Evolution in number of customers per access network | Graph 1

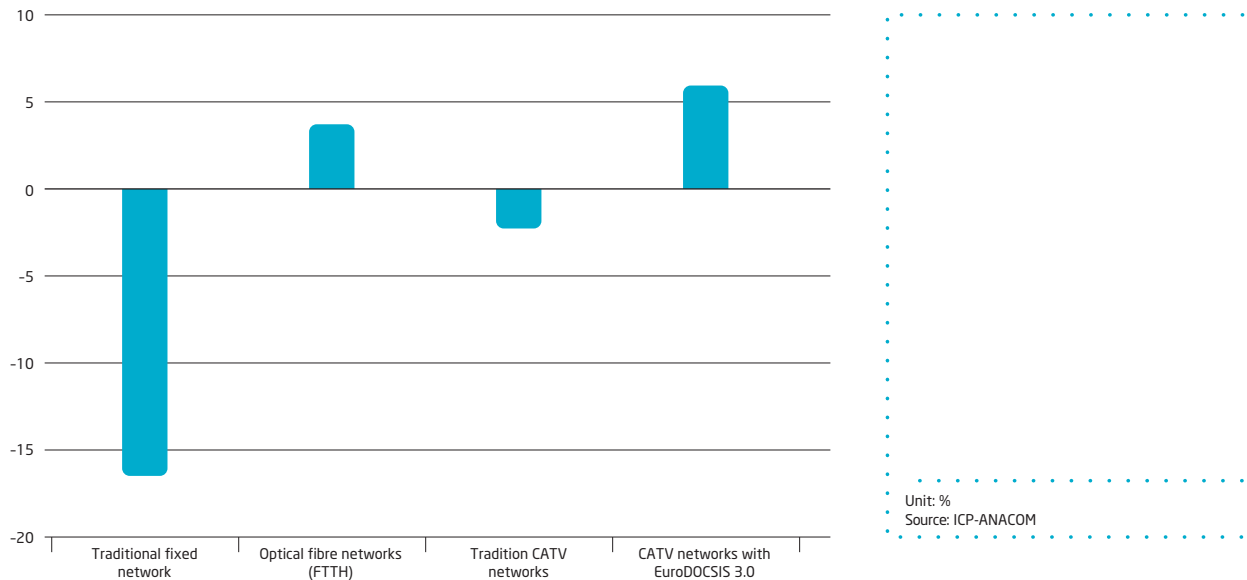
As can be seen in the above graph, the main means of access to communications services are the mobile and fixed telephone network. Mobile accesses account for about 64 % of total accesses, while the traditional fixed

network represents nearly 12 % of the total. The CATV are responsible for about 6 % of all accesses. Other means of access represent a small fraction of the total.

Evolution in number of customers per access network (relative weight) | Graph 2

It is noted that despite the decline seen in the FTTH have grown and were particularly driven by a number of policy initiatives and regulatory and financial measures taken to promote the development of next generation networks (NGN). At year end, there were about 35 thousand

customers supported over this form of access. Likewise, next generation networks supported over CATV networks have grown significantly and at the end of the year they were used by about 56 thousand customers.

Marginal shares of fixed access network electronic communications customers - 2009 | Graph 3

1.2.2. Electronic Communications Services

The voice, data and subscription TV services can be provided using the various means of access outlined above.

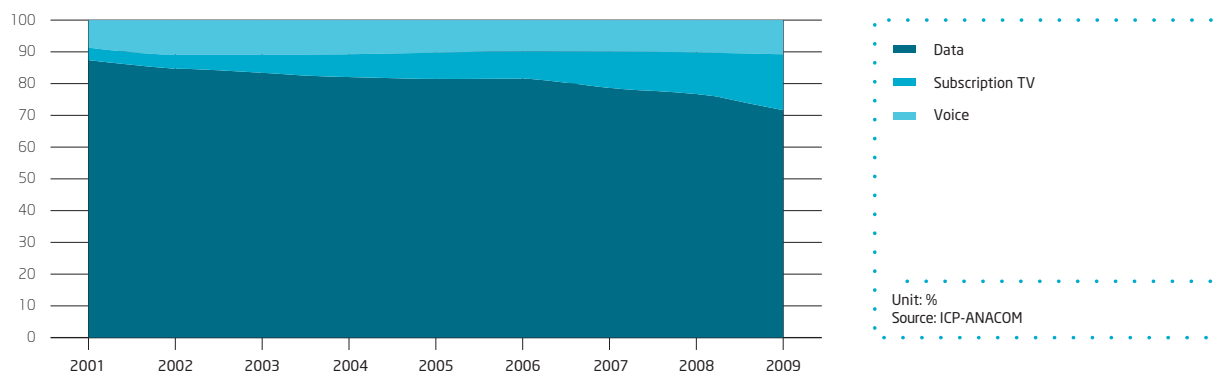
As well as voice and low speed data services, the traditional fixed network currently supports broadband Internet access services and TV distribution services.

Likewise, fixed telephony services and broadband Internet access services are provided over the cable TV distribution networks.

With the advent of 3rd generation mobile networks, broadband Internet access and TV distribution (in unicast mode) became available to customers of mobile networks.

Currently, satellite networks in Portugal are mainly used to provide TV distribution services.

As can be seen, voice services account for about 72 % of all customers of electronic communications services. The relative weight of voice has, however, been declining slowly with the service's average rate of growth (5.5 % / year) lower than the overall growth rate (8.1 % / year). The highest rate of growth is being reported for data services (fixed and mobile), growing by about 31 % on average annually, reaching about 17 % of all customers by the end of the period being reported. Subscription TV services represent 10 % of the total.

Evolution in the relative weight of the number of clients per service | Graph 4

Despite the dominance of voice services in terms of customers, in terms of the revenues derived from services, it appears that the primary drivers of revenue growth are data services and subscription TV. It should however be noted that the bundled offers, double play or triple play, which incorporate television services and/or Internet and/or telephone are only accounted for if the share of revenue from these offers is not directly attributable to specific services, so that in 2008 these represented only about 3 % of total revenues.

Revenues from voice services, representing about 90 % of revenues in 2000, represented about 63 % in 2008, falling an average of 1.8 % per year. In contrast, data revenues grew by 49 % per year, while revenues from subscription TV grew by 19 % per year, excluding revenues from bundled services.

1.2.3. Multiple play offers

In Portugal, several operators and service providers have begun distribution and sales of electronic communications services in an integrated manner using bundled offers, combining voice, Internet access and subscription TV (multiple play).

The first of these offers appeared in 2001, supported over the cable TV distribution network. Since then, several operators have launched deals of this kind, using the fixed switched telephone network (using the local loop unbundling offer (LLU) or their own network), alternative networks (fixed wireless access (FWA)) and, more recently, again cable networks.

The increasing penetration of these offers suggests a need for them to be monitored, not only in the traditional way – disaggregating them according to the regulatory definition of the services, – but also as combined products.

Available statistical information about these offers is presented below.

Providers of multiple play offers (service bundles)³

In 2009, there were nine providers offering packages of services, one less than in 2008.

Providers of service in bundles | Table 1

	2006	2007	2008	2009
double play	5	9	8	8
triple play	4	8	6	7
quadruple play	0	0	1	1
Number of providers of service in bundles	6	11	10	9

Unit: number of providers
Source: ICP-ANACOM

³ By 'Bundles of services' means a commercial offer of a single operator which includes two or more services offered for a single price and as part of one bill.

Number of products with bundled services

In 2009, the number of customers signing up to offers in bundles³ (according to the definition of the EC) grew by 25 %, reaching 899 thousand subscribers. This evolution

was mainly driven by triple play products, which grew 41 %, now representing 52 % of all such products.

Number of subscriptions to bundles of services, by type | Table 2

	2008	2009	Var. 2008/2009	Average annual var. 2006/2009	Accumulated var. 2006/2009
double play	390,275	404,611	3.7 %	6.3 %	20.1 %
triple play	333,353	471,268	41.4 %	54.4 %	268.0 %
quadruple play	9,650	23,185	140.3 %		
Total number of offers of bundles of services	733, 278	899, 064	22.6 %	24.6 %	93.4 %

Unit: no. of offers, %
Source: ICP-ANACOM

Note should also be made of the significant growth (140 %) in quadruple play – offer comprised of fixed and mobile voice service and fixed and mobile broadband Internet access. However, this offer represents just 2.6 % of total sign-up volume.

Penetration of offers of bundles of services

In terms of penetration, around 16 % of classic family households have signed up to multiple play offers.

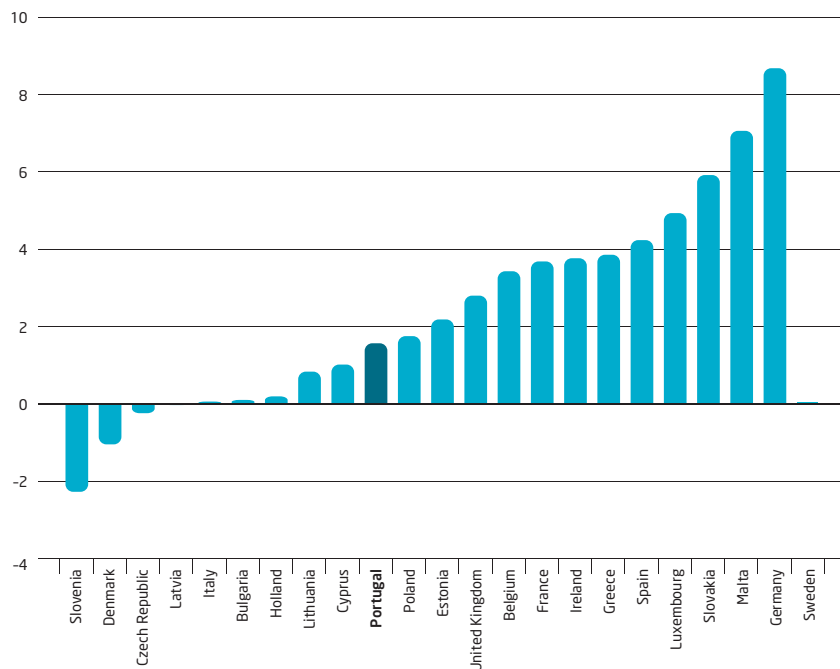
Penetration rate of bundled product subscribers per 100 households | Table 3

	2008	2009	Var. (p. p.) 2008/2009	Average annual var. (p.p.) 2006/2009	Accumulated var. (p.p.) 2006/2009
double play	7.0	7.3	0.3	0.4	1.2
triple play	6.0	8.5	2.5	2.1	6.2
quadruple play	0.2	0.4	0.2	0.1	0.4
Penetration of bundles products per household	13.2	16.2	3.0	2.6	7.8

Unit: %, p. p.
Source: ICP-ANACOM

When calculated in terms of population, the penetration of these products reaches 8.5 per 100 inhabitants. In 2008, penetration was reported at 6.9.

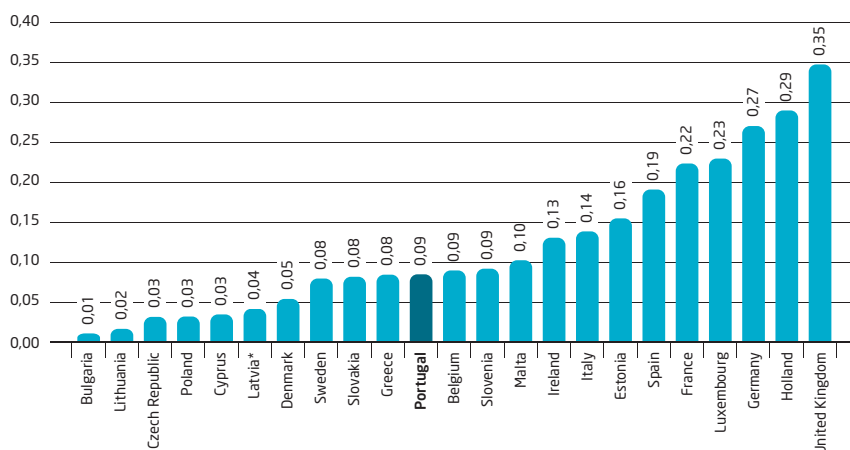
In 2009, virtually all countries have seen an increase in services offered in bundles. The penetration of these products in Portugal increased by about 1.6 % compared to 2008. On average, the penetration of bundles in the EU grew by 2.4 %.

Growth in penetration of bundled products per 100 inhabitants in the EU | Graph 5

Unit: bundles per 100 inhabitants
 Source: European Commission, Progress report
 on the Single European Electronic Communications
 Market in 2009 (15th Report).

Compared with the other member states of the EU, Portugal is below average in terms of the percentage of subscribers to bundled products. It should be noted, however, that the definition of the bundle of services used here, which was developed by the EC, underreports the bundled offers in Portugal by excluding those offers that, although promoted,

sold and billed together, do not have an integrated tariff - i.e. it is possible to identify the individual prices of each service. If all bundled offers in Portugal were considered the penetration rate would rise from 9 per 100 inhabitants to 15.2 per 100 inhabitants (the same may occur in other EU countries).

Penetration of bundled offers per 100 inhabitants | Graph 6

Unit: %
 Source: European Commission, Progress report
 on the Single European Electronic Communications
 Market in 2009 (15th Report).

1.3. Profile of use of electronic communications

The profile of residential and business (large companies and SMEs) users of electronic communications is described below, detailing those who signed up to multiple play products.

For this purpose, use is made of the specific surveys that have been conducted by ICP-ANACOM.

1.3.1. Profile of the residential consumer of electronic communications

In this section, an integrated view of the residential consumer of electronic communications services is presented, based on the *Inquérito ao Consumo dos Serviços de Comunicações Electrónicas* (Electronic Communications Services Consumer Survey) of December 2009⁴.

The reference consumer is an individual aged 15 years or older⁵ residing in Portugal in a private household⁶, while the services considered are as follows:

- Mobile telephone service (M);
- Fixed telephone service (F);
- Internet access service (I), distinguishing its four forms of access: mobile broadband (MBB), fixed broadband (FBB), mobile narrowband (MNB) and fixed narrowband (FNB);
- Subscription television service (TV).

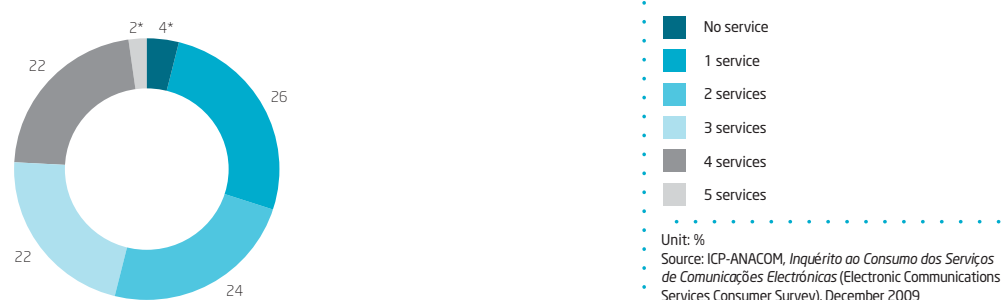
In the following sections, the penetration of various combinations of services among individuals is presented with their socio-economic and demographic profile and their level of satisfaction with the services provided.

Penetration of services

At the end of 2009, almost one in every four individuals had four or more separate electronic communications services (not necessarily acquired as a bundle). About 4 % of individuals had no access to this type of service. The distribution of individuals according to the various possible combinations of services – one, two, three or four services – is relatively uniform, ranging from 26 to 22 %.

Distribution of individuals by the number of electronic communications services which they have

Graph 7



Base: Individuals aged 15 years or over.

Note: Key to symbols on estimates: (#) Unreliable estimate; (*) Acceptable estimate; (no symbol) Reliable estimate

4 The universe is composed of individuals of 15 years or more who reside in private housing units located in Mainland Portugal or in the Autonomous Regions (Azores and Madeira). The sample is representative at the level of NUTS II (with sampling errors not exceeding 5.5 percentage points for the smaller regions – Alentejo, Algarve, A.R. Azores and A.R. Madeira and not exceeding 4.5 for the others) having been composed of 3,106 interviews. Households were selected by means of proportional stratified random sampling according to the crossing of the NUTS II Region variables and the size of the household. Within each household one individual was selected by means of sampling by quotas guaranteeing the marginal totals of the sex, age class, level of education and employment status variables, according to the General Population Census (2001) of INE – Instituto Nacional de Estatística (Statistics Portugal). Information compilation was performed using CAPI – Computer Assisted Personal Interviewing between 6 November and 20 December 2009. The results regarding the Mobile Telephone Service are based on the universe of the individuals and present a maximum margin of error of less than 2 p.p. (with a degree of reliability of 95 %). The results regarding the Fixed Telephone Service, internet Service and paid Television Service are based on the universe of the households and present a maximum margin of error of less than 2.6 p.p. (with a level of reliability of 95 %). Fieldwork and data processing was performed by the company GfK Metris.

5 According to the Annual Estimates of Residential Population of INE (Statistics Portugal) (2008), around 15 % of the resident population in Portugal is under the age of 15 %.

6 Insofar as access to the mobile telephone service is made at the individual level, it was decided that the individual would be considered as the unit of analysis. In this sense, access to the other services (Fixed Telephone, internet and Paid TV) should be interpreted as the possibility of the individual to access the respective services when available in his household.

The most common combinations of services are fixed telephone, mobile phone, fixed broadband and subscription TV (20 %), whereas these might not be acquired as a bundle, and the mobile phone service only (19 %).

Use of the fixed telephone or mobile telephone service in isolation or in conjunction with the subscription TV service is also relatively popular with a frequency of 9 and 8 %, respectively.

Penetration of services and service combinations | Table 4

	%
M + F + FBB + TV	19.8
M	18.8
M + F	9.0 *
M + F + TV	8.0 *
M + TV	7.2 *
F	6.5 *
M + BFF + TV	5.8 *
M + MFF	3.1 *
M + F + FBB	3.0 *
M + MBB + TV	2.6 *
F + TV	2.3 *
Other combinations	9.8 *
None	4.0 *

Unit: %

Source: ICP-ANACOM, *Inquérito ao Consumo das Comunicações Eletrónicas* (Electronic Communications Services Consumer Survey), December 2009

Base: Individuals aged 15 years or over.

Note 1: "Other combinations" refers primarily to the combination of the Internet access service (MBB, MNB, FBB, FNB) with other electronic communications services (M, F, TV).

Note 2: Key to symbols on estimates: (#) Unreliable estimate; (*) Acceptable estimate; (no symbol) Reliable estimate.

It is also noted that the vast majority (96 %) of individuals who have Internet also have access to the mobile telephone service.

Socio-demographic profile of residential consumers

In this section, the profile of the residential consumer of electronic communications services is described in terms of region, family structure, age group, education and employment status and social class of the household to which the individual belongs.

The identification of the profile of the electronic communications consumer is based on three types of exploratory analysis made of additional data:

• Descriptive analysis of data

This method involves determining the proportion of individuals / family households with access to electronic communications services in accordance with the type of socio-demographic characteristics.

In addition, an assessment is made of the significant differences in the proportion of individuals / households who consume the type of services i in group j and in group j^{-1} by testing two samples for proportions. Within this section, i refers to the combination of different types of services (M+F+FBB+TV; M; M+F; M+F+TV; M+TV; F; M+FBB+TV; other combinations, no service), group j refers to the category of individuals with the socio-demographic variable under analysis, group j^{-1} refers to individuals with the other categories of this variable.

• Simple correspondence analysis

This technique allows study of the relationships and similarities between the horizontal and vertical categories of a double entry table with nominal variables by converting the table into a graphical representation in which the rows and columns of the table are depicted using points in a graph. In Appendix 1, the methodology used is presented and exemplified with more detail;

• Cluster analysis

Likewise, groups - clusters - with homogeneous behaviour have been formulated using the k-means non-hierarchical method, based on the Euclidean distance and centroid criterion for the aggregation of responses.

Regional characterization

The consumption of electronic communications services differs depending on the region where the user is located.

Consumption of electronic communications services in accordance with NUTS II region | Table 5

Integrated consumption of services	North	Centre	Lisbon	Alentejo	Algarve	Azores	Madeira	Total
M + F + FBB + TV	14 *	17 *	31 *	15 #	17 *	30 *	22 *	20
M	25 *	15 *	14 *	27 *	21 *	6 #	10 #	19
M + F	11 *	10 *	6 #	13 #	8 #	2 #	2 #	9 *
M + F + TV	7 *	8 #	10 *	4 #	10 #	14 #	9 #	8 *
M + TV	5 #	10 *	8 *	6 #	5 #	8 #	15 #	7 *
F	8 *	8 #	3 #	10 #	6 #	7 #	7 #	7 *
M + FBB + TV	6 #	5 #	8 *	2 #	3 #	4 #	14 #	6 *
Other combinations	22 *	20 *	20 *	18 *	27 *	24 *	18 *	21
None	4 #	8 #	1 #	5 #	5 #	3 #	3 #	4 *
Total	100	100	100	100	100	100	100	100

Unit: %

Source: ICP-ANACOM, *Inquérito ao Consumo dos Serviços de Comunicações Eletrónicas* (Electronic Communications Services Consumer Survey), December 2009

Base: Individuals aged 15 years or over according to Nomenclature of Territorial Units for Statistics (NUTS) II region.

Note 1: Key to symbols on estimates: (#) Unreliable estimate; (*) Acceptable estimate; (no symbol) Reliable estimate.

Note 2: The proportions highlighted in blue indicate those that are significantly different (horizontal) in accordance with the test of two samples for proportions. Higher proportions are highlighted in light blue and lower proportions in dark blue.

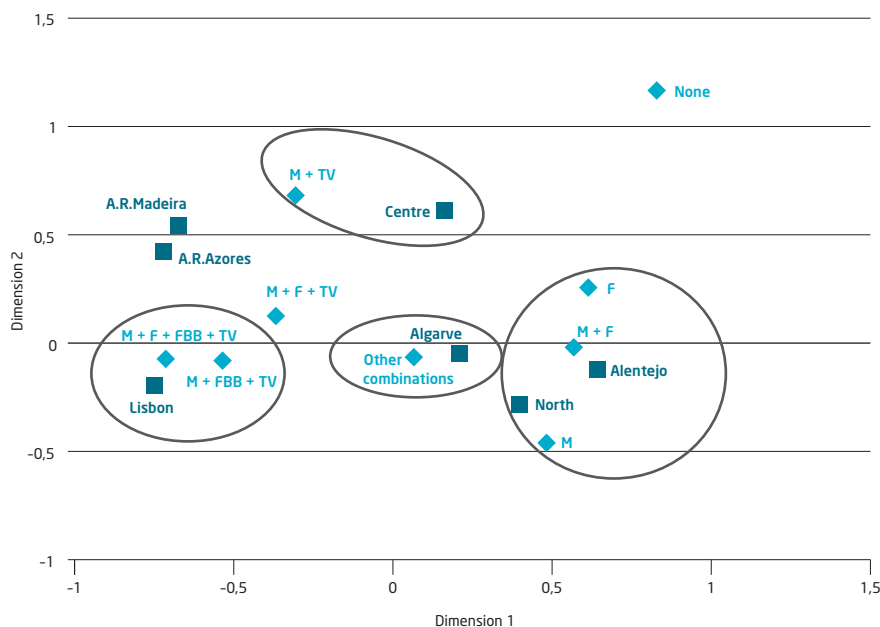
The population that resides in Lisbon and the Azores stands out in terms of intensity of integrated consumption of four services - mobile and fixed telephone service, fixed broadband Internet access and subscription TV service (M+F+FBB+TV).

Exclusive use of the mobile phone service tends to be relatively significant in the North and Alentejo. In the Centre of the country, the consumption of the mobile phone

services in conjunction with the subscription TV service is relatively more intense.

The Alentejo stands out compared to other regions in terms of the relatively greater exclusive use of the mobile phone service. In the Algarve, the use of less standardized services ("other combinations") is relatively more intense.

Correspondence analysis between the integrated consumption of services and NUTS II region | Graph 8



Source: ICP-ANACOM, *Inquérito ao Consumo dos Serviços de Comunicações Eletrónicas* (Electronic Communications Services Consumer Survey), December 2009

Base: Individuals aged 15 years or over.

Note: The two axes represented show 89 % of the total inertia. The following categories stand out with a smaller contribution to the formation of the two axes (less than 75 %): M+FBB+TV and Other combinations of service ("others") in terms of integrated consumption of services and the autonomous regions and the Algarve in terms of NUTS II regions.

It should be stressed that these regional differences are influenced by the geographical availability of services and may not reflect differences in preferences among consumers from different geographical areas.

On the other hand, with the great majority of the Portuguese population resident in the Lisbon, Central and North regions, the type of consumption in these geographic areas tends to have greater overall impact.

Characterization according to family structure

Individuals living in larger households are more likely to access more electronic communications services simultaneously (M+F+TV+FBB) or to have other less usual

combination of services that include mobile Internet or narrowband Internet.

By contrast, individuals in small households tend to use a smaller number of services more intensely, especially the fixed telephone or mobile telephone service.

In particular, individuals who live alone are characterized by the exclusive use of the fixed telephone service (F) or mobile telephone service (M).

Consumption of electronic communications services according to family size | Table 6

Integrated consumption of services	1 individual	2 individuals	3 individuals	4 or more individuals	Total
M + F + FBB + TV	5 #	17 *	21 *	29 *	20
M	34 *	16 *	16 *	17 *	19
M + F	7 #	14 *	8 *	6 #	9 *
M + F + TV	5 #	12 *	8 *	6 *	8 *
M + TV	8 #	8 *	7 *	6 *	7 *
F	13 *	10 *	5 #	2 #	7 *
M + FBB + TV	4 #	3 #	9 *	7 *	6 *
Other combinations	14 *	16 *	23 *	27 *	21
None	10 #	5 #	3 #	2 #	4 *
Total	100	100	100	100	100

Unit: %

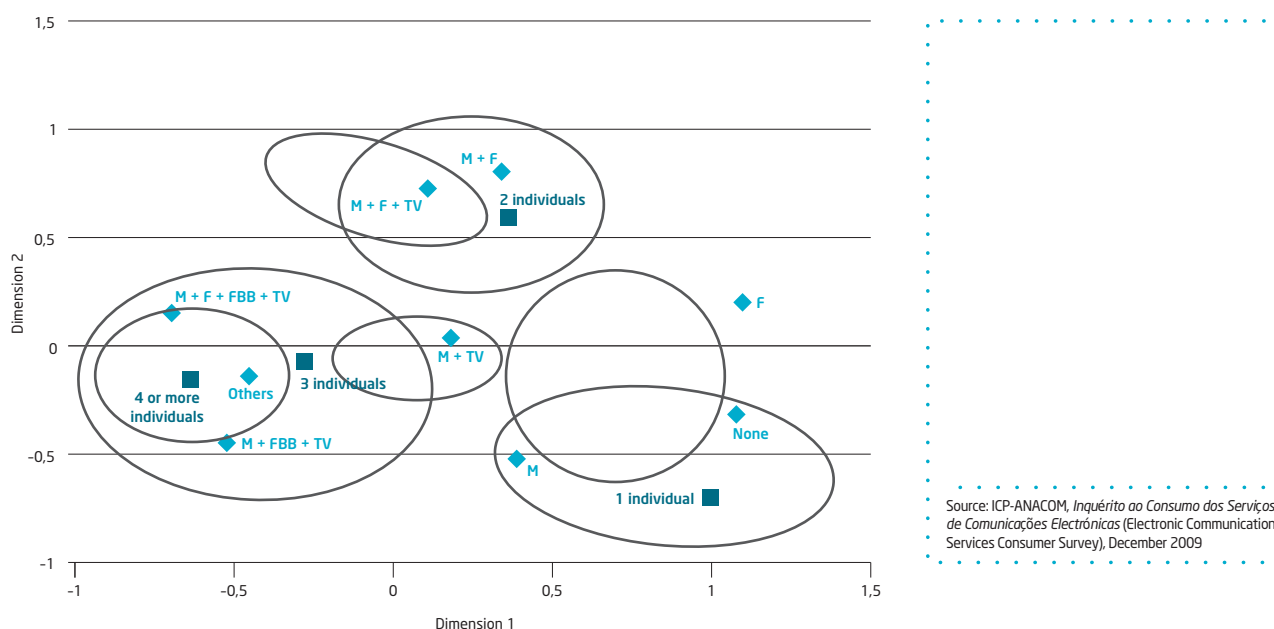
Source: ICP-ANACOM, *Inquérito ao Consumo dos Serviços de Comunicações Electrónicas* (Electronic Communications Services Consumer Survey), December 2009

Base: Individuals aged 15 years or over according to family size.

Note 1: Key to symbols on estimates: (#) Unreliable estimate; (*) Acceptable estimate; (no symbol) Reliable estimate

Note 2: The proportions highlighted in blue indicate those that are significantly different (horizontal) in accordance with the test of two samples for proportions. Higher proportions are highlighted in light blue and lower proportions in dark blue.

Correspondence analysis between the integrated consumption of services and family size | Graph 9



Base: Individuals aged 15 years or over.

Note: The two axes represented show 96 % of the total inertia. The following categories stand out with a smaller contribution to the formation of the two axes (less than 65 %): M+FBB+TV in terms of integrated consumption of services and "3 individuals" in terms of family size. The remaining categories have contributions in excess of 93 %.

It should also be noted that the consumption of electronic communications by individuals with children in their household is distinct from individuals with elderly members in their households.

The presence of children in a household is reflected in the consumption of a broader range of services, especially combinations comprising the Internet access service, combinations of four services (M+F+FBB+TV) and other types of less usual combinations that include mobile Internet or narrowband Internet.

The existence of elderly members in a household is linked to more limited consumption of services: in particular the exclusive use of the fixed telephone service, and the use of fixed and mobile telephone service, in conjunction with the subscription TV service. Moreover, it is observed that use of the Internet access service together with other electronic communications services is relatively less intense in these cases.

Consumption of electronic communications services in accordance with the presence of children or elderly members in the household | Table 7

Integrated consumption of services	Family household with ...		Total
	Children	Elderly	
M + F + FBB + TV	23 *	11 *	20
M	20 *	20 *	19
M + F	6 #	10 #	9 *
M + F + TV	5 #	14 *	8 *
M + TV	7 *	6 #	7 *
F	1 #	17 *	7 *
M + FBB + TV	9 *	1 #	6 *
Other combinations	26 *	13 *	21
None	2 #	9 #	4 *
Total	100	100	100

Unit: %

Source: ICP-ANACOM, *Inquérito ao Consumo dos Serviços de Comunicações Eletrónicas* (Electronic Communications Services Consumer Survey), December 2009

Base: Individuals aged 15 years or over according to presence of children or elderly members.

Note 1: Key to symbols on estimates: (#) Unreliable estimate; (*) Acceptable estimate; (no symbol) Reliable estimate.

Note 2: The proportions highlighted in blue indicate those that are significantly different (horizontal) in accordance with the test of two samples for proportions. Higher proportions are highlighted in light blue and lower proportions in dark blue.

Characterization according to age

The diversified consumption of services with Internet access (M+F+FBB+TV; M+FBB+TV and other combinations of services which include mobile and narrowband internet) is relatively stronger among the younger population (up to 34 years).

As the age of the individual increases, distinct patterns of consumption are observed and there is a trend towards a more restricted use of electronic communications services, with a less evident presence of the Internet access service.

Exclusive use of the mobile telephone service is the most evident among individuals in between 35-44 years.

The population aged 55 and older tends to make greater use of the mobile and fixed telephone service or these together with TV.

On the other hand, in the age group of 65 or over, the exclusive use of the fixed telephone service and use of no services becomes more evident. Note that, according to the Annual Estimates of Resident Population of INE (Statistics Portugal) (2008), about 18 % of the population residing in Portugal is 65 years of age or older.

Consumption of electronic communications services by age group | Table 8

Integrated consumption of services	15-24	25-34	35-44	45-54	55-64	65 or over	Total
M + F + FBB + TV	28 *	26 *	23 *	23 *	17 *	4 #	20
M	14 *	18 *	27 *	17 *	18 *	19 *	19
M + F	2 #	5 #	5 #	9 #	19 *	15 *	9 *
M + F + TV	4 #	3 #	6 #	9 #	12 #	14 *	8 *
M + TV	5 #	8 #	8 #	9 #	7 #	6 #	7 *
F	1 #	0 #	3 #	5 #	8 #	21 *	7 *
M + FBB + TV	10 #	10 *	7 #	5 #	2 #	1 #	6 *
Other combinations	35 *	28 *	19 *	19 *	16 *	9 #	21
None	2 #	2 #	2 #	4 #	1 #	11 *	4 *
Total	100	100	100	100	100	100	100

Unit: %.

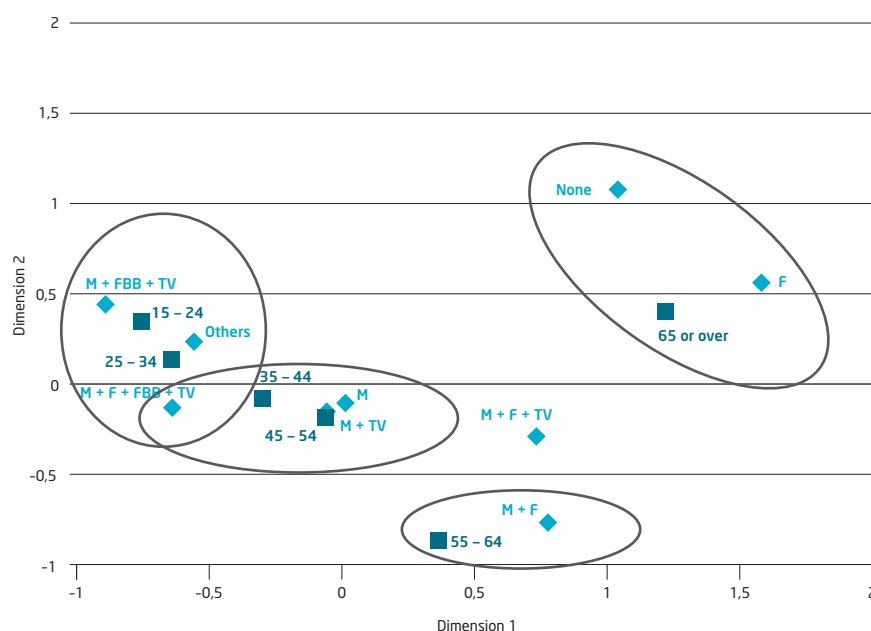
Source: ICP-ANACOM, *Inquérito ao Consumo dos Serviços de Comunicações Eletrónicas* (Electronic Communications Services Consumer Survey), December 2009

Base: Individuals aged 15 years or over according to age group.

Note 1: Key to symbols on estimates: (#) Unreliable estimate; (*) Acceptable estimate; (no symbol) Reliable estimate

Note 2: The proportions highlighted in blue indicate those that are significantly different (horizontal) in accordance with the test of 2 samples for proportions. Higher proportions are highlighted in light blue and lower proportions in dark blue.

Correspondence analysis between the integrated consumption of services and age group | Graph 10



Source: ICP-ANACOM, *Inquérito ao Consumo dos Serviços de Comunicações Electrónicas* (Electronic Communications Services Consumer Survey), December 2009

Base: Individuals aged 15 years or over.

Note: The two axes represented show 94 % of the total inertia. The following categories stand out with a smaller contribution to the formation of the two axes (less than 65 %): M and M+TV in terms of integrated consumption of services and 35-54 years in terms of age group. The remaining categories have contributions in excess of 88 %.

Characterization according to education and employment status

The educational level of the individual and their employment status are also determining factors for the type of integrated consumption of electronic communications services.

The population tends to be concentrated in the lower levels of schooling. According to INE (Statistics Portugal) data, about half the resident population has an education level that is lower than secondary level. It is exactly in this group

that exclusive access to the fixed and/or mobile telephone service, and its use in conjunction with the telephone service tend to have higher expression.

Although with less weight, individuals with a higher level of education (above secondary) tend to have a larger and more diverse set of services which includes the Internet access service (fixed and mobile).

Consumption of electronic communications services, according to level of education | Table 9

Integrated consumption of services	Higher education	Secondary education	3rd stage primary	2nd stage primary	1st stage primary or less	Total
M + F + FBB + TV	30 *	38 *	29 *	19 *	7 *	20
M	8 #	9 #	17 *	23 *	25	19
M + F	1 #	3 #	4 #	7 #	15 *	9 *
M + F + TV	2 #	4 #	8 #	9 #	11 *	8 *
M + TV	7 #	5 #	3 #	12 #	8 *	7 *
F	0 #	1 #	1 #	3 #	13 *	7 *
M + FBB + TV	13 #	8 #	10 #	5 #	2 #	6 *
Other combinations	37 *	31 *	28 *	18 *	11 *	21
None	1 #	0 #	0 #	3 #	7 *	4 *
Total	100	100	100	100	100	100

Unit: %

Source: ICP-ANACOM, *Inquérito ao Consumo dos Serviços de Comunicações Eletrónicas* (Electronic Communications Services Consumer Survey), December 2009

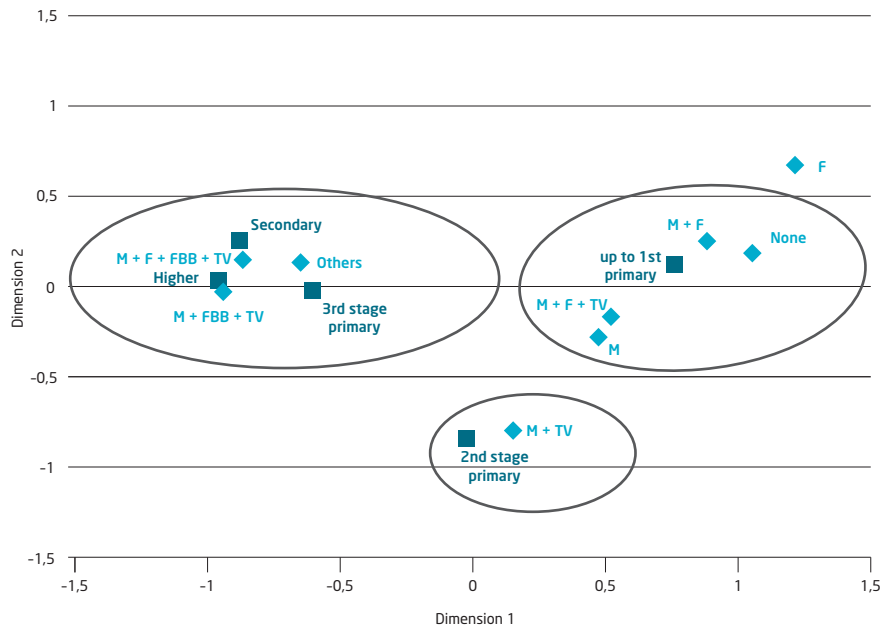
Base: Individuals aged 15 years or over according to level of education.

Note 1: Key to symbols on estimates: (#) Unreliable estimate; (*) Acceptable estimate; (no symbol) Reliable estimate.

Note 2: The proportions highlighted in blue indicate those that are significantly different (horizontal) in accordance with the test of two samples for proportions. Higher proportions are highlighted in light blue and lower proportions in dark blue.

Correspondence analysis between the integrated consumption of services and level of education

Graph 11



Source: ICP-ANACOM, *Inquérito ao Consumo dos Serviços de Comunicações Electrónicas* (Electronic Communication Services Consumer Survey), December 2009

Base: Individuals aged 15 years or over.

Note: The two axes represented show 96 % of the total inertia. All categories contribute more than 75 % to the formation of the two axes.

Regarding the variable “employment status”, it appears that the employed and student population are distinguished through a greater appetite for fixed broadband in conjunction with the other electronic communications services. Students also stand out for more intensive use of “other combinations”.

In contrast, it was observed that the retired population prefers access to the fixed telephone service, either exclusively or used in conjunction with the subscription TV service and/or mobile telephone service.

Consumption of electronic communications services, according to employment status | Table 10

Integrated consumption of services	Employed population	Unemployed population	Students	Retired	Other inactive	Total
M + F + FBB + TV	25	20 #	32 *	8 *	11 #	20
M	19	22 #	7 #	18 *	25 *	19
M + F	7 *	6 #	1 #	17 *	10 #	9 *
M + F + TV	6 *	8 #	3 #	14 *	8 #	8 *
M + TV	8 *	9 #	4 #	6 #	8 #	7 *
F	2 #	3 #	0 #	18 *	9 #	7 *
M + FBB + TV	8 *	4 #	10 #	1 #	5 #	6 *
Other combinations	24	25 #	43 *	10 *	13 #	21
None	2 #	3 #	0 #	7 #	12 #	4 *
Total	100	100	100	100	100	100

Unit: %

Source: ICP-ANACOM, *Inquérito ao Consumo dos Serviços de Comunicações Eletrónicas* (Electronic Communications Services Consumer Survey), December 2009

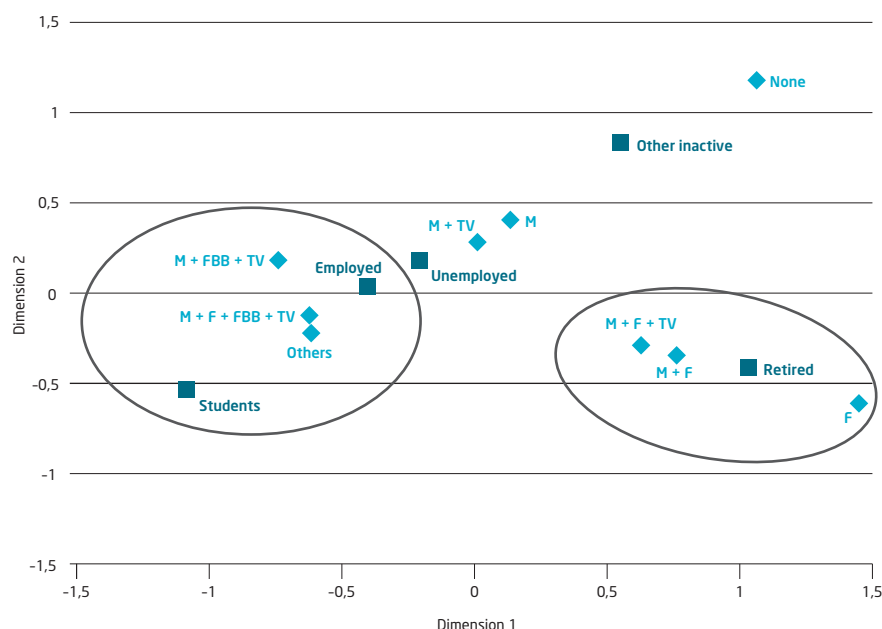
Base: Individuals aged 15 years or over according to employment status.

Note 1: Key to symbols on estimates: (#) Unreliable estimate; (*) Acceptable estimate; (no symbol) Reliable estimate.

Note 2: The proportions highlighted in blue indicate those that are significantly different (horizontal) in accordance with the test of two samples for proportions. Higher proportions are highlighted in light blue and lower proportions in dark blue.

Correspondence analysis between the integrated consumption of services and employment status

| Graph 12

Source: ICP-ANACOM, *Inquérito ao Consumo dos Serviços de Comunicações Eletrónicas* (Electronic Communications Services Consumer Survey), December 2009

Base: Individuals aged 15 years or over.

Note: The two axes represented show 95 % of the total inertia. The following categories stand out with a smaller contribution to the formation of the two axes (less than 50 %): M+TV in terms of integrated consumption of services and "unemployed" in terms of employment status. The remaining categories have contributions in excess of 80 %.

Characterization according to social class

The population's access to electronic communication services also varies by the household's social class.

Individuals belonging to households of higher social classes have more electronic communications services and, in particular, tend to have Internet access service – in its various forms – along with some of the other electronic communications services.

Individuals in households of a lower social class use fewer services and there is a greater propensity for the exclusive use of the mobile and/or fixed telephone service. Note however that the combination of telephone service with subscription TV service also tends to be more significant among the population of households with a lower social class.

Consumption of electronic communications services according to social class | Table 11

Integrated consumption of services	A/B	C	D	E	Total
M + F + FBB + TV	37 *	30 *	13 *	13 *	20
M	7 #	12 *	23	25 *	19
M + F	1 #	6 #	13 *	8 #	9 *
M + F + TV	3 #	5 #	11 *	8 #	8 *
M + TV	5 #	7 #	8 *	8 #	7 *
F	0 #	2 #	10 *	6 #	7 *
M + FBB + TV	13 *	9 #	3 #	4 #	6 *
Other combinations	32 *	28 *	14 *	21 *	21
None	0 #	1 #	5 *	8 #	4 *
Total	100	100	100	100	100

Unit: %

Source: ICP-ANACOM, *Inquérito ao Consumo dos Serviços de Comunicações Eletrónicas* (Electronic Communications Services Consumer Survey), December 2009

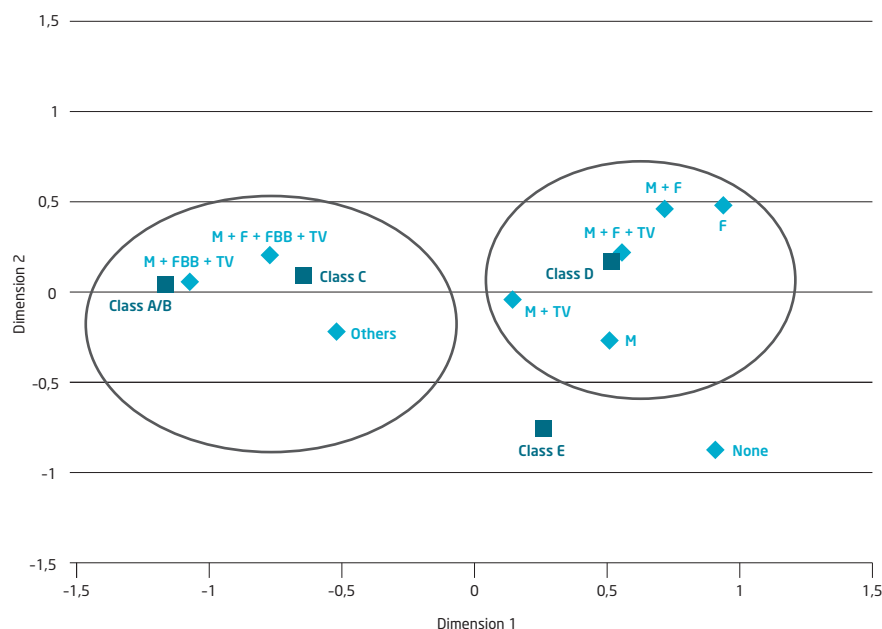
Base: Individuals aged 15 years or over according to household social class.

Note 1: Key to symbols on estimates: (#) Unreliable estimate; (*) Acceptable estimate; (no symbol) Reliable estimate

Note 2: The proportions highlighted in blue indicate those that are significantly different (horizontal) in accordance with the test of two samples for proportions. Higher proportions are highlighted in light blue and lower proportions in dark blue.

Note 3: Social class is determined according to educational level and occupation of the individual with highest income in the household. The class A is the highest social class and E the lowest.

Correspondence analysis between the integrated consumption of services and social class of household | Graph 13



Base: Individuals aged 15 years or over.

Note: The two axes represented show 99.5 % of the total inertia. All categories contribute more than 75 % to the formation of the two axes.

Characterization of users of service / combination of services⁷.

So far, each characteristic of the individual has been analysed in a one-dimensional perspective. The intention now is to systematize the features that stand out in respect of each of the groups of users of services in a multidimensional

perspective. It was possible to identify four profiles of use of electronic communications services using cluster analysis. The table below illustrates the main characteristics identified in each obtained group, enabling comparison of the incidence of each characteristic in the respective group and in comparison to the total population.

⁷ The combination of services does not necessarily imply its use in a multiple play bundle.

Profile of users of electronic communication services from an integrated perspective | Table 12

	GROUP 1			GROUP 2			GROUP 3					
				Use of few services, prevalence of mobile telephone service in place of fixed			Range of services, prevalence of Internet access service					
							"more educated"			"younger"		
	% group	% global		% group	% global		% group	% global		% group	% global	
Combination of services	F	21.0	6.5	M	31.4	18.8	M+F+FBB+TV	35.3	19.8	M+F+FBB+TV	25.3	19.8
	M+F	17.0	9.0				M	12.0	2.6			
	M+F+TV	15.7	8.0	M+TV	8.9	7.2	Other combinations	32.2	9.8		26.7	9.8
	None	8.4	4.0									
Family size	Up to 2 individuals	81.8	43.0	3 or more individuals	63.8	57.0	3 or more individuals	62.0	57.0	3 or more individuals	80.6	57.0
Children / elderly present	Elderly	48.2	18.1				Children	30.8	26.1	Children	42.7	26.1
Age group	65 years or over	78.0	19.4	35-64 years	82.5	45.6	25-34 years	33.7	18.1	15-24 years	42.0	17.0
Level of education	Up to 1st stage primary	93.1	45.3	Up to 1st stage primary	99.9	45.3	Higher and secondary education	93.1	32.2	1st and 2nd stage primary	76.0	22.4
Employment status	Retired	85.4	22.3	Other inactive / employed	88.8	65.9	Employed	80.1	53.3	Student / employed	83.0	61.2
Social class	D	95.2	51.0	D/E	89.3	65.9	A/B/C	98.5	34.0	D/E	88.4	65.9

Source: ICP-ANACOM, *Inquérito ao Consumo dos Serviços de Comunicações Eletrónicas* (Electronic Communications Services Consumer Survey), December 2009
Base: Individuals aged 15 years or over.

Note: Cluster analysis using K-means method with four classes. According to the distance matrix between the groups, it is observed that group 1 presents greater dissimilarities in respect of group 3 "more educated" (2.343) and group 3 "younger" (2.054).

The identified groups have the following characteristics:

- The first of the groups identified refers to users who prefer the fixed telephone service (F, M+F, M+F+TV), as well as to individuals not using any service.

The members of this first group belong to smaller sized households (1-2 individuals), which include elderly residents and of a lower social class (D). The fact of being retired, of older age (65 years or over) and with a lower education level (up to primary level) appears to be determinant for classifying this type of user.

- A second group is comprised of users of mobile telephone services as an exclusive service or in conjunction with the subscription TV service. In this group, use of the mobile phone service stands out.

These individuals tend to belong to larger households (three or more individuals) and lower social class (D and E). This group comprises adults of working age (35-64 years) with a low level of education (up to primary level) and who are employed or inactive (not retired or students).

- The third group of electronic communication users is comprised by those who use different services in an integrated manner, specifically, fixed and/or mobile telephone service, fixed broadband and subscription TV, as well as combining other less usual services including mobile Internet or narrowband Internet. Among these individuals, the Internet access service predominates.

This type of user tends to belong to larger households (three or more individuals) which include children. With regard to individual characteristics, it is possible to present two different profiles:

- On the one hand there is a group of younger individuals (15-24 years) with intermediate levels of education (secondary education), employees and students. In terms of their household's social class, lower levels (D and E) are particularly evident).
- Meanwhile, there is a second profile, characterized by a slightly higher age group (25-34 years) with higher levels of education (secondary and higher education), higher incidence of employment and a relatively higher social class (A/B/C).

Satisfaction of residential consumers with services provided

In overall terms, users of electronic communications services tend to be satisfied with the services provided.

Average level of satisfaction with the service provided by the operator of each electronic communications service which the individual has | Table 13

Integrated consumption of services	M	F	MI	FI	TV	Total
M + F + FBB + TV	7.6	7.1	.	7.2	7.4	7.3
M	7.7	.	.	.	.	7.7
M + F	7.6	7.2	.	.	.	7.4
M + F + TV	7.9	7.6	.	.	7.7	7.7
M + TV	7.7	.	.	.	7.5	7.6
F	.	7.9	.	.	.	7.9
M + FBB + TV	7.9	.	.	7.2	7.5	7.5
Other combinations	7.7	7.3	7.2	7.5	7.6	7.5
Groups (clusters)						
Group 1	7.7	7.7	6.5	7.2	7.8	7.7
Group 2	7.7	7.4	7.1	7.5	7.7	7.6
Group 3 – “more educated”	7.5	7.1	7.2	7.2	7.4	7.3
Group 3 – “younger”	7.8	7.2	7.3	7.4	7.5	7.6
Total	7.7	7.3	7.2	7.3	7.5	7.6

Unit: scale 1 to 10

Source: ICP-ANACOM, *Inquérito ao Consumo dos Serviços de Comunicações Electrónicas* (Electronic Communications Services Consumer Survey), December 2009

Base: Individuals aged 15 years or over according to the electronic communications services which they have.

Note 1: MI refers to mobile Internet and FI to fixed Internet.

Note 2: See previous section for more detail on the profile of the groups (clusters).

Note 3: Original measurement scale: 1: very dissatisfied; 10: Very Satisfied.

Note 4: The measurements highlighted in blue indicate those that are significantly different (vertically) according to the test of equality between averages. Higher measurements are highlighted in light blue and lower measurements in dark blue.

Note 5: The margin of error of the measurements on a scale of 1 to 10 is all equal to or less than 0.4 absolute points.

Individuals who have only fixed telephone service or mobile telephone service, as well as those who have access to the fixed and mobile telephone service and subscription TV service (M+F+TV) were the ones who showed, on average, higher satisfaction with the service provided by operators. The average satisfaction of these individuals lies between 7.9 and 7.7.

By type of associated services, the users who are more satisfied, on average terms, with their service tend to be in Group 1.

Individuals with four electronic communications services (M+F+FBB+TV) are on average less satisfied with their services (7.3), with the fixed telephone and fixed broadband service contributing most to this view.

Likewise, users of the “more educated” Group 3 tend to be on average less satisfied.

Finally, it should be noted that individuals who have mobile telephone service tend to be relatively more satisfied (7.7 points on a scale of 1 to 10) and those who have the mobile Internet services (7.2), fixed Internet (7.3) and fixed telephone (7.3) are relatively less satisfied with the services provided by the respective operators.

1.3.2. Profile of the residential consumer of multiple play offers

This section will describe the profile of the user, usage and level of satisfaction of residential consumers of multiple play offers.

The *Inquérito ao Consumo dos Serviços de Comunicações Electrónicas* (Electronic Communications Services Consumer Survey) of December 2009 will once again be used for this purpose. Where appropriate, comparisons will be made to the results of the 2008 survey⁸.

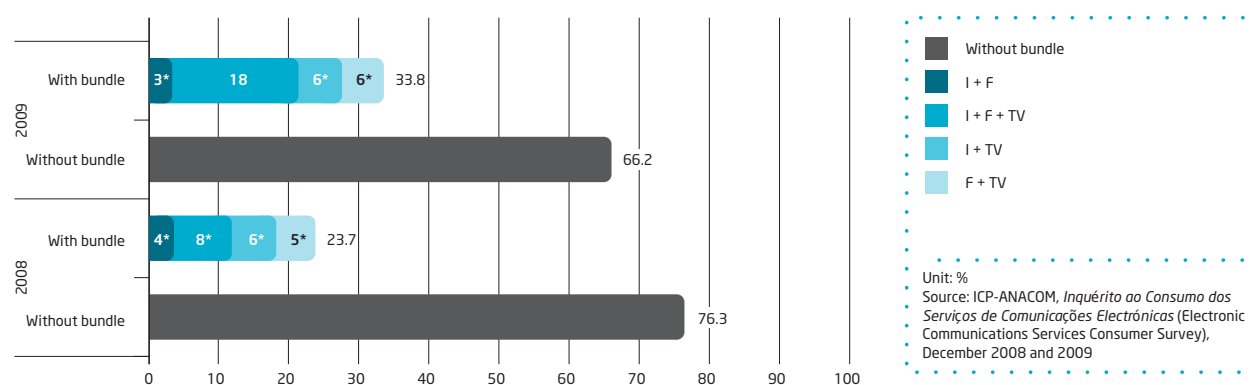
In this context, the unit of analysis is now the household insofar as all the electronic communications services considered in multiple play are associated with the household (fixed telephone service, Internet access service and subscription TV service).

The penetration of the various modes of multiple play, the socio-demographic profile of the consumers and their level of satisfaction with the services provided are presented below.

Penetration of services

The use of bundled services covered 33.8 % of Portuguese households as at the end of 2009, with a significant increase seen over the previous year (23.5 % at the end of 2008).

Subscription to multiple play offers | Graph 14



Base: Total households (excluding non-respondents).

Note: Key to symbols on estimates: (#) Unreliable estimate; (*) Acceptable estimate; (no symbol) Reliable estimate.

This increase resulted largely from increased subscription to triple play bundles (I+F+TV), which became available in 18 % of households.

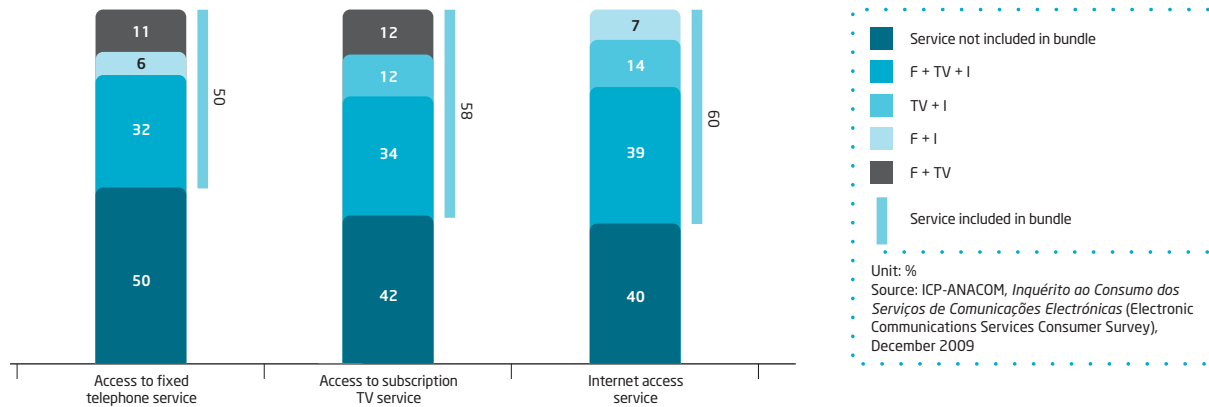
One in two households with access to fixed telephone service has this service as part of a bundle with other services. Among those who have the Internet access

service, 60 % are customers of a multiple play offer, and among those who subscribe to paid television, 58 % have signed up to a bundle.

Among the customers of each of the services, customers of the Internet access are those most likely to have a triple-play offer.

⁸ The universe is composed of individuals of 15 years or more who reside in private housing units located in Mainland Portugal or in the Autonomous Regions (Azores and Madeira). The sample is representative at the level of NUTS I having been composed of 2040 interviews on the Mainland and 780 interviews in each of the Autonomous Regions. Households were selected by means of proportional stratified random sampling according to the crossing of the NUTS II Region variables and the size of the household. Within each household one individual was selected by means of sampling by quotas guaranteeing the marginal totals of the sex, age class, level of education and employment status variables, according to the General Population Census (2001) of INE (Statistics Portugal). The gathering of information was by CAPI - Computer Assisted Personal Interviewing which took place between 5 November and 29 December 2008. The results regarding the Mobile Telephone Service are based on the universe of the individuals and present a maximum margin of error of less than 2 % (with a degree of reliability of 95 %). The results regarding the Fixed Telephone Service, Internet Service and paid Television Service are based on the universe of the households and present a maximum margin of error of less than 3 % (with a level of reliability of 95 %). The company TNS-Euroteste was responsible for the fieldwork and data handling.

Use of integrated services in bundles | Graph 15



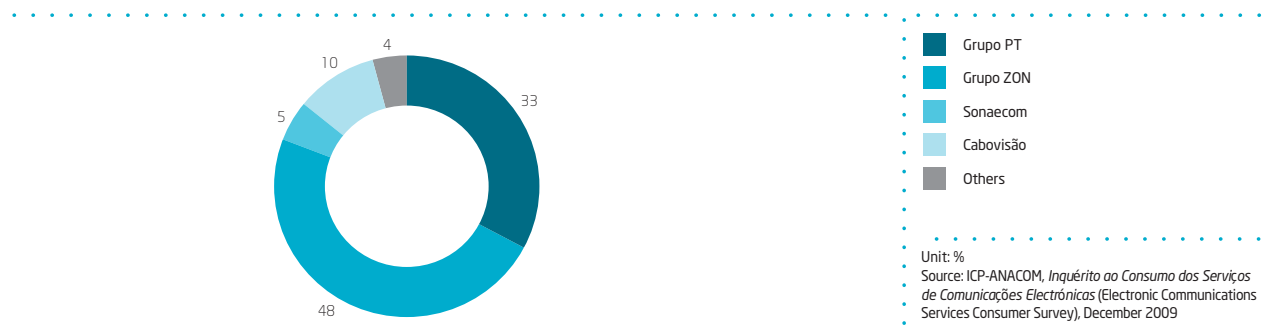
Base: All family households which have respective electronic communication service

Note: Key to symbols on estimates: (#) Unreliable estimate; (*) Acceptable estimate; (no symbol) Reliable estimate

According to the survey responses, multiple play access is mainly provided through Grupo ZON (48 %). Customers of Grupo PT and Cabovisão – Sociedade de Televisão por

Cabo, S. A (Cabovisão) represent 33 and 10 % of households, respectively.

Percentage of multiple play customers per operator | Graph 16



Base: Family households with service in bundles.

Note: Key to symbols on estimates: (#) Unreliable estimate; (*) Acceptable estimate; (no symbol) Reliable estimate.

Characterization of the residential consumers of multiple play offers

Using cluster analysis⁹, two groups of users can be identified. On the one hand, there is a group of users who do not use the multiple play service or who have the fixed telephone

service in conjunction with the subscription TV service (F+TV). Meanwhile, there is a second group comprising those who have triple and double play offers (TV+I).

⁹ K-means method.

Profile of users of multiple play services | Table 14

	GROUP 1			GROUP 2		
	Non-user of multiple play and user of double play with fixed telephone			User of triple play and double play with Internet		
		% group	% global		% group	% global
Bundles services	None	86.8	66.2	F+TV+I	25.5	17.9
	F+TV	7.7	6.1	TV+I	9.4	6.3
Size of family household	Up to 2 individuals	77.8	45.7	3 or more individuals	72.2	54.3
Children/elderly present	Elderly	41.2	19.4	Children	37.2	25.6
Age group	55 years or more	82.9	65.6	Less than 55 years	92.5	34.4
Level of education	Up to 1st stage primary	91.1	42.0	From 2nd stage primary	85.2	58.0
Employment status	Retired and other inactive	78.7	32.2	Employed and student	84.4	60.3
Social class	D	81.7	52.4	A/B/C	44.6	31.4

Unit: %

Source: ICP-ANACOM, *Inquérito ao Consumo dos Serviços de Comunicações Eletrónicas* (Electronic Communications Services Consumer Survey), December 2009

Base: Family households.

Note: Cluster analysis by K-means method with two classes. The two groups identified have a distance of 1.96.

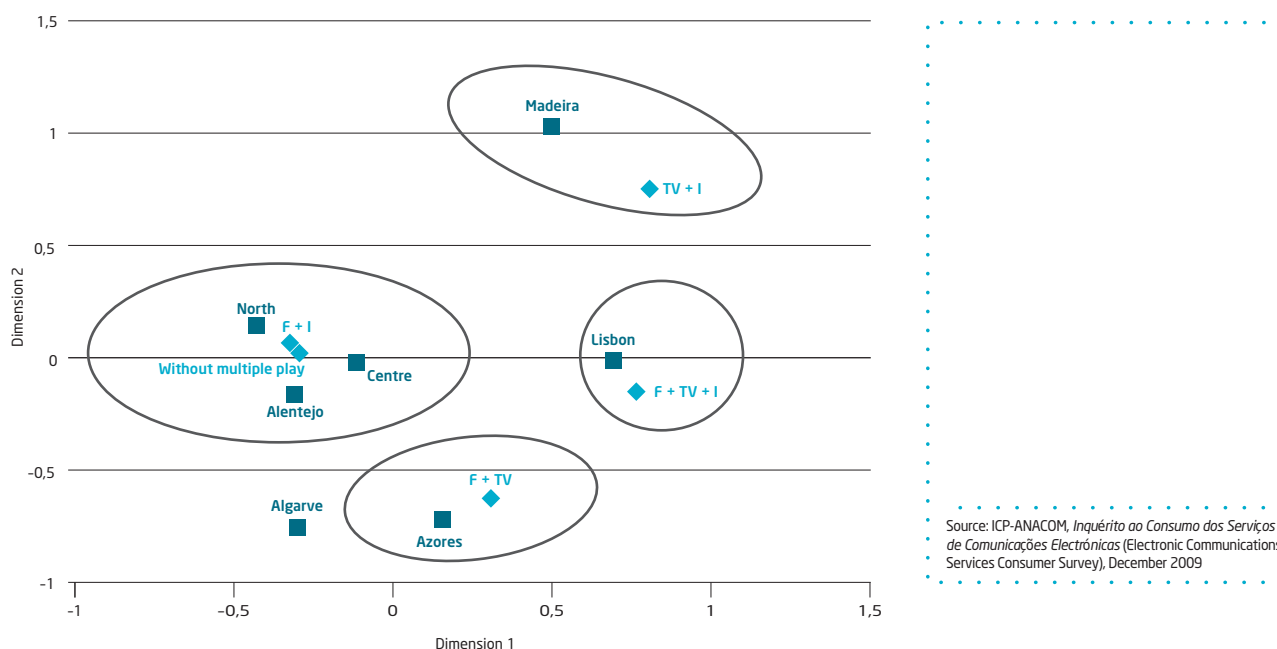
These groups have the following socio-demographic profiles:

- Group 1 (without bundled services and double play F+TV) consists of households that tend to be smaller in size, with elderly members and of a lower social class. The individuals comprising these households belong to older age groups and have lower levels of education. They also tend to be part of the group of retirees;
- Group 2 (double and triple play TV+) is composed of larger households with children and of a higher social class. Moreover, there is a greater tendency for the subjects of these households to young and adults of a working age,

with levels of education which tend to be higher and they are employed or students.

Although the NUTS II region is not relevant to the formation of the groups described above, it is seen that households in the North and Alentejo are those that are more likely not to have bundled services. The double play F+TV offer tends to be most used by families in the Azores while the double play TV+I has greater expression with families in Madeira. Triple play has a greater tendency to be used in the Lisbon region.

Correspondence analysis between multiple play consumption and NUTS II region | Graph 17



Base: Family households.

Note: The two axes represented show 96.7 % of the total inertia. The following categories stand out with a smaller contribution to the formation of the two axes (less than 60 %): F+I in terms of the multiple play services and the Centre in terms of NUTS II regions.

Satisfaction of residential consumers with multiple play offers

The average level of satisfaction with the services of providers that offer multiple play is slightly below the average level of satisfaction expressed by individuals who do not consume such products. The lowest level of satisfaction

is associated with the fixed telephone service and Internet (F+I) bundle, particularly due to the former service.

Satisfaction with the fixed telephone service tends to be lower when included in a bundle.

Average level of satisfaction with the service provided as multiple play | Table 15

	F	MI	FI	TV	Total
Without bundles service	7.5	7.3	7.3	7.6	7.5
F+TV+I	7.2	7.2	7.3	7.5	7.3
TV+I	7.5	6.4	7.4	7.6	7.4
F+I	7.1	7.3	7.3	7.1	7.2
F+TV	7.3	7.6	7.0	7.6	7.5
Total	7.4	7.2	7.3	7.5	

Unit: scale 1 to 10

Source: ICP-ANACOM, *Inquérito ao Consumo dos Serviços de Comunicações Electrónicas* (Electronic Communications Services Consumer Survey), December 2009

Base: Households according to the electronic communications services they have in bundle.

Note 1: The row total refers to average satisfaction with the respective service irrespective of whether it is part of bundle. The column total refers to the estimate made using the average levels of satisfaction in each of the services included in the bundle.

Note 2: MI stands for mobile Internet and FI for fixed Internet.

Note 3: Original measurement scale: 1: very dissatisfied; 10: Very Satisfied

Note 4: The measurements highlighted in blue indicate those that are significantly different (vertically) according to the test of equality between averages. Higher proportions are highlighted in light blue and lower proportions in dark blue.

Note 5: The margin of error of the measurements on a scale of 1 to 10 is all equal to or less than 0.4 absolute points.

1.3.3. Profile of the business consumers of electronic communications

An analysis is made below of the business consumer of electronic communications with an integrated perspective, with use made of two surveys. For small and medium enterprises the analysis is performed using the *Inquérito ao Consumo das Comunicações Electrónicas pelas Empresas Portuguesas* (Survey on the Use of Electronic Communications by Portuguese Companies)¹⁰ of December 2007. (It should be noted that ICP-ANACOM regularly promotes this type of survey, however, more recent information is not available. Despite the reference data of the information, it is considered that the findings are still useful to characterize this type of user. This information has already been made available, albeit in a different format).

For large companies the analysis is based on the *Inquérito ao Consumo das Comunicações Electrónicas* (Survey on the Use of Electronic Communications) – large companies¹¹ of December 2009.

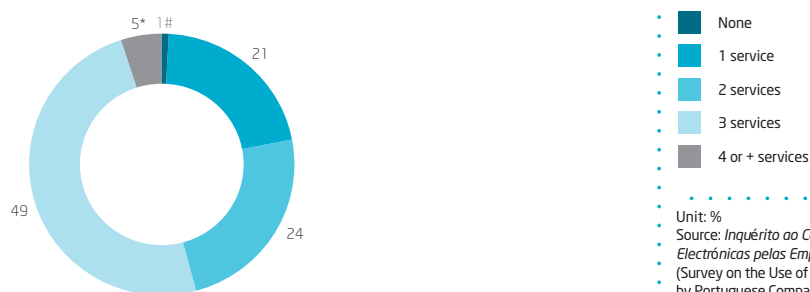
First of all, it should be noted that according to the latest data from INE (Statistics Portugal) *Sistema de Contas Integradas das Empresas* (Integrated Business Accounts System, 2007), the Portuguese business fabric consists mainly of micro companies (95.4 %). Small companies represent 3.9 % of the business fabric, medium companies 0.6 % and large companies 0.1%.

In the first section the penetration of the various services is presented for both small and medium enterprises and for large enterprises, with a focus on subscriptions to multiple play products. The second section analyzes the profile of the business user of electronic communications services.

Penetration of services

At the end of 2007, half of businesses with fewer than 250 employees had three electronic communications services. The use of four electronic communications services simultaneously (M+F+I+TV) is very low in the business context: only 5 % of the companies in question reported having access to four services.

Distribution of SMEs by the number of electronic communications services which they have | Graph 18



Base: total.

Note 1: The counting of services includes: mobile telephone services, fixed telephone service, fixed Internet access service, mobile Internet access service, Subscription TV service.

Note 2: The option "None" refers to situations of a company not having telecommunications in the name of the company (personal telecommunications use or telecommunications of another company).

Note 3: Key to symbols on estimates: (#) Unreliable estimate; (*) Acceptable estimate; (no symbol) Reliable estimate

10 The universe of this study refers to Micro, Small and Medium-Sized Enterprises (SME), with their head office in Portugal, the economic activity of which falls within one of the following sections and groups of CAE codes (Rev. 2.1): Section D (Manufacturing Industries), Section F (Construction), Section G (Wholesale and retail commerce, repair of automobile vehicles, motorcycles and goods for domestic and personal use), Group H 551 (Hotel establishments), Group H 552 (Camp sites and other short stay accommodation), Section I (Transport, storage and communications), Section K (Real estate activities, rentals and services provided to companies), Group O 921 (Cinematographic and video activities) and Group O 922 (Radio and Television Activities). The sampling plan includes a pre-stratified multi-stage probability sample. The national territory was divided into strata, according to the NUTSII region and the presence of the telecommunications operators in each region. A two-stage sample was carried out in each stratum. The first stage of sampling corresponds to the selection of parishes (with unequal probabilities in proportion to the number of companies they include, in relation to the target population) and the second stage corresponds to the selection of companies (by means of stratified random sampling by sector of activity and size of company). 2,403 interviews were conducted guaranteeing an absolute maximum margin of error of 2.0 (semi-amplitude of a reliability interval of 95 per cent for one proportion). The specific unbundlings within each electronic communications service translate into greater errors: mobile telephone service (2.4), fixed telephone service (2.0) and internet access service (2.5). The fieldwork was carried out by the company Qmetrics, S.A. Face to face interviews were carried out supported by the CAPI System (Computer Assisted Personal Interviewing) from 21 November to 21 December 2007 and from 3 to 15 January 2008. The estimation used extrapolators calculated by Qmetrics, S.A. The extrapolators allowed for adjustment of the results obtained to known totals of additional variables (NUTS II, sector of activity and company size from physical data from Dec/2006 and economic data from Dec/2005 of the National Institute of Statistics) with the objective of correcting distortions observed in the sample.

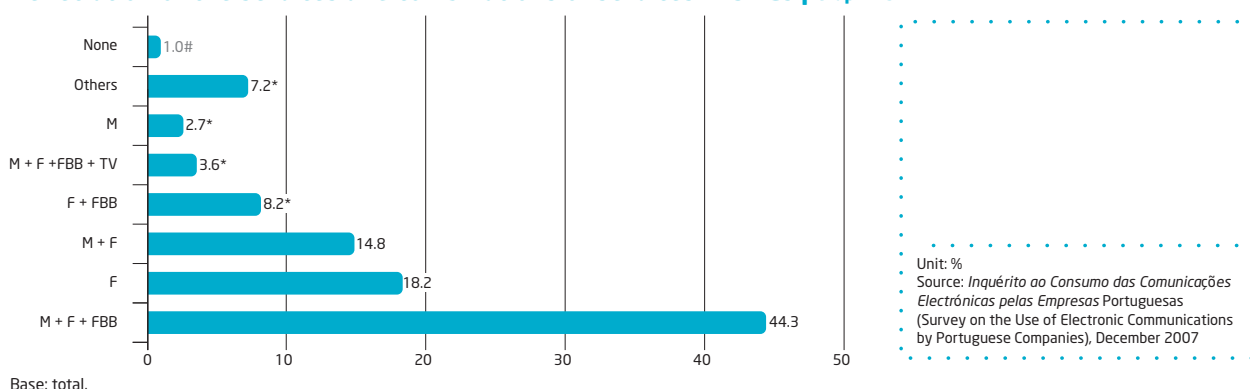
11 The universe of this study refers to Large companies (i.e. with 250 employees or more or with an annual turnover exceeding 50 million euros), with their head office in Portugal, the economic activity of which falls within sections B to N of the CAE (Economic Activity Codes) – Rev.3. This exhaustive survey of large companies was conducted using CATI (Computer Assisted Telephone Interviewing) between 18 January and 12 February 2010. The base for the survey was obtained from INE (Statistics Portugal) (reference 2007) for all sections except section K, the base for which was obtained from the company D&B. A total of 1,043 companies were surveyed with a response rate of 11.6 % (121 companies). Around 75 of non-responses were due to refusals (actual refusals to respond to the study, unavailability of the respondent at the time of compilation or an excess of contact attempts – more than 10 unsuccessful attempts). The request for written responses, not subsequently provided by the respondent, account for 15 % of non-responses. The remaining 10 % of non-responses resulted from uncontactable telephone numbers and may refer to companies which closed between 2007 and 2009, and so do not make up the universe in question. According to the presented response rate, and unit of analysis of this survey refers to a restricted group of large companies. This fieldwork was conducted by the company Qdata.

About 44 % of the SMEs under analysis use fixed and mobile telephone services, together with fixed broadband (M+F+FBB).

Among Portuguese companies with fewer than 250 employees, the exclusive use of the telephone service is

still quite significant. It is estimated that 18 % of these companies use the fixed telephone service only and that 15 % have the fixed and mobile telephone service (M+F). The use of the mobile phone service on an exclusive basis is very low (3 %).

Penetration of the services and combinations of services in SMEs | Graph 19



Note 1: The "Others" option includes combinations of the Internet service (MBB, FBB, NB) with other electronic communications services (M, F, TV); the option "None" refers to situations of a company not having telecommunications in the name of the company (use of personal telecommunications or telecommunications of another company).

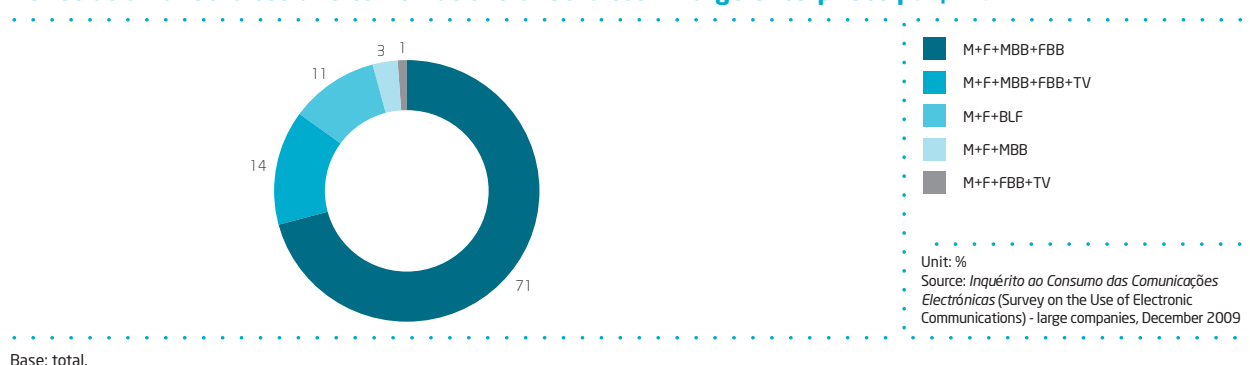
Note 2: Key to symbols on estimates: (#) Unreliable estimate; (*) Acceptable estimate; (no symbol) Reliable estimate

Data from the survey in December 2009 addressed to large corporations reveal that all had at least three electronic communications services.

Among large companies, the most usual combination of services (71 %) comprised the fixed telephone service,

mobile telephone service, fixed broadband and mobile broadband (M+F+MBB+FBB). The combination of these four services with TV service subscription is another relatively common combination (14 %).

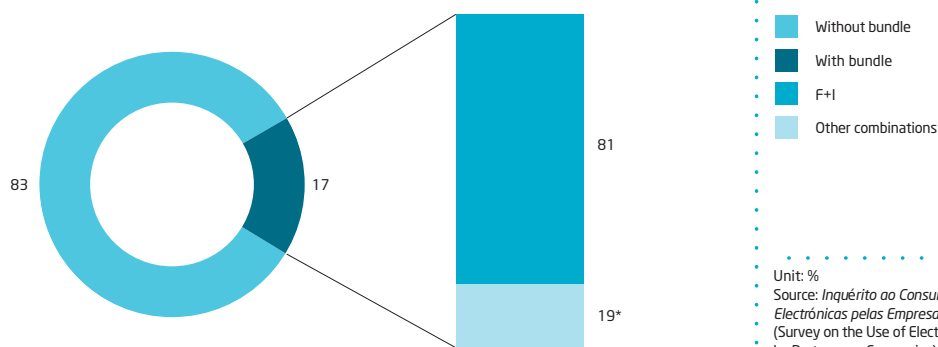
Penetration of services and combinations of services in large enterprises | Graph 20



Subscription to multiple play offers is lower among corporate customers, compared to residential customers. Multiple play products are used by about 17 % of companies with fewer than 250 employees, with note made of the dominance of

the double play bundle consisting of the fixed telephone service and Internet access service (used by 81 % of companies with services in a bundle).

Electronic communications services in multiple play in SMEs | Graph 21

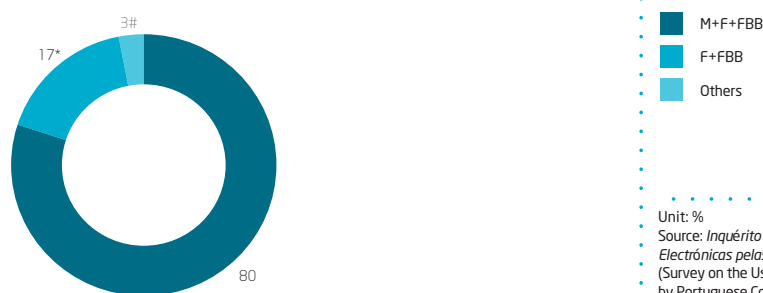


Base: total.

Note: Key to symbols on estimates: (#) Unreliable estimate; (*) Acceptable estimate; (no symbol) Reliable estimate.

About four in every five SMEs with double play service (F+I) have these two services in conjunction with the mobile telephone service (M+F+FBB).

Integrated use of services by SMEs with double play F+I | Graph 22



Base: companies with double play.

Note: Key to symbols on estimates: (#) Unreliable estimate; (*) Acceptable estimate; (no symbol) Reliable estimate.

Characterization of the corporate user of electronic communications services

A characterization is presented below of the business user (SMEs) of electronic communications services, taking into account the sector in which the company operates, company size and the number of years for which it has been operating in its market.

Characterization according to sector of activity

According to data from the *Inquérito ao Consumo das Comunicações Electrónicas pelas Empresas Portuguesas* (Survey on the Use of Electronic Communications by Portuguese Companies) of 2007, directed at SMEs,

companies of the construction and real estate subsectors and of other services (transport, communication, cinematographic activities, radio and television) tend to subscribe more often to two telephone services (fixed and mobile) in conjunction with fixed broadband. In each of these sub-sectors over 65 % of companies have these three services (M+F+FBB).

The use of the two telephone services (fixed and mobile) on an exclusive basis is relatively more intense in the manufacturing sector. In the retail sub-sector companies tend to give preference to the telephone service, especially, in this case, access to the fixed telephone service on an exclusive basis.

Penetration of electronic communications services in SMEs by sector of activity | Table 16

Integrated consumption of services	Manufacturing	Construction	Retail	Tourism	Real estate	Other service	Total
M + F + FBB	41 *	68	36	25 #	68	71 *	45
F	17 *	3 #	26	11 #	3 #	3 #	18
M + F	21 *	11 #	17 *	2 #	3 #	3 #	15
F + FBB	6 #	4 #	10 *	29 #	7 #	12 #	8 *
M + F + FBB + TV	1 #	2 #	3 #	26 #	10 #	7 #	4 *
M	2 #	4 #	3 #	0 #	1 #	1 #	3 *
Others	11 #	9 #	6 *	9 #	8 #	3 #	7 *
Total	100	100	100	100	100	100	100

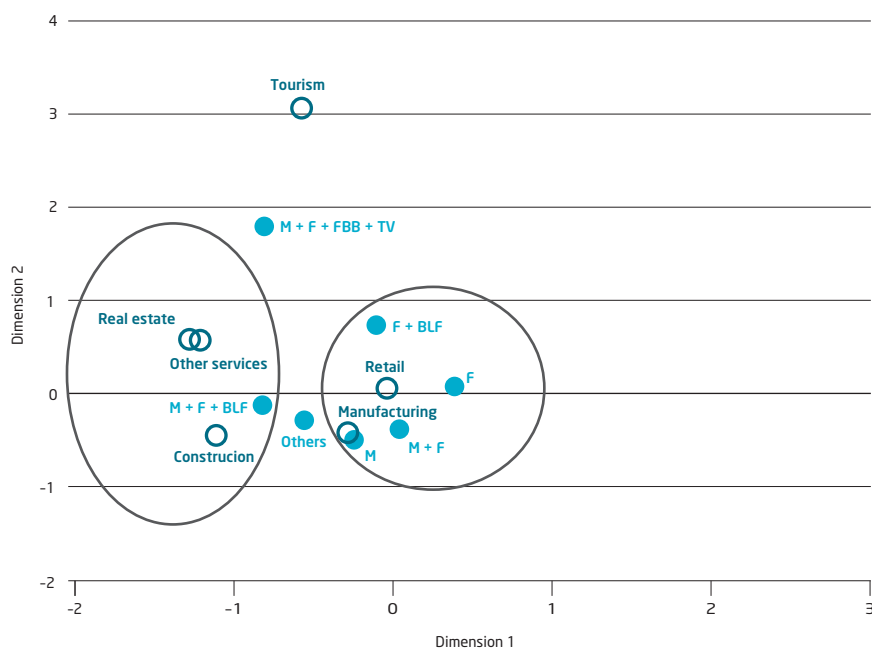
Unit: %

Source: *Inquérito ao Consumo das Comunicações Electrónicas pelas Empresas Portuguesas* (Survey on the Use of Electronic Communications by Portuguese Companies), December 2007

Base: Companies with electronic communications services according to their sector of business.

Note 1: Key to symbols on estimates: (#) Unreliable estimate; (*) Acceptable estimate; (no symbol) Reliable estimate.

Note 2: The proportions highlighted in blue indicate those that are significantly different (horizontal) in accordance with the test of two samples for proportions. Higher proportions are highlighted in light blue and lower proportions in dark blue.

Correspondence analysis between the integrated consumption of services and SME sector of business**| Graph 23**

Source: *Inquérito ao Consumo das Comunicações Electrónicas pelas Empresas Portuguesas* (Survey on the Use of Electronic Communications by Portuguese Companies), December 2007

Base: total.

Note: The two axes represented show 94 % of the total inertia. The following categories stand out with a smaller contribution to the formation of the two axes (less than 55 %): M and "other services" in terms of integrated consumption of services and "Manufacturing" in terms of business sector. The remaining categories have contributions in excess of 85 %.

Characterization according to size and age of company

The company's size influences the use of services. On the one hand, SMEs with five or more employees have a relatively stronger penetration of the two telephone services (fixed and mobile) in conjunction with fixed broadband. On the other hand, smaller companies (fewer than five employees)

have lower levels of subscription to these services. In the latter group, there is noted penetration of the fixed telephone service, particularly on a basis of exclusive use, as well as in conjunction with the mobile telephone or fixed broadband service.

Electronic communications services that the company has by size of enterprise (SME) | Table 17

Integrated consumption of services	1 - 4 employees	5 - 9 employees	10 - 24 employees	25 - 249 employees	Total
M + F + FBB	34	62	57 *	64 *	45
F	27	6 #	10 #	4 #	18
M + F	16 *	15 *	11 #	4 #	15
F + FBB	10 *	6 #	8 #	6 #	8 *
M + F + FBB + TV	3 #	4 #	6 #	5 #	4 *
M	4 #	1 #	1 #	0 #	3 *
Others	7 *	7 #	7 #	18 #	7 *
Total	100	100	100	100	100

Unit: %

Source: *Inquérito ao Consumo das Comunicações Electrónicas pelas Empresas Portuguesas* (Survey on the Use of Electronic Communications by Portuguese Companies), December 2007

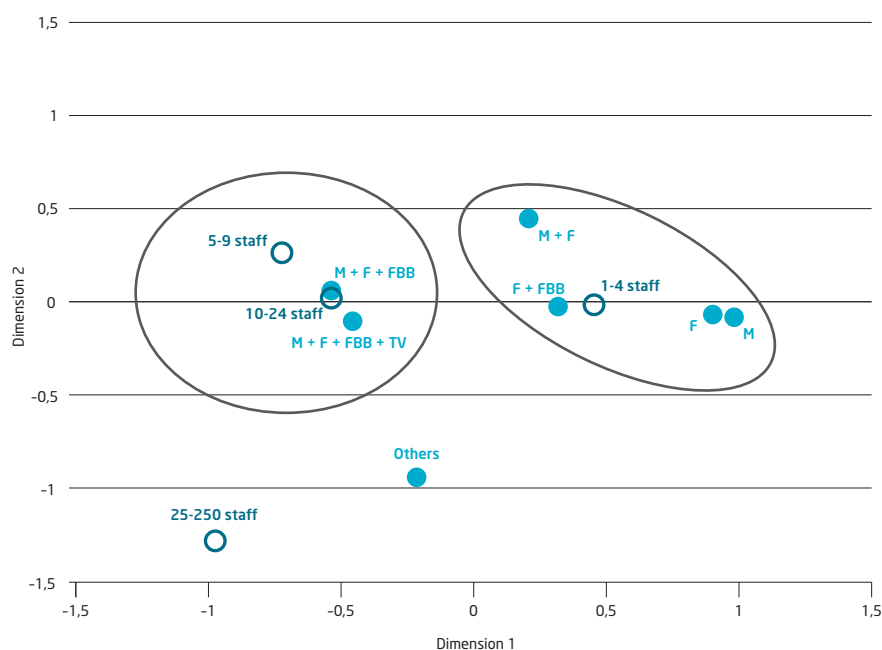
Base: Companies with electronic communications services in accordance with the number of staff.

Note 1: Key to symbols on estimates: (#) Unreliable estimate; (*) Acceptable estimate; (no symbol) Reliable estimate.

Note 2: The proportions highlighted in blue indicate those that are significantly different (horizontal) in accordance with the test of two samples for proportions. Higher proportions are highlighted in light blue and lower proportions in dark blue.

Correspondence analysis between the integrated consumption of services and company size (SME)

Graph 24



Source: *Inquérito ao Consumo das Comunicações Electrónicas pelas Empresas Portuguesas* (Survey on the Use of Electronic Communications by Portuguese Companies), December 2007

Base: total.

Note: Two axes represented show 99 % of the total inertia. All categories contribute more than 81 % to the formation of the two axes.

Albeit less significant, the age of a company also reflects differential use of electronic communications services. Among small and medium enterprises, the oldest (25 or more years on the market) stand out for their consumption

of the fixed telephone service on an exclusive basis. The most recently formed companies tend to have a relatively higher penetration of fixed broadband in conjunction with the telephone service (fixed and/or mobile).

Electronic communications services that SMEs have by number of years in the market | Table 18

Integrated consumption of services	1-4 years	5-9 years	10-24 years	25 ou + years	Total
M + F + FBB	46	48	48	36 *	45
F	14 *	14 *	16 *	30 *	18
M + F	10 #	12 *	17 *	16 *	15
F + FBB	12 *	11 #	5 #	8 #	8 *
M + F + FBB + TV	4 #	3 #	3 #	5 #	4 *
M	4 #	4 #	2 #	1 #	3 *
Others	9 #	7 #	9 *	5 #	7 *
Total	100	100	100	100	100

Unit: %

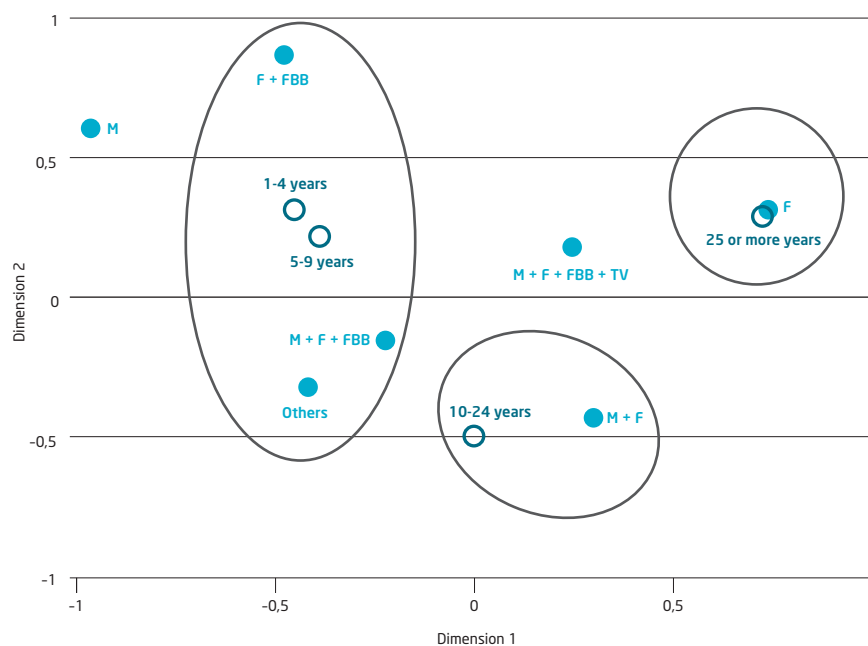
Source: *Inquérito ao Consumo das Comunicações Electrónicas pelas Empresas Portuguesas* (Survey on the Use of Electronic Communications by Portuguese Companies), December 2007

Base: Companies with electronic communication services according to age of company.

Note 1: Key to symbols on estimates: (#) Unreliable estimate; (*) Acceptable estimate; (no symbol) Reliable estimate.

Note 2: The proportions highlighted in blue indicate those that are significantly different (horizontal) in accordance with the test of two samples for proportions. Higher proportions are highlighted in light blue and lower proportions in dark blue.

Correspondence analysis between the integrated consumption of services and age of SME | Graph 25



Source: *Inquérito ao Consumo das Comunicações Electrónicas pelas Empresas Portuguesas* (Survey on the Use of Electronic Communications by Portuguese Companies), December 2007

Base: total.

Note: The two axes represented show 97.5 % of the total inertia. All categories contribute more than 78 % to the formation of the two axes.

Appendix 1 - Simple correspondence analysis

Simple correspondence analysis is a technique for exploratory analysis of categorized data suited to the analysis of double entry tables, referring to nominal variables, given the correspondence measurements between rows and columns. An assessment is made of the affinities between certain rows and columns of the contingency table under the hypothesis of independence between the rows and columns.

The aim is then to present the method underlying this

method of data analysis, while at the same time presenting a concrete example, referring to Graph 8 of the present report, developed using Statistical Package for the Social Sciences (SPSS) Statistical Software.

The following contingency table is considered between two variables A and B, where A refers to a nominal variable expressed in rows with H categories and B refers to another nominal variable expressed in columns with J categories.

Contingency table between two variables (A and B) | Table 19

A	B				Line total
	1	2	...	J	
1	n_{11}	n_{12}	...	n_{1J}	n_{1+}
2	n_{21}	n_{22}	...	n_{2J}	n_{2+}
...	...	...	...	...	...
H	n_{H1}	n_{H2}	...	n_{HJ}	n_{H+}
Column total	n_{+1}	n_{+2}	...	n_{+J}	n

Where n_{hj} is the frequency observed by the intersection of the h-th category of variable with the j-th category of variable B; n_{h+} the overall frequency observed in the h-th category of A; n_{+j} the overall frequency observed in the j-th category of B; and n the grand total of observed frequencies.

Considering the specific example regarding the integrated use of electronic communications services (variable A with 9 categories), and regional location of these users (variable B with 7 categories), the following contingency table is presented, resulting from the Electronic Communications Services Consumer Survey, residential population, of 2009.

Contingency table between the integrated consumption of services and NUTS II region | Table 20

Integrated consumption of services	NUTS II							Line total
	North	Centre	Lisbon	Alentejo	Algarve	A.R. Azores	A.R. Madeira	
M + F + FBB + TV	148	121	254	35	20	21	15	613
M	266	105	112	63	25	4	7	584
M + F	116	73	47	31	9	2	1	279
M + F + TV	74	57	79	11	12	10	6	248
M + TV	53	69	64	14	6	5	11	223
F	82	55	24	24	7	5	5	203
M + FBB + TV	60	36	65	4	3	3	10	181
Other combinations	244	143	158	43	33	16	13	649
None	42	54	6	13	7	2	2	126
Column total	1,086	713	809	238	121	68	71	3,106

Using the contingency table, it is possible to build the correlation matrix (P) given by dividing each cell by the total of observed frequencies (n).

Correlation matrix | Table 21

	B				Line total
	1	2	...	J	
A					
1	p_{11}	p_{12}	...	p_{1j}	p_{1+}
2	p_{21}	p_{22}	...	p_{2j}	p_{2+}
...	...	...	...	...	...
H	p_{H1}	p_{H2}	...	p_{Hj}	p_{H+}
Column total	p_{+1}	p_{+2}	...	p_{+j}	1

where $p_{hj} = n_{hj}/n$; $p_{h+} = n_{h+}/n$; $p_{+j} = n_{+j}/n$.

In the example, the following matrix is obtained.

Correlation matrix between the integrated consumption of services and NUTS II region | Table 22

Integrated consumption of services	NUTS II							Line total
	North	Centre	Lisbon	Alentejo	Algarve	A.R. Azores	A.R. Madeira	
M + F + FBB + TV	0.05	0.04	0.08	0.01	0.01	0.01	0.00	0.20
M	0.09	0.03	0.04	0.02	0.01	0.00	0.00	0.19
M + F	0.04	0.02	0.02	0.01	0.00	0.00	0.00	0.09
M + F + TV	0.02	0.02	0.03	0.00	0.00	0.00	0.00	0.08
M + TV	0.02	0.02	0.02	0.00	0.00	0.00	0.00	0.07
F	0.03	0.02	0.01	0.01	0.00	0.00	0.00	0.07
M + FBB + TV	0.02	0.01	0.02	0.00	0.00	0.00	0.00	0.06
Other combinations	0.08	0.05	0.05	0.01	0.01	0.01	0.00	0.21
None	0.01	0.02	0.00	0.00	0.00	0.00	0.00	0.04
Column total	0.35	0.23	0.26	0.08	0.04	0.02	0.02	1

The correspondence analysis is based on the following aspects:

1. Each element is represented by its stipulated profile (obtained by dividing the elements in a row by the total sum of elements of that row).

The row profile of the h-th category is given by:

$$a_h = [n_{h1}/n_{h+}, n_{h2}/n_{h+}, \dots, n_{hj}/n_{h+}]' = [p_{h1}/p_{h+}, p_{h2}/p_{h+}, \dots, p_{hj}/p_{h+}]', \text{ with } h=1, \dots, H.$$

The H row profiles form the initial cloud of the elements of variable A.

For each category of integrated consumption of services, the following vectors are obtained with respect to the respective row profile:

$$\begin{aligned} a_1 &= [0,241 \ 0,197 \ 0,414 \ 0,057 \ 0,033 \ 0,034 \ 0,025]' \\ a_2 &= [0,456 \ 0,180 \ 0,192 \ 0,109 \ 0,043 \ 0,007 \ 0,013]' \\ a_3 &= [0,417 \ 0,261 \ 0,168 \ 0,111 \ 0,033 \ 0,006 \ 0,004]' \\ a_4 &= [0,298 \ 0,231 \ 0,318 \ 0,043 \ 0,047 \ 0,038 \ 0,026]' \\ a_5 &= [0,240 \ 0,310 \ 0,289 \ 0,064 \ 0,026 \ 0,024 \ 0,047]' \end{aligned}$$

$$a_6 = [0,407 \ 0,273 \ 0,119 \ 0,118 \ 0,035 \ 0,025 \ 0,024]'$$

$$a_7 = [0,332 \ 0,197 \ 0,357 \ 0,025 \ 0,017 \ 0,016 \ 0,055]'$$

$$a_8 = [0,375 \ 0,220 \ 0,244 \ 0,066 \ 0,050 \ 0,025 \ 0,020]'$$

$$a_9 = [0,337 \ 0,428 \ 0,047 \ 0,102 \ 0,052 \ 0,018 \ 0,016]'$$

The column profile of the j-th category:

$$b_j = [n_{1j}/n_{+j}, n_{2j}/n_{+j}, \dots, n_{Kj}/n_{+j}]' = [p_{1j}/p_{+j}, p_{2j}/p_{+j}, \dots, p_{Kj}/p_{+j}]', \text{ with } j=1, \dots, J.$$

The J line row profiles form the initial cloud of elements of variable B.

For each of the regional categories, the following vectors are obtained relating to the respective column profile:

$$b_1 = [0,136 \ 0,245 \ 0,107 \ 0,068 \ 0,049 \ 0,076 \ 0,055 \ 0,224 \ 0,039]'$$

$$b_2 = [0,169 \ 0,148 \ 0,102 \ 0,080 \ 0,097 \ 0,078 \ 0,050 \ 0,200 \ 0,075]'$$

$$b_3 = [0,314 \ 0,139 \ 0,058 \ 0,097 \ 0,080 \ 0,030 \ 0,080 \ 0,196 \ 0,007]'$$

$$b_4 = [0,147 \ 0,266 \ 0,131 \ 0,045 \ 0,060 \ 0,100 \ 0,019 \ 0,179 \ 0,054]'$$

$$b_5 = [0,167 \ 0,206 \ 0,075 \ 0,095 \ 0,048 \ 0,059 \ 0,025 \ 0,270 \ 0,054]'$$

$$b_6 = [0,304 \ 0,064 \ 0,025 \ 0,140 \ 0,080 \ 0,074 \ 0,043 \ 0,237 \ 0,034]'$$

$$b_7 = [0,217 \ 0,105 \ 0,018 \ 0,090 \ 0,149 \ 0,068 \ 0,141 \ 0,185 \ 0,028]'$$

2. Each element is associated with a mass that is the corresponding marginal frequency, equivalent to the centre of gravity of the cloud of the elements of A or B (respectively):

It is designated by column masses to the marginal proportions of columns given by the vector:

$$c = [c_1 \ c_2 \ \dots \ c_j]' = [p_{+1} \ p_{+2} \ \dots \ p_{+j}]'$$

It is designated by row masses to the marginal proportions of rows given by the vector:

$$l = [l_1 \ l_2 \ \dots \ l_H]' = [p_{1+} \ p_{2+} \ \dots \ p_{H+}]'$$

In the example, the centre of gravity of the cloud of categories related to the integrated consumption of services refers to the vector:

$$c = [0,350 \ 0,230 \ 0,260 \ 0,077 \ 0,039 \ 0,023]'$$

and the centre of gravity of the cloud of regional categories refers to the vector:

$$l = [0,198 \ 0,188 \ 0,090 \ 0,080 \ 0,072 \ 0,065 \ 0,058 \ 0,209 \ 0,040]'$$

To better understand the origin of the vectors mentioned, two of the resulting tables are given below.

Row profile | Table 23

	North	Centre	Lisbon	Alentejo	Algarve	A.R. Azores	A.R. Madeira	Line total
M + F + FBB + TV	0.241	0.197	0.414	0.057	0.033	0.034	0.025	1.00
M	0.456	0.180	0.192	0.109	0.043	0.007	0.013	1.00
M + F	0.417	0.261	0.168	0.111	0.033	0.006	0.004	1.00
M + F + TV	0.298	0.231	0.318	0.043	0.047	0.038	0.026	1.00
M + TV	0.240	0.310	0.289	0.064	0.026	0.024	0.047	1.00
F	0.407	0.273	0.119	0.118	0.035	0.025	0.024	1.00
M + FBB + TV	0.332	0.197	0.357	0.025	0.017	0.016	0.055	1.00
Other combinations	0.375	0.220	0.244	0.066	0.050	0.025	0.020	1.00
None	0.337	0.428	0.047	0.102	0.052	0.018	0.016	1.00
Total	0.350	0.230	0.260	0.077	0.039	0.022	0.023	

Column profile | Table 24

	North	Centre	Lisbon	Alentejo	Algarve	A.R. Azores	A.R. Madeira	Line total
M + F + FBB + TV	0.136	0.169	0.314	0.147	0.167	0.304	0.217	0.198
M	0.245	0.148	0.139	0.266	0.206	0.064	0.105	0.188
M + F	0.107	0.102	0.058	0.131	0.075	0.025	0.018	0.090
M + F + TV	0.068	0.080	0.097	0.045	0.095	0.140	0.090	0.080
M + TV	0.049	0.097	0.080	0.060	0.048	0.080	0.149	0.072
F	0.076	0.078	0.030	0.100	0.059	0.074	0.068	0.065
M + FBB + TV	0.055	0.050	0.080	0.019	0.025	0.043	0.141	0.058
Other combinations	0.224	0.200	0.196	0.179	0.270	0.237	0.185	0.209
None	0.039	0.075	0.007	0.054	0.054	0.034	0.028	0.040
Column total	1.00	1.00	1.00	1.00	1.00	1.00	1.00	

3. The space metric is the distance of chi-squared.

The distance between two row profiles (a_h and $a_{h'}$) is defined using the chi-squared metric, that is, using the Euclidean distance weighted by the inverse of the relative frequency corresponding to each term, given by:

$$d^2(a_h, a_{h'}) = \sum_{j=1}^J \frac{1}{p_{+j}} \left(\frac{p_{hj}}{p_{h+}} - \frac{p_{h'j}}{p_{h'+}} \right)^2$$

Therefore, $d^2(a_h, a_{h'})$ refers to the Euclidean distance between a_h and $a_{h'}$ in the D_c metric, where D_c is the diagonal matrix of elements $c_j = p_{+j}$.

Equivalently, the distance between column profiles (b_j and $b_{j'}$):

$$d^2(b_j, b_{j'}) = \sum_{h=1}^H \frac{1}{p_{h+}} \left(\frac{p_{hj}}{p_{+j}} - \frac{p_{hj'}}{p_{+j'}} \right)^2$$

is obtained in the D_l metric, which is the diagonal matrix of the marginal proportions of rows $l_j = p_{h+}$.

Applying this to the example under consideration we obtain the following metrics:

$$D_c = \begin{bmatrix} p_{+1} & & 0 \\ & \ddots & \\ 0 & & p_{+J} \end{bmatrix} = \begin{bmatrix} 0,350 & & 0 \\ & \ddots & \\ 0 & & 0,023 \end{bmatrix}$$

$$D_l = \begin{bmatrix} p_{1+} & & 0 \\ & \ddots & \\ 0 & & p_{H+} \end{bmatrix} = \begin{bmatrix} 0,198 & & 0 \\ & \ddots & \\ 0 & & 0,040 \end{bmatrix}$$

The proposed D_c and D_l metrics to calculate, respectively, the distance between categories of the cloud of the elements of A or the distance between the categories of the cloud of the elements of B, have an important property - the principle of distributional equivalence: the aggregation of two row profiles (a_h and $a_{h'}$) does not alter the distance between any two categories of B and aggregation of two column profiles (b_j and $b_{j'}$) does not alter the distance between any two categories of A.

It is noted that the chi-squared distance may be converted into an ordinary Euclidean distance by modifying the scale of the axes, to facilitate correspondence to the analysis in principal components¹²:

$$\frac{p_{hj}}{p_{h+}} \rightarrow \frac{p_{hj}}{\sqrt{p_{+j}p_{h+}}} \quad \frac{p_{hj}}{p_{+j}} \rightarrow \frac{p_{hj}}{\sqrt{p_{h+}p_{+j}}}$$

¹² The correspondence analysis may be considered a special case for the analysis of main components, while directed at categorical data organised in contingency tables and not continuous data.

In this sense the centre of gravity of the cloud of elements of A is now given by,

$$\tilde{c} = [\tilde{c}_1 \ \tilde{c}_2 \ \dots \ \tilde{c}_j]' = [\sqrt{p_{+1}} \ \sqrt{p_{+2}} \ \dots \ \sqrt{p_{+j}}]'$$

and of the elements of B by

$$\tilde{l} = [\tilde{l}_1 \ \tilde{l}_2 \ \dots \ \tilde{l}_H]' = [\sqrt{p_{1+}} \ \sqrt{p_{2+}} \ \dots \ \sqrt{p_{H+}}]'$$

Insofar as the correspondence analysis aims to reduce the initial dimension space of the problem [$\min(H, J) - 1$], keeping as much information as possible (i.e., maintaining, as far as possible, the original distances between pairs of elements), it has as its aim the decomposition of the total inertia (equivalent to chi-squared divided by $n: \frac{\chi^2}{n}$), in order to identify a lower number of dimensions which best represent a point cloud of the problem in question.

The elements of the inertia matrix (V) associated with the categories of A are determined by the expression:

$$v_{jj'} = \sum_{h=1}^H p_{hj} \left(\frac{p_{hj}}{\sqrt{p_{+j}p_{h+}}} - \tilde{c}_j \right) \left(\frac{p_{hj'}}{\sqrt{p_{+j'}p_{h+}}} - \tilde{c}_{j'} \right)$$

The elements of the inertia matrix (W) associated with the categories of B are determined by the expression:

$$\omega_{jj'} = \sum_{j=1}^J p_{+j} \left(\frac{p_{hj}}{\sqrt{p_{h+}p_{+j}}} - \tilde{l}_h \right) \left(\frac{p_{hj'}}{\sqrt{p_{h+}p_{+j'}}} - \tilde{l}_{h'} \right)$$

The generator vectors of the principal axes of inertia refer to the eigenvectors of the matrix V or W, depending on $J < H$ or $J > H$, by simply diagonalizing the smaller sized matrix. It is on the principal axes of inertia that the different categories of variables A and B will be projected.

The correspondence analysis is based on a simple set of steps and indicators that assist in interpreting the resulting information:

1. The choice of the number of axes to retain based on criteria such as:

- Pearson criterion - retain the number of axes such that the percentage of cumulative inertia¹³ exceeds 80 %;
- Analysis of the histogram of eigenvalues and retain only those eigenvalues that satisfy the condition $\lambda_\alpha - \lambda_{\alpha-1} > \varepsilon$ (where ε is a small number in relative terms).

According to the example under consideration, it is observed that through the first two axes it is possible to explain 89 % of the total inertia, so that, considering the above criteria, it will be sufficient to retain two axes of analysis.

Eigenvalues and inertia of the axes | Table 25

Dimension	Values	Partial inertia	Chi-squared	Proportion of inertia	
				Accounted	Accumulated
1	0.26	0.067		0.70	0.70
2	0.14	0.018		0.19	0.89
3	0.07	0.005		0.06	0.95
4	0.06	0.004		0.04	0.98
5	0.03	0.001		0.01	1.00
6	0.02	0.000		0.00	1.00
Total		0.096	298.61	1.00	

¹³ Note that partial inertia, associated with axis α is obtained through its value to the power of α of matrix V, which in practice measures the contribution of the dimension α to the explanation of the data variation (total inertia)

2. Projection of the categories of variables A and B on the axes of inertia retained:

- The projection of the category A_h over the non-trivial eigenvector of order α of $V(\mu_{\alpha})$ can be written according to the expression:

$$f'_{h\alpha} = \sum_{j=1}^J \left(\frac{p_{hj}}{p_h + \sqrt{p_{+j}}} \right) \mu_{\alpha j}$$

- It is also demonstrated that the projection of the category B_j on the eigenvector of order α obtained is obtained according to the projection of category A_h , (where λ_{α} is the respective value).

$$f'_{j\alpha} = \frac{1}{\sqrt{\lambda_{\alpha}}} \sum_{h=1}^H \left(\frac{p_{hj}}{p_{+j}} \right) f'_{h\alpha}$$

The table below shows the coordinates of the projections of the elements of the variables in analysis relative to the retained axes. It should be noted that the points projected on the axes allow observation of the direction (positive or negative) of the relationship between the categories that best explain each axis.

Coordinates of the projections made in relation to the retained axes | Table 26

	Axis 1	Axis 2
Integrated consumption of services		
M + F + FBB + TV	-0.717	-0.075
M	0.476	-0.461
M + F	0.560	-0.019
M + F + TV	-0.372	0.123
M + TV	-0.311	0.676
F	0.607	0.256
M + FBB + TV	-0.540	-0.080
Other combinations	0.061	-0.068
None	0.819	1.164
NUTS II Regions		
North	0.387	-0.285
Centre	0.154	0.610
Lisbon	-0.751	-0.195
Alentejo	0.634	-0.120
Algarve	0.202	-0.051
A.R. Azores	-0.724	0.420
A.R. Madeira	-0.679	0.541

3. Analysis of absolute contributions, i.e. the contribution of each category to the formation of each axis:

- In terms of the categories of variable A:

$$C_{h\alpha}^a = \frac{p_h + (f'_{ha})^2}{\lambda_\alpha}$$

- In terms of the categories of variable B:

$$C_{j\alpha}^a = \frac{p_j + (f'_{ja})^2}{\lambda_\alpha}$$

Given the example in analysis the following absolute contributions result for each axis. The categories with greater expression with respect to the formation of each axis are highlighted in bold.

Absolute contributions | Table 27

	Axis 1	Axis 2
Integrated consumption of services		
M + F + FBB + TV	0.39	0.01
M	0.16	0.30
M + F	0.11	0.00
M + F + TV	0.04	0.01
M + TV	0.03	0.24
F	0.09	0.03
M + FBB + TV	0.07	0.00
Other combinations	0.00	0.01
None	0.10	0.40
NUTS II Regions		
North	0.20	0.21
Centre	0.02	0.63
Lisbon	0.57	0.07
Alentejo	0.12	0.01
Algarve	0.01	0.00
A.R. Azores	0.04	0.03
A.R. Madeira	0.04	0.05

4. Analysis of relative contributions, i.e. the explanation of a category of A or B from each of the axes (the contribution of the axis to category A or B):

- In terms of the categories of variable A:

$$C_{h\alpha}^r = \frac{(f'_{h\alpha})^2}{\sum_{j=1}^J \frac{1}{p_{h+}} (p_{hj} - p_{+j})^2}$$

- In terms of the categories of variable B:

$$C_{j\beta}^r = \frac{(f'_{j\beta})^2}{\sum_{h=1}^H \frac{1}{p_{+j}} (p_{hj} - p_{+j})^2}$$

The relative contributions of each axis, given the sample under analysis, are presented in the table below (the categories best represented on each axis are highlighted in bold).

Relative contributions | Table 28

	Axis 1	Axis 2
Integrated consumption of services		
M + F + FBB + TV	0.94	0.01
M	0.66	0.33
M + F	0.87	0.00
M + F + TV	0.73	0.04
M + TV	0.25	0.63
F	0.82	0.08
M + FBB + TV	0.55	0.01
Other combinations	0.11	0.07
None	0.48	0.51
NUTS II Regions		
North	0.75	0.21
Centre	0.11	0.88
Lisbon	0.96	0.03
Alentejo	0.77	0.01
Algarve	0.17	0.01
A.R. Azores	0.56	0.10
A.R. Madeira	0.39	0.13

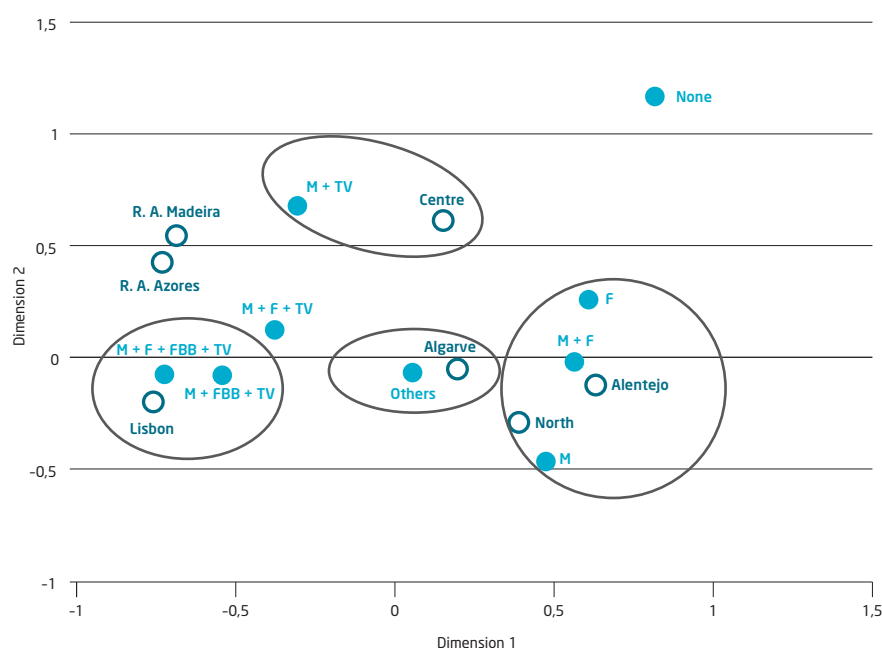
5. Representation of the projections in the plane graph.

Graphic representation is considered an excellent tool for visualising the results presented above, whereby account should be taken of the fact that the more similar a pair of categories, the closer their projections. Groups of categories of variable A may therefore emerge whose affinity is

explained by the projection of the categories of variable B in the vicinity of these groups (or vice versa).

The following graph refers to the plane representation of the example under analysis.

Correspondence analysis between the integrated consumption of services and NUTS II region | Graph 26



Source: Output adapted SPSS

This graph, in conjunction with the previous indicators, suggests the following analysis of results:

- The proximity of the three points represented by the services F, M+F and M compared to their distance from the services M+F+FBB+TV and M+FBB+TV indicates that axis 1 reflects a contrast between these two groups of consumption of services. That is, there is heterogeneity among consumers who have the telephone (fixed and/or mobile) service only and consumers with a more diverse range of services which includes, in addition to the telephone service, fixed broadband and subscription TV service.
- The regions represented on the right side of axis 1, particularly the Alentejo and the North, have relatively higher proportions of categories F, M+F and M, while those on the left, particularly Lisbon, have high proportions of categories M+F+FBB+TV and M+FBB+TV.

- The category of services M+TV and "No service" have greater representation on axis 2, with note made of a greater distance compared to other types of consumer services, including M. The consumers of the regions illustrated in the upper part of axis 2, particularly the central region, have higher proportions of such categories of services (particularly M+TV).
- The balls highlighted in the graph are only to help in the interpretation, demonstrating the categories with greater homogeneity amongst themselves, and were also drawn in view of the most represented categories on the two created axes.

Appendix 2 - Cluster analysis - K-means method

Cluster analysis is an exploratory technique of multivariate data analysis that allows classification of a set of categories in homogeneous groups, observing only the similarities or dissimilarities between them.

Hierarchical methods can be used which require the calculation of a matrix of similarity / distances or non-hierarchical methods that are applied directly to the original data and which are derived from an initial allocation of individuals through a number of pre-defined groups.

The cluster analysis conducted in the context of the present report was based on the non-hierarchical clustering method called K-means, which generally involves the transfer of an individual to the cluster whose centroid is at the shortest distance. This method is widely used in cluster analysis, in particular because it is widespread in most statistical software and due to its ease of application when dealing with a large number of observations.

The following is a brief explanation of this method and, as an example, its application resulting in the final presentation in Table 12, Profile of users of electronic communication services from an integrated perspective. The entire analysis was performed using SPSS statistical software.

A first relevant issue in cluster analysis lies in the type of data available and to be subjected to analysis. The k-means method requires that the variables are numeric or binary.

Insofar as it is sought to analyze the profile of the consumer of electronic communications services through the (Electronic Communications Services Consumer Survey), residential population, of 2010, a vast array of information is available, associated with the type of integrated consumption of services and the socio-demographic and economic characteristics of the consumer. All these variables are categorical and mostly with more than two categories (polytomous variables). In this sense, the original variables are transformed into binary

variables, with a view to the application of the method, showing them all on the same scale (0 and 1). The list of variables considered is given below:

Serv_1: 1 if the individual has the fixed and mobile telephone service in conjunction with fixed broad band subscription television (M+F+FBB+TV); 0 otherwise

Serv_2: 1 if the individual has, on an exclusive basis, the mobile telephone service (M); 0 otherwise

Serv_3: 1 if the individual has, on an exclusive basis, the telephone service (fixed and mobile) (M+F); 0 otherwise

Serv_4: 1 if the individual has the telephone service (fixed and mobile) in conjunction with the subscription television service (M+F+TV); 0 otherwise

Serv_5: 1 if the individual has the mobile telephone service and the subscription television service (M+TV); 0 otherwise

Serv_6: 1 if the individual has, on an exclusive basis, the fixed telephone service (F); 0 otherwise

Serv_7: 1 if the individual has the mobile telephone service in conjunction with the fixed broadband and Subscription TV (M+FBB+TV); 0 otherwise

Serv_8: 1 if the individual has other combinations of services not expressed by the above variables (Other combinations); 0 otherwise

Serv_9: 1 if the individual has no electronic communication services (None); 0 otherwise

North: 1 if the individual belongs to NUTS II region Norte; 0 otherwise

Centre: 1 if the individual belongs to NUTS II region Centro; 0 otherwise

Lisbon: 1 if the individual belongs to NUTS II region Lisboa; 0 otherwise

Alentejo: 1 if the individual belongs to NUTS II region Alentejo; 0 otherwise

Algarve: 1 if the individual belongs to NUTS II region Algarve; 0 otherwise

Azores: 1 if the individual belongs to Região Autónoma dos Açores; 0 otherwise

Madeira: 1 if the individual belongs to Região Autónoma da Madeira; 0 otherwise

Dim_1: 1 if the individual belongs to a family household consisting of 1 individual; 0 otherwise

Dim_2: 1 if the individual belongs to a family household consisting of 2 individuals; 0 otherwise

Dim_3: 1 if the individual belongs to a family household consisting of 3 individuals; 0 otherwise

Dim_4: 1 if the individual belongs to a family household consisting of 4 or more individuals; 0 otherwise

Agreg_children: 1 if the individual belongs to a family household with children; 0 otherwise

Agreg_elder: 1 if the individual belongs to a family household with elderly members; 0 otherwise

Age_15_24: 1 if the individual is aged 15 to 24 years; 0 otherwise

Age_25_34: 1 if the individual is aged 25 to 34 years; 0 otherwise

Age_35_44: 1 if the individual is aged 35 to 44 years; 0 otherwise

Age_45_54: 1 if the individual is aged 45 to 54 years; 0 otherwise

Age_55_64: 1 if the individual is aged 55 to 64 years; 0 otherwise

Age_65m: 1 if the individual is aged 65 or over; 0 otherwise

Until EB_1stage: 1 if the individual has a level of education up to 1st stage of primary education; 0 otherwise

EB_2stage: 1 if the individual has a level of education 2nd stage of primary education; 0 otherwise

EB_3stage: 1 if the individual has a level of education 3rd stage of primary education; 0 otherwise

Secondary education: 1 if the individual has a level of education up to secondary education; 0 otherwise

Higher education: 1 if the individual has a level of education up to higher education; 0 otherwise

Employed: 1 if the individual is employed; 0 otherwise

Student: 1 if the individual is a student; 0 otherwise

Unemployed: 1 if the individual is unemployed; 0 otherwise

Retired: 1 if the individual is retired; 0 otherwise

Oth_inactive: 1 if the individual is in other inactive situation; 0 otherwise

Class_AB: 1 if the individual belongs to a family household in social class A or B; 0 otherwise

Class_C: 1 if the individual belongs to a family household in social class C; 0 otherwise

Class_D: 1 if the individual belongs to a family household in social class D; 0 otherwise

Class_E: 1 if the individual belongs to a family household in social class E; 0 otherwise

Starting from a large dimension data matrix: according to the example in question, there are 3.106 rows (associated with each individual respondent) and 42 columns (one for each of these variables).

The K-means method starts with a number of groups (clusters) defined a priori (k) and calculates points which represent the centres of these groups and which are scattered homogeneously in terms of the set of responses obtained and moved, heuristically, to reach a static equilibrium. A division is made of all the cases obtained by the predetermined k groups and the best partition of the n cases will be one that optimizes the chosen criterion.

The following steps of the K-means algorithm are summarised:

1. Initial partition of the subjects into K groups defined from the outset by the analyst;
2. Calculation of the centroids for each k group (in the SPSS, by defaults the first k observations are used as centroids of the k groups in the first routine step, whereas the analyst may define the value of the centroids to be used) and calculation of the Euclidean distance of the centroids from each individual in the database;
3. Group the individuals whose centroids are closets and repeat step 2 until there is no significant variation between the minimum distance of each individual of the database from each of the centroids of the k groups.

One of the tables of results from the application of this method is the ANOVA table which enables the variables allowing the separation of groups to be identified using analysis of two measurements:

- Variability between groups (given by the cluster mean square): the variables with strong discriminating power between groups show a high variability between groups and variables with weak power of discrimination between groups have a reduced variability.
- Variability within groups (given by the mean square error): the lower the variability within the group the greater the explanatory power of the variable to form the groups.

Inasmuch as F is given by the ratio between these two measures (variability between groups / variability within groups), the higher the value of F, the greater the contribution of the variable in defining the groups.

Given the example in question, the following steps were taken to obtain the final model:

- Application of the K-means method for different values of k (namely k=2, k=3, k=4 and k=5) with a view to assessing how many groups allow a greater differentiation with pertinent and coherent interpretation in the context of the electronic communications sector;
- Assessment of the contribution of the variables to the definition of groups, with removal of the main sets of variables with weak contribution (i.e. low value of F).

The set of variables related to the NUTS II region to which the individual belongs was removed, because they are not generally relevant to the definition of groups and the method was considered with k = 4, because it resulted in better and coherent differentiation with interpretive value with respect to the economic and socio-demographic profile of the user in relation to the type of consumption of electronic communications services of a relevant nature.

Application of the K-means method with four groups established a priori, with a maximum of 30 iterations for the convergence of the algorithm and based on the set of variables described above, excluding the set of variables for region NUTS II, results in the following analysis:

1. **Convergence of the method:** after the 28th iteration, the method was stabilized, i.e., no or little change is observed in the centring of the groups. The table below shows the variation of the centring of groups in each iteration, whereby the minimum distance between the initial centres was 3.606.

Variation of the centre of clusters in each iteration | Table 29

Iteration	Change in Cluster Centres			
	1	2	3	4
1	1.706	1.827	1.858	1.776
2	0.196	0.429	0.207	0.212
3	0.169	0.527	0.130	0.093
4	0.084	0.173	0.180	0.086
5	0.054	0.070	0.108	0.091
6	0.058	0.021	0.059	0.081
7	0.055	0.031	0.050	0.064
8	0.031	0.049	0.042	0.034
9	0.021	0.084	0.078	0.024
10	0.024	0.040	0.049	0.031
11	0.011	0.020	0.024	0.017
12	0.026	0.013	0.022	0.034
13	0.025	0.006	0.032	0.040
14	0.016	0.014	0.030	0.032
15	0.021	0.006	0.018	0.029
16	0.049	0.000	0.007	0.055
17	0.064	0.006	0.015	0.075
18	0.090	0.002	0.012	0.113
19	0.092	0.006	0.029	0.131
20	0.063	0.019	0.024	0.085
21	0.026	0.008	0.009	0.031
22	0.021	0.006	0.006	0.024
23	0.017	0.000	0.000	0.020
24	0.026	0.001	0.000	0.029
25	0.020	0.001	0.005	0.025
26	0.010	0.000	0.000	0.011
27	0.002	0.000	0.000	0.002
28	0.000	0.000	0.000	0.000

2. Assignment of individuals to the created groups:

assignment of individuals to the created groups: the table that follows refers to a portion of the output that illustrates the group comprising each individual and the distance from

the centre of the respective group (thereby making it possible to assess how similar or dissimilar the individual is from the assigned group).

Assignment of individuals to the created groups | Table 30

Case Number	Cluster	Distance
1	1	1.874
2	1	2.566
3	1	1.875
4	2	1.725
5	3	2.009
6	1	2.060
7	3	2.028
8	4	1.963
9	2	2.406
10	4	2.039
...	...	...

Note: Whereas the original output refers to 3,106 lines (individuals), for illustrative purposes, only the first 10 cases are presented.

3. ANOVA table: all these variables have high F values, contributing greatly to the definition of the groups.

In each set of variables defined, note is made of:

- Integrated consumption of services: the diverse set of services M+F+FBB+TV (serv_1), the use of fixed telephone service on an exclusive basis (serv_6), the use of other less frequent combinations of services (serv_8).
- Size of household: households with four or more individuals.

- Presence of children or elderly members in the household.
- Age: young people (aged 15 to 24 years) and elderly people (65 years or over).
- Level of education: up to 1st stage primary level.
- Employment status: in employment, student and retired.
- Social class: upper class (A and B) and lower-middle class (D).

ANOVA table | Table 31

	Cluster		Error		F	Sig.
	Mean Square	Df	Mean Square	Df		
SERV_1 (M+F+FBB+TV)	15.615	3	.144	3102	108.740	.000
SERV_2 (M)	6.501	3	.147	3102	44.338	.000
SERV_3 (M+F)	3.859	3	.078	3102	49.409	.000
SERV_4 (M+F+TV)	2.186	3	.071	3102	30.650	.000
SERV_5 (M+TV)	.194	3	.067	3102	2.912	.033
SERV_6 (F)	6.885	3	.054	3102	126.436	.000
SERV_7 (M+FBB+TV)	1.990	3	.053	3102	37.544	.000
SERV_8 (Other combinations)	9.617	3	.156	3102	61.543	.000
SERV_9 (None)	1.062	3	.038	3102	28.085	.000
DIM_1	9.057	3	.112	3102	80.858	.000
DIM_2	17.861	3	.189	3102	94.612	.000
DIM_3	6.472	3	.187	3102	34.545	.000
DIM_4	23.528	3	.191	3102	123.413	.000
AGREG_CHILDREN	20.545	3	.173	3102	118.536	.000
AGREG_ELDER	28.892	3	.121	3102	239.744	.000
AGE_15_24	28.340	3	.114	3102	248.882	.000
AGE_25_34	17.390	3	.131	3102	132.378	.000
AGE_35_44	7.513	3	.135	3102	55.539	.000
AGE_45_54	10.785	3	.120	3102	89.912	.000
AGE_55_64	8.175	3	.105	3102	77.746	.000
AGE_65M	106.686	3	.053	3102	2002.509	.000
HIGH ED.	34.613	3	.079	3102	437.544	.000
SEC. ED.	46.889	3	.111	3102	423.517	.000
EB_3STAGE	17.968	3	.076	3102	237.474	.000
EB_2STAGE	33.773	3	.074	3102	458.675	.000
ATEEB_1STAGE	240.150	3	.016	3102	15116.562	.000
EMPLOYED	89.284	3	.163	3102	548.257	.000
UNEMPLOYED	.998	3	.037	3102	27.119	.000
STUDENT	6.633	3	.066	3102	100.394	.000
RETIRED	123.736	3	.054	3102	2303.645	.000
OTH_INACTIVE	7.777	3	.103	3102	75.753	.000
CLASS_AB	72.934	3	.075	3102	967.626	.000
CLASS_C	19.844	3	.117	3102	169.368	.000
CLASS_D	123.615	3	.131	3102	945.979	.000
CLASS_E	25.057	3	.103	3102	243.230	.000

4. Centre of the final groups: centre of the final groups: these results allow the average of each variable to be ascertained in each of the created groups. Being only binary variables, the average is equivalent to the proportion of this

“characteristic” within the group. The proportions which have more significance in each group for the distinct characteristics are highlighted in a different colour.

Centres of the final groups | Table 32

	Cluster			
	1	2	3	4
SERV_1	0.35	0.04	0.11	0.25
SERV_2	0.09	0.18	0.31	0.18
SERV_3	0.02	0.17	0.14	0.05
SERV_4	0.03	0.16	0.08	0.07
SERV_5	0.06	0.06	0.09	0.08
SERV_6	0.00	0.21	0.05	0.01
SERV_7	0.12	0.01	0.03	0.07
SERV_8	0.32	0.09	0.13	0.27
SERV_9	0.00	0.08	0.06	0.02
DIM_1	0.12	0.30	0.11	0.04
DIM_2	0.26	0.52	0.26	0.15
DIM_3	0.31	0.12	0.27	0.32
DIM_4	0.31	0.06	0.36	0.48
AGREG_CHILDREN	0.31	0.03	0.25	0.43
AGREG_ELDER	0.06	0.48	0.14	0.08
AGE_15_24	0.20	0.00	0.03	0.42
AGE_25_34	0.34	0.00	0.10	0.24
AGE_35_44	0.22	0.02	0.25	0.19
AGE_45_54	0.16	0.03	0.32	0.11
AGE_55_64	0.07	0.17	0.26	0.03
AGE_65M	0.01	0.78	0.04	0.01
HIGH ED.	0.42	0.01	0.00	0.04
SEC. ED.	0.51	0.00	0.00	0.20
EB_3STAGE	0.05	0.03	0.00	0.33
EB_2STAGE	0.01	0.04	0.00	0.43
ATEEB_1STAGE	0.00	0.93	1.00	0.00
EMPLOYED	0.80	0.01	0.62	0.63
UNEMPLOYED	0.02	0.00	0.05	0.08
STUDENT	0.10	0.00	0.00	0.20
RETIRED	0.03	0.85	0.06	0.01
OTH_INACTIVE	0.05	0.13	0.27	0.07
CLASS_AB	0.60	0.01	0.01	0.02
CLASS_C	0.38	0.04	0.10	0.10
CLASS_D	0.01	0.95	0.53	0.64
CLASS_E	0.00	0.00	0.37	0.24

It is through this information that the created groups are "labelled".

In Table 12 of the present report, three groups stand out, with the third subdivided, being equivalent to four groups. To

organise information and give interpretative sense, the final groups shown in Table 12 have a different order with respect to the original formulation (Table 32). The correspondences between the groups are presented below.

Correspondence between the original and final groups | Table 33

Original groups	Final groups (Table 12)
1	3 "more educated"
2	1
3	2
4	3 "younger"

In Table 12, the column "% group" in group k refers specifically to the values contained in Table 32 (centres of the final groups) for the respective characteristics and group k, representing the percentage of individuals who, allocated to group k, present characteristic j referenced in the first column.

Also in Table 12 "overall %" is shown (percentage of individuals with the characteristic j in the total individuals observed), which allows us to evaluate the extent to which the group exceeds the overall %, indicating the strong presence of this characteristic in that group.

As an example, group 1 of Table 12 is analysed in greater detail:

- This group is strongly constituted by individuals who have few services (62.1 %: 21 % have fixed telephone service only, 17 % the telephone service (M+F), 15.7 % telephone services and subscription TV (M+F+TV) and 8.4 % have no

service). In the overall population analysed, these values are considerably lower, as can be seen in the "% overall" column.

- The individuals of group 1 tend to have a type of socio-demographic and economic characteristic which is more pronounced compared to the population structure. In this group, 81.8 % of individuals belong to small family households (up to 2 individuals). In the total population this characteristic has an occurrence which is almost half this (43 %). The remaining characteristics shown in Table 12 with reference to this group also refer to characteristics which are more pronounced than in the population at large: particularly, elderly members in household, higher age group- 65 years or over, lower education levels - up to 1st stage primary, retired and lower social class - D.

5. Distance between the centres of the final groups:
this distance is given by the Euclidean distance which will be

greater according to the dissimilarity between the respective groups.

Matrix of distances between the centres of the groups | Table 34

Original group		1	2	3	4
	Final group	3 "more educated"	1	2	3 "younger"
1	3 "more educated"		2.343	1.643	1.252
2	1	2.343		1.578	2.054
3	2	1.643	1.578		1.357
4	3 "younger"	1.252	2.054	1.357	

According to the note to Table 12: "According to the distance matrix between the groups, it is observed that group 1

presents greater dissimilarities in respect of group 3 "more educated" (2.343) and group 3 "younger" (2.054)".

I - The development of high-speed networks and services in Portugal in 2009

The development of high-speed networks in Portugal was particularly marked during the year 2009, a phenomenon which was driven by several factors, including the competitive dynamic, regulatory developments and sectorial policy.

Following the spin-off of Grupo TV Cabo/ZON, incentives were put in place to encourage the Grupo PT to step up the development of optical fibre access networks. In fact, without TV Cabo/ZON's cable TV network, Grupo PT ceased to have the physical means enabling the development of bundled offers over high-speed accesses – a growing commercial and technological trend – being restricted to the copper network and ADSL 2+ whose theoretical maximum download speed is 24 Mbps. Simultaneously, it gained a competitor with a size, a portfolio of services and business experience which is relevant in these markets.

As such, Grupo PT joined the set of operators – namely, Sonaecom – Serviços de Comunicações, S. A. (Sonaecom), TVTEL (now acquired by TV Cabo/ZON) – which in previous years had started their investment in fibre optic networks and the launch of commercial products supported over such networks.

At a regulatory level and in terms of sectorial policy, various aspects associated with the development of these networks were clarified, thereby reducing the associated uncertainty and contributing to the promotion of the necessary investments. Among the developments occurring of a regulatory nature and in terms of sectorial policy, the following are noted:

- signature in January 2008 of an agreement between operators and Government under which the former pledged to bring forward, to 2009, the allocation of resources enabling the connection of a fibre optic network to 1.5 million users. The government pledged to support the implementation of the investment in NGR networks and promote the domestic and institutional use of these networks;
- European Commission Recommendation of 18 September 2008 on the regulatory approach to Next Generation Access networks (NGA);
- approval by the Management Board of ICP-ANACOM, in February 2009, of the regulatory approach to NGA

following the public consultation launched the year before;

- the approval of Decree-Law no. 123/2009 of 21 May, which *inter alia*, promotes the removal or mitigation of barriers to the construction of infrastructure to accommodate NGN and promotes competition by ensuring non-discriminatory and open access to ducts, poles and other facilities belonging to other entities operating in other sectors, such as entities in possession of networks of ducts with crucial importance to the territorial expansion of NGN.
- The Decree-Law also establishes the requirement for construction of ITUR – Infra-estruturas de Telecomunicações em Urbanizações (Telecommunications Infrastructure in Housing Developments) during development or settlement, also strengthening the legal regime applicable to ITED – Infra-Estruturas de Telecomunicações em Edifícios (Telecommunications Infrastructure in Buildings);
- Meanwhile, in order to ensure territorial cohesion, with the support of the EC, the Government launched five public tenders (Centre, Alentejo and Algarve, North, the Autonomous Region of Madeira and the Autonomous Region of Azores) to address possible market failings in terms of investment in NGN in 136 rural municipalities. A protocol was likewise established with banks, establishing a credit line of 800 million euros for investment projects in the context of NGN (infrastructure construction and network deployment).
- In November 2009, the Management Board of ICP-ANACOM approved the final versions of the 2nd edition of the ITED Manual and the first edition of the ITUR Manual, establishing the obligation to install optical fibre and avoiding monopolization of infrastructure by the first operator.

The situation in terms of next generation networks and services (fixed), as at the end of 2009, is presented below. Next generation fixed networks providing high-speed access are currently supported over optical fibre (FTTH/B) and over cable TV distribution networks which make use of the Data Over Cable Service Interface Specification 3.0 (EuroDOCSIS 3.0 standard).¹⁴

¹⁴ See. European Commission, "Community Guidelines for the application of State aid rules in relation to rapid deployment of broadband networks".

Access platforms and technologies for high-speed Internet

In this section, there is also information available about the penetration and the geographic distribution of high-speed access in Portugal¹⁵.

1. Cabled households

At the end of fourth quarter 2009 (4Q09), there were around 16 operators with installed high-speed accesses. The main network operators who have installed high-speed access in Portugal are ZON, PT Comunicações, S. A. (PTC), Cabovisão and Sonaecom.

At that time, the number of cabled households with optical fibre (FTTH/B) for all operators was reported at 1.2 million¹⁶, approximately 21.2 % of total classic family households.

The number of households with accesses using EuroDOCSIS 3.0 – the standard used by cable television operators to provide high-speed services, totalled 2.8 million, representing around 50.2 % of total households. This value is about 2.4 times greater than the number of households cabled with optical fibre (FTTH/B).

Households cabled with Fibre Optic (FTTH/B), by NUTS II and per 100 households | Table 35

NUTS II	4Q09	
	No. of cable households (FTTH/B)	Cabled households (FTTH/B) per 100 households
North	349,621	19.3
Centre	89,173	6.5
Lisbon	704,727	50.6
Alentejo	380	0.1
Algarve	25,159	7.5
ARA	3,097	3.0
ARM	12,333	10.5
Total	1,184, 490	21.2

Source: ICP-ANACOM

Cabled households supported using EURODOCSIS 3.0 standard or equivalent, per NUTS II and per 100 households | Table 36

NUTS II	4Q09	
	No. of cable households (EuroDOCSIS 3.0)	Cabled households (EuroDOCSIS 3.0) per 100 households
North	831,189	45.9
Centre	374,115	27.2
Lisbon	1, 316,203	94.5
Alentejo	36,086	7.9
Algarve	197,917	59.3
ARA	0	0.0
ARM	53,054	45.1
Total	2, 808, 564	50.2

Source: ICP-ANACOM

¹⁵ The information presented here was compiled from providers and may be modified if there are revisions or updates.

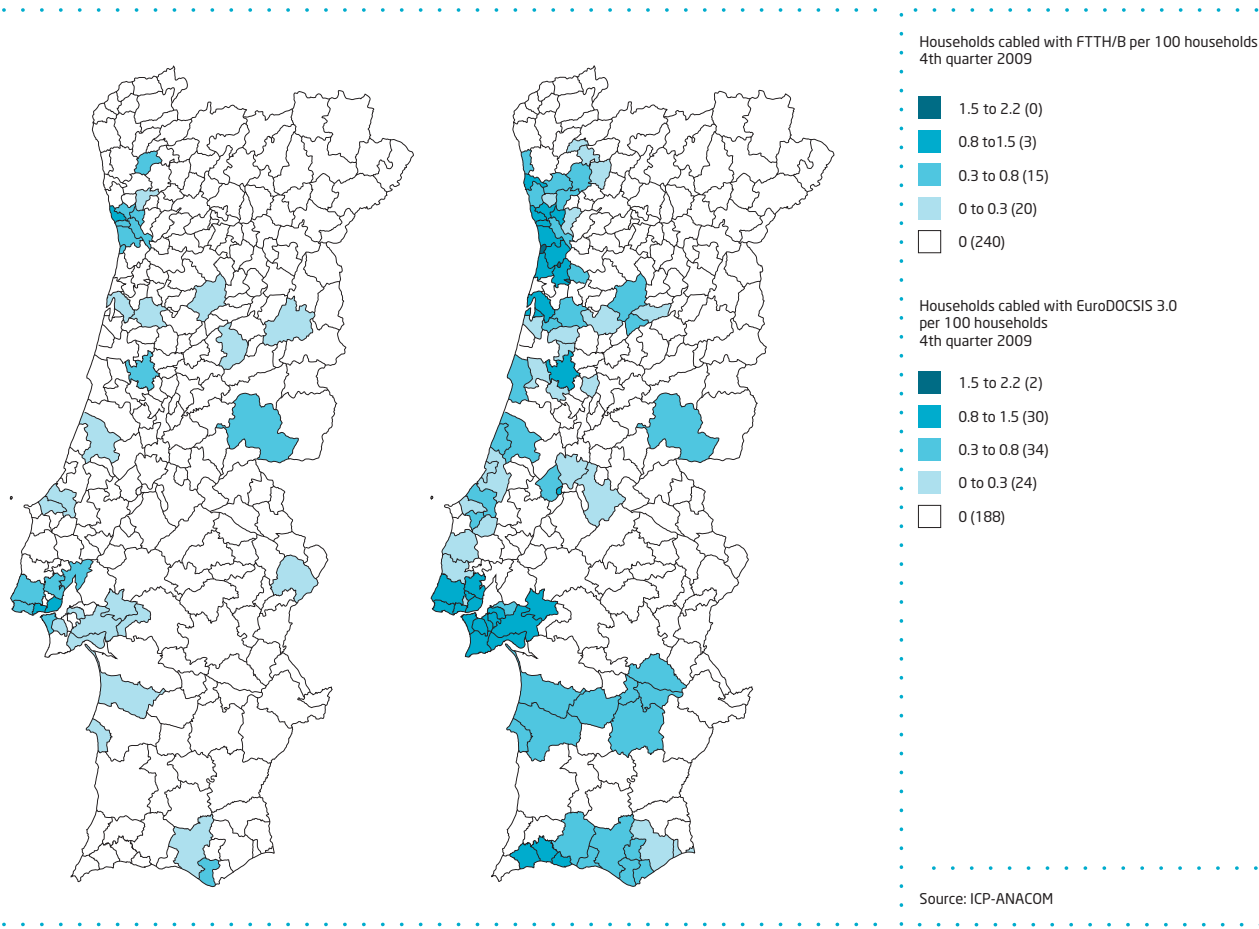
¹⁶ The provision of the service by more than one operator in the same region implies the possibility of multiple cabling of the same household. This means that the sum of cabled households by all operators may result in duplicate counting.

The provision of the service by more than one operator in the same region implies the possibility of multiple cabling of the same household. This means that the sum of cabled households by all operators may result in duplicate counting.

It has been estimated that the effect of double counting reaches a maximum of 19 % in the case of FTTH/B, 9 % in the case of EuroDOCSIS 3.0 and 33 %, if FTTH/B and EuroDOCSIS 3.0 are considered together.

High-speed accesses are concentrated in the Lisbon and north regions.

Geographical distribution of households cabled with FTTH/B and EuroDOCSIS 3.0 | Figure 1



2. Residential customers of services supported using high-speed accesses

At the end of 2009, there were 88 thousand residential customers reported as using services supported by high-speed accesses (FTTH and EuroDOCSIS 3.0 or equivalent), representing 2.2 % of cabled accesses.

Penetration in terms of classic family households, in 4Q09, is reported at 1.6 per 100 households.

Residential customers with high-speed access, per 100 households, by NUTS II in 4Q09 | Table 37

NUTS II	Residential customers per 100 households
North	1.6
Centre	0.2
Lisbon	3.7
Alentejo	0.1
Algarve	0.6
ARA	0.1
ARM	1.6
Total	1.6

Source: ICP-ANACOM.

Note: Includes data from an operator who does not disaggregate customers between residential and non-residential.

Lisbon has the highest penetration (3.7 per 100 households).

3. Non-residential customers and premises (estimated)

According to compiled information, there are about 212 thousand non-residential premises with high-speed access. The number of non-residential accesses/customers of these services is reported at 3.8 thousand.

The number of residential customers with high-speed represents around 1.8 % of total cabled buildings.

homes passed with optical fibre. France continues to lead the rankings, with nearly 6 million homes cabled.

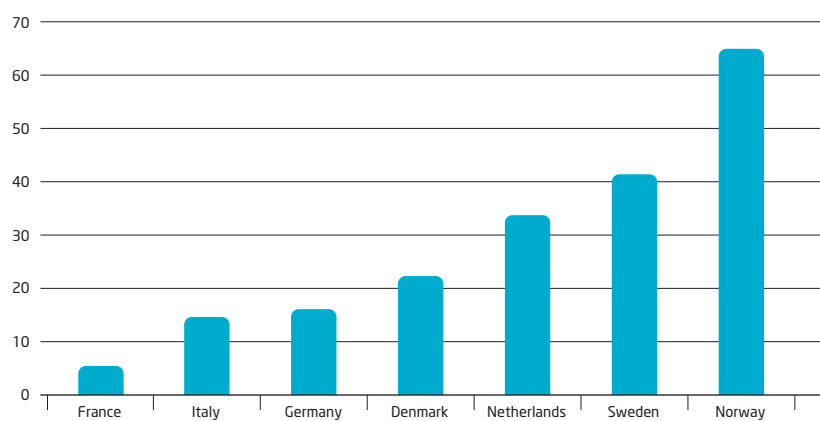
Meanwhile, Portugal is one of the countries of Europe included, since late 2009, in the Global Ranking of the FTTH Council Europe. This ranking consists of the countries where the number of subscribers exceeds 1 % of households.

According to the same study, the countries with the largest number of subscribers are Norway, Sweden and the Netherlands, Denmark and Germany.

4. International comparisons

According to a study by Institut de l'Audiovisuel et des Télécommunications en Europe (IDATE), Portugal is in fourth place in the ranking of European countries in terms of

FTTH/B Subscribers per 100 cabled households / buildings – 4Q09 | Graph 27



Unit: 100 subscribers per cabled households.
Source: IDATE for the FTTH Council Europe