# Determinants of Computer and Internet Adoption and Use in Cameroon

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## Abstract

The aim of this paper is to make explicit the factors that determine the adoption and use of the computer and internet in Cameroon using a household survey carried out in the year 2008. The  paper distinguishes five groups of determinants within different modes of diffusion and  estimates their impact with the help of econometric tests. Level of education and age, among  other socioeconomic factors on the one hand, and life style, perceived utility and perceived  difficulty among other psycho sociological factors on the other, seem to play a particularly  important role in the adoption and use of the computer and the Internet in Cameroon. It is  argued that, the state should encourage the opening of media centres and promote the training  of youths and social networks.
*Keywords: ICT, determinants, Development, Internet, Africa.*

## 1.    Introduction

There exist many theoretical approaches in the literature that explain the choice of adoption and use of ICTs. The main approaches distinguish five groups of factors, namely socioeconomic factors, acquired competences, lifestyle, perceived utility, and perceived ease. In earlier studies on domestic digital divide in Western Europe (e.g., Kiesler *et al*., 1997), the role of the first group of factors has been established, although psycho-sociological factors are underscored in studies in developing countries(Shih and Venkatesh, 2003).

It is therefore interesting to understand whether socioeconomic factors play a similar role on prime adopters in developing countries like Cameroon

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where equipment in ICTs remain very limited and access to internet very recent (Njoh, 2012) or whether psycho-sociological factors such as perceived utility or perceived complexity have a higher incidence. But this question raises another important one: that of the modes of diffusion of these two closely complementary ICTs and their respective underlying logics in a context where the majority of households have access to them out of the home (see table 2).

This paper has four main objectives: to explore the existence of many modes of diffusion of the computer and the Internet in Cameroon, to propose pertinent indicators of their adoption and use, to highlight and explain the domestic digital divide which results from the two choices, and finally to compare this domestic digital divide to that observed in certain countries of Western Europe like France and Luxemburg. To achieve these objectives, two main hypotheses are advanced or tested: on the one hand, the existence of many modes of diffusion of ICT and on the other hand, the decisive weight of psycho-sociological factors in explaining their adoption and use.

The first objective is crucial for the definition of indicators of the concepts of adoption and use in a situation where the possession of these two technologies by households remain limited. The second and third objectives aim to analytically investigate the determinants of adoption and use of these two technologies and to empirically evaluate their impact on indicators constructed in order to highlight  first order digital divide (equipment in ICTs) and second order digital divide (use of ICTs) in Cameroon. The fourth objective is to show that the double digital divide which exists between developed countries and a developing country such as Cameroon is not fundamentally due to socioeconomic factors such as household income[1] as has been demonstrated in household studies on adoption and use of ICT in Europe, but also and mainly to other factors such as lifestyle, household competences, perceived utility and perceived ease of the use of these ICTs. In order to achieve the third and fourth objectives, we need to construct indicators not only for endowment and use of both the computer and internet, but of other ICTs that reflect the lifestyle of the household as well as perceived utility and perceived ease of use by these households. It is therefore important to first outline the method used for the construction of these

indicators before presenting that used to determine the impact of the different factors of adoption and use of ICTs earlier mentioned.

Existing studies on ICT in Cameroon have not considered these issues. Amin (2011) highlights the role of contextual factors on the use of the Internet especially by unemployed youth, namely illegal activities such as drug dealing, money laundering, forgery and credit-card fraud. Njoh (2012) mentions several obstacles to ICT development in cities and the role of these technologies in their development. The last issue is away from our problem; barriers inherited from colonization (poor overcrowded areas opposed to residential areas with modern infrastructure) and institutional barriers such as high costs of services, existence of monopolies may prevent the promotion of ICTs. The analysis developed assumes institutional barriers given, but takes into account built barriers through variables such as localization.

Chinn and Fairlie's (2004) depth study of the causes of the global digital divide uses direct cross-sectional data from several countries on the one hand and holds among determinants of Internet use, microeconomic and macroeconomic variables on the other; but especially these variables belong to both the supply and demand-side. From that point of view, the study lies implicitly in the medium and long term. The approach adopted in this paper lies in the short term and considers only the demand side in estimating the impact of the determinants of the adoption or use of ICT in a developing country: it compares indirectly obtained econometric results to those of similar studies conducted in developed countries.

The data used to construct the statistics on the adoption and use of the computer and Internet and their determinants is obtained from a survey[8] carried out by the GRETA (Groupe de Recherche et d'Etude en Economie Théorique et Appliquée) in 2008 on more than 2650 households in the francophone region of Littoral, precisely in the town of Douala (85.59%), and in the Anglophone region of South-West, precisely in the towns of Limbe (9.4%) and Buea (4.72%)). This large disparity is due to the fact that Douala is a large metropolis in which a large number of both anglophone and

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[8] Navigation Data of Internet users constitute another source, but they are not available in Cameroon

francophone upper classes of the population live, meanwhile Buea and Limbe are small towns.

These data and the results obtained from their analyses could imperfectly represent the situation or behaviour of urban households in Cameroon as the towns of the eight other regions including the Centre that host the capital city are excluded from the survey. However, they are close to that of Yaounde, a town comparable to Douala in demography and per capita income. Neighbouring agglomerations such as Obala and Mbalmayo are also comparable to Buea and Limbe in these two aspects. The correspondence between Douala and Yaounde, between Buea and Limbe on the one hand and Mbalmayo and Obala on the other, is important because these six towns represent about 50% of the urban population of Cameroon (3 over 6.2 million of inhabitants), and these reasons explain the choice of the three towns. In order to guarantee the representativeness of the sample with respect to the population of the three towns chosen, the households were selected using a method that combines techniques of stratified sampling and simple random sampling.

The survey considers a dozen elements that can characterise households. Religion, language spoken (national), level of education, sector of occupation (public, private or unemployed), and holding a position of responsibility or not at the workplace, age and gender[9] seem evident. Others as one has stayed abroad or not during the past years, is a member or not of associations, the size or structure of household, proprietor or not of a dwelling unit, and socio-professional category are also important. Socioeconomic characteristics are retained in priority because of the role they played in developed countries during the first phase of the diffusion of ICTs (Kiesler et al. 1997). These factors are far from being homogenous; some such as income and the ownership or not of dwelling unit are economic in nature while others such as religion and language are cultural. A third category made up of age, size or household structure, marital status, and gender are essentially sociological in nature. All of these factors allow the distinction of households

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[9] Gender and age are considered in their sociological and not demographic sense

by the way they determine mental structures and behaviour in circumscribed frameworks that can be the family, a generation, work or larger frameworks such as associations. This study does not consider the social capital of households that has been recognised for impacting on the adoption and use of the computer and internet by many studies (Agarwal and Ali, 2005, Pénard and Suire, 2006); instead localization of the household, which is an indicator of neighbourhood or proximity that has a high socioeconomic connotation for households residing in urban areas, is considered. This variable generates positive or negative physical externalities via the presence (low costs of renting) or absence (high costs of renting) of ICT infrastructures or immaterial externalities such as the imitation effect and conformism (assumed positive in residential areas and negative in popular areas). This externality can influence individuals in their choice.

The survey distinguishes thirteen types of equipment or devices: desktop computers, laptop computers, internet connection, television, satellite TV channels, cable TV channels, CD and DVD drives, MP3 drives, fixed phones, mobile telephones, digital cameras and video cameras. This study directly involves the first three devices and the others indirectly through complementarity and competition[10]. It's important to note that the paper assumes telecommunication infrastructure, Internet connectivity, entrepreneurship culture and the structure of the market, that also determine adoption and use of ICTs, given. All those factors offer the potential for increased availability of information, reduction of transaction costs and improved efficiency in many different activities (UNCTD 2004)

The discussion that follows is organized into three sections, namely the literature review and research hypotheses (I), the methodology used (II) and the results obtained and economic policies posited to reduce the digital divide (III).

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[10] Equipments complementary to computer and Internet are: phones, CD/DVD drives, MP3 drives, digital and video camera. Equipments in competition with them are: TV, satellite TV channels and cable TV channels.

## 2. Background and hypotheses

This section presents the literature on modes of diffusion of the computer and the Internet; it closes with hypotheses on the determinants of adoption and use choices, and the indicators used in the econometric tests as endogenous variables.

There exist many theoretical approaches in the literature that explain the choice of adoption and use of ICTs. Early studies on the adoption and use of ICTs (computers and internet) by households in developed countries ascertained the primary role of socioeconomic factors (Kiesler et al., 1997), Hoffmann and Novak (1996), (Pitkow et al., 1998)**,** Johnson et al (1999). Also, with the continuous increase of internet users, it has been observed that other factors such as localization, household size, social network, and lifestyle influence the adoption of ICTs by households (Le Guel et al 2005).

Subsequent studies in developing countries emphasize other factors such as perceived utility, perceived ease of use, and social networks. The Technology Acceptance Model of Davis (1989) considers perceived utility, perceived complexity of a technology and social network of an individual as the main argument for his adoption or use, the last being measured by frequency of use (Jackson et al.1997) or variety of uses (Shih and Venkatesh. 2003). Perceived utility is derived from beliefs on the impact of the technology in many aspects: performance of individuals in their everyday activities, possibility to undertake new activities and social recognition due to the adoption of a technology, as earlier theorised by Rogers (1995). Perceived complexity takes first of all a psychological dimension linked to the mental or intellectual effort to product in order to make use of a technology (Kiesler et al. 1997; Norman 1999). The Innovation Diffusion Theory highlights the role of social network (interpersonal communication, associative life) on the acquisition or use of a technology. The literature distinguish pure adoption from out of home access to this equipment which is an alternative for households that cannot afford to buy the equipment or that do not wish to raise funds for the purchase of equipment that would be underused. Out of home access encompasses the renting of ICT equipment and their availability at the workplace.

### 2.1 Pure Adoption

Pure adoption is the owning of ICT equipment by households. The analysis at this level is not simply monographic; firstly, it determines the main indicators of the concepts of adoption and use; secondly, it establishes the importance of other ICTs that describe the lifestyle of respondents and constitutes a factor for the adoption of ICTs and finally, it makes comparison with West European countries. The table shows the ICT equipment of surveyed households in 2008.

| Equipment | Rate | | | | Equipment | Rate | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Frequency (number of respondents) | % rate | Frequency (number of | % rate | | Frequency (number of respondents) | % Rate | Frequency (number of | % rate |
| | Cameroun | | Gabon | | | Cameroun | | Gabon | |
| Desktop computers | 286 | 10,98 | 216 | 15,98 | CD/DVD drives | 1635 | 62,98 | 856 | 63,31 |
| Lap top computers | 155 | 5,95 | 258 | 19,08 | MP3 drives | 549 | 21,10 | 460 | 34,02 |
| Home internet connections | 2258 | 86,61 | 200 | 15,74 | Fixed phone | 121 | 4,65 | | |
| Satellite TV channels | 25 | 0,97 | | | Digital Camera | 197 | 7,62 | 183 | 13,54 |
| Cable TV channels | 1463 | 56,44 | | | Video Camera | 50 | 1,93 | 93 | 6,88 |
| Mobile phones | 2478 | 94,869 | 1261 | 93,27 | Television E.C | 35 | 1,35 | | |

**Table 1: ICT equipment of households in 2008**
Source: Author's calculations based on data of 2008 surveys in Cameroon and Gabon

These results are obtained from the frequency tables  performed on data from the 2008 survey in Cameroon and from data obtained via  a similar survey carried out  in Gabon  by the CERDIMO (Centre d'Etude, de Recherche, en

Développement International et Management des Organisations de l'Université Omar Bongo).

The comparison of household equipment in ICTs between Cameroon and Gabon, a country of Central Africa sub-region, shows a high penetration of ICTs in the latter country, including mobile phones, Internet connection, CD / DVD drives, MP3 drives and digital or video cameras. This is due to three factors: the establishment early of a competitive market with more than two operators, the high population density of Libreville where the survey was carried out (75% of the urban population) and presumably the income gap per capita between the two countries.

A striking contrast with West European countries is noticed at the level of the equipment rate of households in fixed phones which is an unknown or inaccessible technology. Less than 5% for households owning fixed phones against 66.1% in France (ICT Development Indices Report 2004). In more than one third of investigated households (35.26%), two people own a mobile phone. This device is absent only in 5.13% of households. The proportion of households equipped with mobile phones in Luxembourg in 2003 for example stood at 89.7%. The possession of mobile phones seems not only to be progressing but to be substituted for fixed phones in Cameroon. Finally, digital cameras are less widespread (7.6% of households).

On the contrary, the rate of equipment in televisions is very high (86.61%) even though it is not yet close to the 100% observed in Northern European countries (close to 75% in Luxemburg). However, the main difference with Northern European countries is at the level of the means of access to information: satellite TV channels are an exception (less than 1% of households against 20% in Luxemburg) meanwhile cable TV channels are found in a majority of households (56.44%) against 72% in Luxemburg. It is likewise with CD/DVD drives with 63% of households equipped with them. We notice a net household penetration rate of 21% for MP3 drives. The high equipment rate of households in TV can have a negative effect on their adoption and use of the computer and internet, because the two equipment are in competition.

The equipment rate of desktop and laptop computers remain very low (10.98% and 5.96% respectively) with respect to developed countries notably

of Northern Europe (53% in Luxemburg, 39% in France in 2002 according to Pénard et al (2006).

The low equipment rate of households in computers, about 11% *(286 households)*, and the low rate of home internet connections by households (less than *1.5%, being 35 households*, against 25% of households in France in 2002), confirms the digital divide with developed countries. It is however important to note that access to ICTs in general and to the computer in particular, as access to internet, can be done elsewhere than at home.

Concerning the number of respondents that own a computer and an internet connection, these statistics explain why at the level of econometric tests, the ownership of a computer is retained as a pertinent indicator of adoption of the computer and the owning of an internet connection rejected as an indicator of the adoption of the internet. There is therefore need for another indicator of internet adoption.

## 2.2 Out of home access to the computer and internet: an alternative form of adoption and use

The second mode of diffusion allows proposing a second indicator of the adoption and use of both ICTs. The 2008 survey indicates, outside of the equipment at home, five other possibilities of access to those ICTs such as shown in table 2. These results are obtained from the frequency tables of data drawn from the 2008 survey. Home access to these two technologies is weak (computer) or residual (internet) and out of home access is the rule. Access by renting comes first: 91.8% of respondents for the internet and 31.32% for the computer. It is important to recall that the internet itself is a use of the computer and the results of the 2008 survey reveal that households are poorly equipped in computers and Internet(11% and 1,5% respectively), but they use to a large extent the two technologies out of home, notably in fee based media centres.

| | Place | Access to the Internet | Access to the computer |
|---|---|---|---|
| HOME | | 2,55 | 12,84 |
| Out of Home | Office | 21,56 | 11,40 |
| | Media centres | 91,83 | 31,32 |
| | School/College | 5,63 | 10,08 |
| | University | 6,34 | 2,27 |
| | Acquaintances /Ass | 2,55 | 14,32 |

**Table 2: Respondents with to computer and internet (percentages)**
Source: Author's calculations based on data of the 2008 survey

Considering the above, the frequency of use of the two technologies is a pertinent indicator, at least of their use. This indicator excludes access at the workplace that has no financial implication. This indicator must refer to internet familiarity, for example computer or Internet access once per month or once per week.

It is worth noting that frequency of use of the computer and internet out of home constitutes an ambiguous or mixed indicator: in the point of view of services offered by each of these technologies, it is seen as use. The frequency is consequently an alternative to the possession of these ICTs. In the point of view of regularity, cost and availability, the frequency is regarded as adoption the same that when one makes use of a taxi or a bus to go about one's activities. This makes of it an alternative to adoption and use as well. In this study, the use dimension of this indicator is privileged, especially in the interpretation of empirical tests results.

Finally, two indicators corresponding to the three behaviours to be explained are retained: The adoption of the computer, the use of the computer and the Internet. The last indicator is global and captures all uses of the computer or the Internet, unlike the indicators for particular uses.

The 2008 survey distinguishes three types of uses for the computer (data processing /spread sheets, installations of software and programming of an application) and four types for the Internet (Interpersonal communication, culture, electronic commerce and administrative services).

## 2.3 Hypotheses on the determinants of the adoption and use of the computer and Internet

These assumptions supplement or modify those mentioned in the literature review given the context of Cameroon. The choice to be equipped at home with ICTs in developing countries follows a different logic depending on the type of equipment: a seemingly collective logic for the purchase of a computer, an internet modem or any other expensive equipment and an individual logic for the purchase of mobile phones or in general all other cheap equipment.

Access to the computer or the internet can also follow a different logic depending on whether equipment at home (collective logic) or through renting in a media centre (individual logic).

More generally, the purchase of expensive equipment (computer, television) is different from the purchase of cheap equipment (mobile phones) by the underlying motivation: in the first case, the durable equipment is multifunctional, belongs to the entire household and is generally considered as an investment participating in the education of children, in activities and entertainment of the family meanwhile in the second case, the personal and non-durable equipment satisfies an individual consumption need. The characteristics of the household head and the cumulative income of the household will be used to explain the choice of the first type of equipment and the income of the respondent to explain the choice of the second.

Beyond the retained hypothesis of a difference in logic as concerns home equipment, the effect of certain variables, notably socioeconomic variables such as income or socio-professional category on out of home access is reversed as will be seen later. In fact, the contrast between the low rate of household ICT equipment and their high access to these same ICTs in media centres suggest that the effect of socioeconomic factors, though important in household choices, can be reversed. Based on the previous analysis of main modes of diffusion, we distinguish pure adoption from renting.

## *2.4  Hypotheses on pure adoption*

The purchase of a computer and internet subscription is expected to be influenced by the characteristics of the household head and those of other representative members of the household (spouse and other income earners) according to the following links or reasons.

Income and socio-professional category positively influence the equipment of households; the two variables are however, generally correlated. The reports of the United Nations Conference on Trade and Development confirm that the first order digital divide is as a result of income inequality between countries (Digital Divide: ICT Development Indices Report, 2004). The high cost of certain equipment, notably the computer, and their rapid declassification explains this relationship. Also, low income categories perceive this equipment as luxuries and not as investment goods.

In the same line of thought, the income of the spouse and other incomes earned increase the purchasing power of the household and the probability to purchase a computer especially when it is intended for the education of children. The relatively high equipment rate in televisions, due to relatively less expensive prices to that of the computer, reinforces this hypothesis.

Nevertheless, this hypothesis has certain limitations: on the one hand, the perceived utility of the computer or the internet is not always in conformity with the potential uses that can be made of it, because of lack of information on the subject by households. The Technology Acceptance Model (TAM) of Davis (1989) underscored this important difference. This observation  leads to believe that the income effect may be overestimated in the case of ICTs since income implicitly represents only the cost side in the rationality of the household-consumer; the utility side being neglected.

The size and composition of the household influences the adoption of the computer, firstly because all members are potential users and secondly because the variety of uses increase with the number of members. This makes of this equipment a collective good with multiple uses in a household. The composition of the household and notably the presence of students can favour the purchase of certain ICTs despite their high prices, their purchase being considered as an investment in the education of children (Venkatesh 1996, Kraut et al.1999). One can expect the occurrence of network economies:

parents would learn from children who quickly adapt and assimilate new technologies (Kraut et al. 1999).

Age: there exists interference between this factor and other factors such as level of education, income or socio-professional category of the household head or the owner of the equipment. The purchase of a computer would depend at the same time on the characteristics of the household head and on that of children. Under these conditions, the sign of the relationship is unknown a priori.

Language: the effect of this characteristic on the decision of households to purchase or use the computer or to subscribe to internet is probably weak if not nil due to the availability of software in French for the current uses of the computer (data processing/ spread sheets, search of information, leisure and entertainment). The use of the computer depends more on the ability to write than on that of speaking one of the two languages.

Localization: it can play an important role in the purchase of this equipment. In rural areas and suburbs where there is no electricity, the probability to purchase the equipment will be very low. On the contrary, in residential areas, the imitation effect or the desire to preserve social image can foster the adoption of the equipment. In urban and suburban areas, the availability of second-hand equipment tends to cancel the negative effect of localization in poor areas.

Perceived ease: The complexity of a technology discourages potential adopters even if this complexity is imaginary (Davis, 1989). The simple idea that a technology is complex (Mathieson 1991, Taylor and Todd 1995), coupled with a lack of knowledge (Kiesler et al. 1997, Norman 1999) reduces its probability of adoption and use. However, the mastery of simple uses eases the understanding of more difficult ones. Analysing the three uses taken two by two, we observe that the percentage of respondents who affirm having mastery of a use is significant and decreases with its complexity: 330 respondents out of 2610 believe[11] mastering both data processing or spread sheets and the installation of software, 239 respondents when we combine

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[11] A very small number of respondents have atypical profiles: they declare having mastery of complex uses, but not of simple ones(less than 30 in a sample of 2650).

data processing or spread sheet and the programming of an application, and finally 226 declare being able to install software and programme an application. In the 2008 survey, four composite elements can serve as indicators through their impact on the perceived ease of a technology: type of training, training, effective competences of the household in the main uses of the computer and the difficulty of use such as the autonomy of a person and his role of counselling.

Perceived utility: computer and internet use can be wholly explained by the household technology interaction model of Venkatesh (1996). In this model, households perform a certain number of activities in which members are expected to contribute by performing various tasks. For this, they make use of the computer or any other equipment in order to ease their duty[12]. On another aspect, the computer is relatively expensive and therefore, its acquisition relies on a cost-benefit analysis. The cost can be approximated by the level of income and benefits by expected utility or services rendered by the equipment. Perceived utility of the technology determines therefore its adoption. This variable is captured in the 2008 survey by users' motivation or reasons for using a computer.

### 2.5. Hypotheses on computer and internet renting

Renting represents the second mode of diffusion of ICTs and is statistically the most widespread after mobile phones.

Access to the computer and internet out of home depends only on the characteristics of the respondent[13]. It follows therefore an individual logic no matter the point of access, even though most of the variables mentioned before influence the access to this equipment.

Income: high prices of equipment make users turn to media centres for their internet connection or other uses of the computer. High income levels might not be significant in the choice to access internet or the computer, especially as media centres supply access, at affordable prices, for users who demand access only for a short time and for basic uses (search for current

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[12] For example, the budget of a household could be managed with the computer, meanwhile installation of software and programming of applications used for studies.

news, leisure, and interpersonal communication). It is however possible that the relationship between income and out of home access to computer equipment be different from that between income and home ICT equipment because the rich would probably use media centres less than the poor as they are equipped in ICTs. The 2008 survey confirms an inverse relationship between internet users in the past three months and income, earners of less than 25000 Francs represents the greater percentage (31.40% of the sample). Position on the socioeconomic ladder which is correlated to income would affect in the same way access to ICTs. Executives who are equipped with ICTs at the workplace or at home would have the tendency to use media centres less often than the unemployed. On the contrary, the effect of age, level of education and localization on out of home access to the computer and internet would be the same as in the case of the acquisition of this equipment.

Age: primary statistics show that age highly affects access to ICTs, corroborating the results of the National Survey on the Level of Penetration and Use of ICTs in Cameroon (SCAN-ICT 2006). The percentage of respondents visiting media centres decreases with age and the highest rate corresponds to people of less than 25 years of age. This is normal as the average income of this age group is low.

Level of education: the survey of 2006 which was not particularly based on households had already highlighted the importance of the level of education on internet access. This result is confirmed by the 2008 survey; respondents or households' use of media centres increases with the level of education of the household head or of children.

Language: its effect is neutral or difficult to determine a priori because of the reasons earlier mentioned.

Localization: Neighbourhood certainly influences access to ICTs. Areas endowed with adequate infrastructure and media centres tend to create demand for their services especially when they have support staffs that freely initiate customers to the basic uses of ICTs. In residential areas where households are relatively more equipped with ICTs, the demand for access is low and prices are higher in media centres.

Lifestyle: this term generally refers to complementary or substitute equipment that has complex effects on the decision of households. On one

hand, they have a negative competitive effect due to the limited resources of households (Daly, 2001) and available time (Vitalari et al. 1985), and on the other hand, they have a positive capitalization effect on decision as the cognitive effort required to acquire knowledge decreases with previous adoption and use (Shugan. 1980) or due to the fact that the adoption of an equipment enlarges the spectrum of the use of others. The 2008 survey reveals two facts on this aspect: the low equipment level of households with complementary technologies (video camera, digital camera) which are supposed to increase the uses of the computer or internet and the high equipment with competitive technologies (television, cable and satellite television channels).

Perceived utility or perceived ease are expected to play a significant role on the decision to access the computer or internet since this decision supposes that users are able to evaluate their aptitudes to use it and their expected gain.

The assumptions above give the meaning or the sign of the relation between each explanatory or exogenous variables constituting or included in a sub-model and the explained or endogenous variables (pure adoption or frequency access via renting to the computer or the Internet). It remains to expose the methodology for testing them.

## 3. Methodology

This section presents the methodology used to verify hypotheses stated previously. The 2008 survey revealed that home internet access was practically non-existent: 30 households out of 2650. The methodology will therefore be applied to the computer for the pure adoption model using possession of equipment as indicator, and to computer and Internet for alternative adoption models using frequency of access.

Following Mc Fadden (2001) and De Le Guel, Pénard et Suire (2004), discrete choice probit models will be used. These models will incrementally test hypotheses on the following composite variables: socioeconomic characteristics, localization, lifestyle, perceived utility, and perceived ease of a technology. Specific determinants included in sub-models will depend on the choice to be explained. Every sub-model comprises a series of binary

variables registered in the second column of the tables of tests results. These binary variables correspond to the modalities of each characteristic (of respondents) for which a reference level is chosen in order to classify them into two categories when the variables take quantitative values or are strictly qualitative: In both cases, two values are attributed: 1 when the variable conforms to the reference level or when the characteristic is verified and 0 in the opposite case. The values of the modalities of different variables retained are given in appendix.

The probit model, defined in terms of the conditional mean of the explained variable with respect to explanatory variables, which is tested using Stata, is given as:

$$E(y_i) = F(\beta_1 + \beta_2), \ i=1\dots 2650$$

Y is the explained binary variable

X is a (1,k) vector of explanatory binary variables

$\hat{a}_2$ is a (k,1) vector of coefficients

$\hat{a}_1$ and $\hat{a}_2$ are coefficients estimated by the maximum likelihood method.

## 4.    Results and policy recommendations

The following tables give the various estimated $\hat{a}_2$, coefficients, the sign or significance proves or disproves our assumptions, for the two models of computer adoption in the one hand, and computer and Internet renting in the other.

### 4.1. Impact on pure adoption of the computer

The owning or not of a computer, a binary variable, is explained by a basic socioeconomic model that is progressively extended to localization and to psycho-sociological factors such as lifestyle, perceived utility and perceived ease.

| Explanatory and reference variables | | ICT adoption model | | | | |
| --- | --- | --- | --- | --- | --- | --- |
| | | Model : computers(desktops and laptops) | | | | |
| | | Socioeconomic model | Localization model | Lifestyle model | Perceived Utility model | Perceived Ease model |
| i) Income of household head<br>*reference variable : having an income higher than 300 000* | | 0,213**<br>(0,103) | 0,221**<br>(0,103) | 0,206**<br>(0,104) | 0,131<br>(0,104) | 0,128<br>(0,105) |
| ii) Total income of household<br>*Reference variable : having an income higher than 300 000* | | 0,031<br>(0,096) | 0,008<br>(0,097) | 0,011<br>(0,095) | -0,010<br>(0,098) | -0,023<br>(0,099) |
| iii) Socio-professional category<br>*reference variable : not having a professional occupation* | | 0,030<br>(0,038) | 0,030<br>(0,038) | 0,025<br>(0,038) | 0,012<br>(0,039) | 0,018<br>(0,040) |
| iv) Level of education<br>*Reference variable : having a level less than secondary* | - Training : general/Professional/none | 0,131<br>(0,154) | 0,147<br>(0,156) | 0,156<br>(0,155) | 0,153<br>(0,169) | 0,152<br>(0,171) |
| | - High school<br>.GCE A/ GCEA+2/.GCE A +3+4/ .GCE A +5 | 0,169***<br>(0,056) | 0,173***<br>(0,056) | 0,172***<br>(0,058) | 0,045**<br>(0,066) | -0,001**<br>(0,066) |
| v) Language | .French : read | 1,175***<br>(0,403) | 1,185***<br>(0,425) | 1,138***<br>(0425) | 1,180**<br>(0,503) | 1,217**<br>(0,554) |
| | .French : spoken | -0,417<br>(0,324) | -0,416<br>(0,336) | -0,412<br>(0,337) | -0,553<br>(0,395) | -0,602<br>(0,420) |
| | .English : read | 0,261<br>(0,189) | 0,249<br>(0,188) | 0,291<br>(0,191) | 0,184<br>(0,233) | 0,139<br>(0,242) |
| | .English : spoken | 0,079<br>(0,183) | 0,060<br>(0,184) | -0,012<br>(0,189) | -0,130<br>(0,229) | -0,141<br>(0,236) |
| vi) Age<br>*Reference variable : being 65 years and above of age* | | 0,049<br>(0,103) | 0,059<br>(0,104) | 0,025<br>(0,105) | 0,169<br>(0,109) | 0,180<br>(0,113) |
| vii) Family structure | .N. of child< 11 yrs | -0,083*<br>(0,050) | -0,084*<br>(0,051) | -0,099*<br>(0,051) | -0,115**<br>(0,057) | -0,133**<br>(0,060) |
| | .N. of child from 11-18 yrs | 0,065<br>(0,043) | 0,073<br>(0,046) | 0,058<br>(0,038) | 0,039<br>(0,059) | 0,043<br>(0,064) |
| | .Persons of more than 18 yrs | 0,029<br>(0,050) | 0,023<br>(0,050) | 0,034<br>(0,050) | 0,006<br>(0,051) | 0,028<br>(0,053) |
| viii) Level of education of spouse | Training : general/ Professional/ none | 0,008<br>(0,171) | -0,012<br>(0,176) | -0,060<br>(0,175) | 0,008<br>(0,191) | 0,012<br>(0,193) |
| | - High school<br>.GCE A/ GCEA+2/.GCE A +3+4/ .GCE A +5 | 0,145***<br>(0,056) | 0,149***<br>(0,056) | 0,116**<br>(0,058) | 0,141**<br>(0,062) | 0,150**<br>(0,063) |

| | | | | 0,218 (0,172) | 0,118 (0,181) | 0,091 (0,203) | 0,105 (0,194) |
|---|---|---|---|---|---|---|---|
| ix) Localization *Reference variable : lives in a popular areas* | .Residential area .High class residential areas | | | | | | |
| x) Lifestyle of respondent | - Television | | | | 0,204 (0,408) | 0,320 (0,420) | 0,378 (0,455) |
| | - Satellite and cable TC | | | | -0,017 (0,189) | -0,054 (0,198) | -0,025 (0,204) |
| | - CD/DVD/MP3 drives | | | | 0,224 (0,196) | 0,051 (0,207) | 0,092 (0,209) |
| | - Fixed and mobile phones | | | | 0,557* (0,319) | 0,618* (0,382) | 0,575 (0,378 |
| | - Digital camera/ video camera | | | | 0,497** (0,225) | 0,563** (0,256) | 0,532** (0,259) |
| xii) Type of training (ease) | - Formal | | | | | -0,066 (0,378) | -0,206 (0,413) |
| | - Informal | | | | | 0,077 (0,320) | -0,183 (0,333) |
| xiii) Training (ease) | - Private centre | | | | | 0,669** (0,337) | 0,576* (0,347) |
| | - Community centre/ Associations/ Friends | | | | | 0,232 (0,289) | 0,268 (0,288) |
| | - Family | | | | | 1,024*** (0,347) | 1,047*** (0,344) |
| | - University/school/ secondary school/ high school | | | | | 0,054 (0,281) | -0,001 (0,278) |
| ix) Difficulties of use (ease) | - Need help from third parties | | | | | -0,243 (0,243) | -0,470** (0,235) |
| | - Assist third parties | | | | | 0,928*** (0,229) | 0,877*** (0,231) |
| x) Reasons for use (utility) | - Personal activities | | | | | | 0,681*** (0,238) |
| | - Professional activities | | | | | | 0,038 (0,233) |
| | - Part of training | | | | | | 0,663** (0,279) |

**Table 3: Results of the computer adoption model**

∗ Significance level equal to 10%; ∗∗ significance level equal to 5%; ∗∗∗ significance level equal to 1%

(.) Wald statistics

From table 3, we observe that socioeconomic factors such as total income of household, level of education, family structure and the level of education of spouse weakly influence computer adoption. Age does not play any role. The effect of language varies: read French has a positive impact while read English and spoken French have no effect on adoption, probably because the two Anglophone town chosen, Limbe and Buea, are more like suburbs than metropolis such as Douala where there is higher proportion of households having above average levels of education.

When the model is incrementally extended, the effect of socioeconomic variables tend to reduce to the profit of psycho-sociological factors: the impact of lifestyle (the possession of a phone, of digital or video camera), perceived difficulty (training in a private centre or in the family, help received from or given to third parties) have a strong effect; perceived utility (personal activities, part of training) has also a significant impact.

### 4.2. Impact on computer and Internet renting

Computer and Internet renting follows an individual logic with respect to the adoption model previously envisaged. Individual characteristics of respondents are therefore retained in order to explain choices. The difference with the first model is due to the fact that purely economic factors such as cost of equipments and income seem no more to influence the decision of households in a decisive manner or in the expected direction given the low cost of renting these equipments out of home.

In the 2008 survey, four sub-categories describe the frequency of use; they are grouped in pairs to obtain a binary variable for econometric test: a weak frequency of use (less than once a month and once or many times a month) and a strong frequency (once or many times a week and once or many times a day). Model results of computer renting, very similar to those of Internet renting model summarized in the table below, are given in appendix.

| Explanatory and reference variables | Descriptive | ICT adoption model | | | | | |
|---|---|---|---|---|---|---|---|
| | | Model : Internet Frequency of use model | | | | | |
| | | Socioeconomic model | Localization model | Lifestyle model | Competences model | Perceived Utility model | Perceived Ease model |
| i) Personal Income of The respondent *reference variable : having an income higher than 100 000* | | 0,220*** (0,055) | 0,233*** (0,058) | 0,214*** (0,060) | 0,238*** (0,075) | 0,117 (0,082) | 0,104 (0,086) |
| ii) Socio-professional category of respondents *Reference variable : does not have a professional occupation* | | -0,001 (0,033) | -0,005 (0,034) | 0,003 (0,035) | 0,005 (0,046) | 0,008 (0,049) | 0,003 (0,049) |
| iii)Type of formation *reference variable: general training* | - Training general/professional/none | -0,077 (0,148) | -0,068 (0,151) | -0,095 (0,156) | -0,243 (0,194) | -0,254 (0,199) | -0,216 (0,208) |
| iv)Level of education *Reference)variable : having a level less than secondary* | - High school .GCE A/ GCEA+2/.GCE A +3+4/ .GCE A +5 | 0,056 (0,052) | 0,045 (0,054) | 0,016 (0,056) | -0,137* (0,074) | -0,158** (0,076) | -0,142* (0,078) |
| v)language | French: read | -0,355 (0,299) | -0,336 (0,299) | -0,220 (0,310) | -0,152 (0,416) | -0,301 (0,447) | -0,319 (0,437) |
| | French: spoken | -0,210 (0,306) | -0,204 (0,306) | -0,225* (0,310) | -0,484 (0,375) | 0,446 (0,404) | -0,445 (0,393) |
| | English: read | 0,142 (0,201) | -0,199 (O,205) | -0,072 (0,312) | -0,610 (0,256) | 0,673*** (0,260) | 0,562** (0,263) |
| | English: spoken | 0,135 (0,173) | -0,137 (0,178) | 0,213 (0,213) | -0,140 (0,210) | -0,133 (0,221) | -0,095 (0,225 |

| | | | | | | ) |
|---|---|---|---|---|---|---|---|
| vi)) Age of respondent *Reference variable: is 65 years and plus* | | -0,179* (0,093) | -0,159* (0,095) | -0,167* (0,100) | -0,121 (0,129) | -0,141 (0,135) | -0,178 (0,137) |
| vii) Localization of house hold *Reference variable : lives in a popular residential area* | | | -0,134 (0,143) | -0,213 (0,148) | -0,229 (0,192) | -0,196 (0,197) | -0,158 (0,204) |
| viii)) Lifestyle of respondent - | - .Desktop/laptop computers | | | 0,592*** (0,150) | 0,425** (0,188) | 0,407** (0,195) | 0,451** (0,199) |
| | .Televisions | | | -0,018 (0,308) | 0,031 (0,425) | -0,174 (0,451) | -0,290 (0,464) |
| | .Cable/satellite TV channels | | | -0,076 (0,190) | 0,044 (0,240) | 0,118 (0,235) | 0,157 (0,246) |
| | .CD/ DVD/ MP3 drives | | | -0,157* (0,188) | -0,397** (0,218) | -0,352* (0,213) | -0,319 (0,224) |
| | .Fixed and mobile phones | | | 0,541** (0,253) | 0,179 (0,305) | 0,234 (0,312) | 0,160 (0,321) |
| | .Digital and video camera | | | 0,120 (0,189) | 0,185 (0,229) | 0,102 (0,241) | 0,069 (0,253) |
| ix) framework of training (ease) | .Formal | | | | 0,085 (0,304) | 0,046 (0,309) | 0,062 (0,330) |
| | .Informal | | | | 0,220 (0,293) | 0,144 (0,303) | 0,176 (0,330) |
| x) Training (ease) | .Private centre | | | | 0,236 (0,238) | 0,112 (0,246) | 0,111 (0,255) |
| | .Community centre | | | | -0,161 (0,229) | -0,116 (0,240) | -0,141 (0,248) |
| | .Associations/Friends | | | | -0,017 (0,292) | 0,012 (0,292) | 0,068 (0,293) |
| | .Family .University/school/ secondary school/ high school | | | | 0,351 (0,244) | 0,358 (0,254) | 0,433 (0,259) |
| xi)) Competences (ease) | .For internet users | | | | 0,650*** (0,202) | 0,610*** (0,208) | 0,670*** (0,211) |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | .For the choice of a cyber | | | | 0,126 (0,183) | 0,188 (0,185) | 0,157 (0,191) |
| | .For the choice of an internet provider | | | | 1,501*** (0,283) | 1,359*** (0,295) | 1,380*** (0,312) |
| xii)) Raisons of uses (utility) | .Personal activities | | | | | -0,135 (0,333) | -0,204 (0,318) |
| | .Professional activities | | | | | 0,929*** (0,217) | 0,956*** (0,249) |
| | .Part of my train | | | | | 0,178 (0,209) | 0,232 (0,214) |
| xiii) Motivation (utility) | .By curiosity | | | | | | -0,220 (0,190) |
| | .In order not to be different from others | | | | | | -0,066 (0,245) |
| | .In order to be different from others | | | | | | 0,480 (0,339) |
| | .Requirements of my job | | | | | | 0,196 (0,277) |
| | .Requirements of my studies | | | | | | -0,624*** (0,236) |
| | .Because it is important for | | | | | | -0,039 (0,190) |

**Table 4: Results of the computer renting model**

∗ Significance level equal to 10%; ∗∗ significance level equal to 5%; ∗∗∗ significance level equal to 1%
(.) Wald statistics

Considering all the models, high personal income and age influence frequency of use only in the basic socio-economic model, the role of socio-professional category and level of education is very low. Spoken or written language does not seem to have a clear effect, even if read English matters in the psycho-sociologic model. Some variables of lifestyle (the possession of a computer) have a complementary effect and others (CD/DVD/MP3), a substitution effect like in the precedent models. The type or place of training does not matter for the respondent who is familiar with internet contrary to perceived difficulty (competences). Variables of perceived utility have opposite effects: positive for professional activities and negative for

requirements to the respondents' studies, which means that the use of Internet is oriented towards activities different from studies like communication, leisure, job searching and search for current news.

## 5. Conclusion

At the completion of this study, it is apparent that two modes of diffusion coexist with the same determinants: pure adoption mode that applies only to the computer (10.98 % of respondents) and not the internet (1.5% of respondents) and the renting mode, which is more widespread and covers 91.98% of respondents for the computer and 31.32 % for Internet.

Two indicators of adoption are retained in the explanation of household behaviours: Domestic endowment in ICTs for the computer, and the alternative form (frequency access through renting), for the computer and the Internet. Two types of models were also tested: the model of pure adoption and the model of adoption through the availability of the equipment and its use.

The socioeconomic model which is pertinent in West Europe for the period of study proves to be inefficient in Cameroon. Its explanatory power is low when tested alone and becomes negligible when other psycho-sociological factors such as lifestyle, perceived utility or perceived complexity in the use of the computer and internet. The idea that people have on the complexity of these two technologies, training, snobbishness, and the previous use of similar technologies are significant contrary to a factor such as personal income which has an inverse effect on the use of internet. Total income on the contrary positively affects adoption by respondents. This difference marks the demarcation line between the two ICTs diffusion modes and their underlying logics.

As regards economic policies, the state should encourage the opening of media centres in urban and rural areas, promote the training of youths, notably in secondary and high schools and continue the covering of the national territory with optical fibres and its accompanying basic infrastructures in a more competitive and open market. The development of social networks by local communities can also stimulate the adoption and use of the computer and the Internet through the imitation effect for adults above

school age. The promotion of private media centres through appropriate tax system can strengthen their development. The capacity and willingness of the state to carry out such reforms constitute a challenge, because resources will be reduced and expenditures increased in the short run, but the effects of these economic policies will be positive in the long run.

## Appendix 1: List of explanatory variables and their values

| Explanatory and reference variables | Descriptive | Modalities | Value of variables |
|---|---|---|---|
| i) Income of household head<br>*reference variable : having an income higher than 300 000* | <25000<br>.25000-50000<br>.51000-100000<br>.101000-150000<br>.151000-200000<br>.201000-3000000<br>.301000-400000<br>.401000-500000<br>.>501000 | -More than300000<br><br>-Less than 300000 | 1<br><br>0 |
| ii)Personal Income of the respondent<br>reference variable= having an income higher than 100000 | <25000<br>.25000-5OOOO<br>.51000-100000<br>.101000-150000<br>.151000-200000<br>.301000-400000<br>.401000-500000<br>.>501000 | -More than 100000<br><br>-Less than 100000 | 1<br><br>0 |
| ii) Socio-professional category of respondents<br>*Reference variable : does not have a professional occupation* | Civil servant<br><br>.Private sector  employee<br><br>.Underemployed | -Does have a professional occupation<br><br>-Does not have a professional occupation | 1<br><br>0 |
| *iii*) Type of training<br>*Reference variable: general* | -General training<br><br>-Professional training<br><br>-None | - General training<br><br>-Professional training or none | 1<br><br>0 |
| iii) Level of education<br> *Reference variable : having a level   less than secondary* | .Primary school<br><br>.First        cycle/secondary school<br><br>.Second      cycle/secondary school<br>.GCE A/<br>GCEA+2/<br>.GCE A +3+4/<br>.GCE A +5 | -Less than secondary school<br>-Secondary School and more | 1<br><br>0 |
| iv) Language | | .French : spoken<br><br>.French : read<br><br>.English : spoken<br><br>.English : read | 1 or 0<br><br>1 or 0<br><br>1 or 0<br><br>1 or 0 |
| v) Age of respondent | .15-22 years | -More than 65 years | 1 |

| | | | |
|---|---|---|---|
| *Reference variable: is 65 years and plus* | .22-29 years | -Less than 65 years | 0 |
| | .30-44years | | |
| | .45-49years | | |
| | .60-à-64 years | | |
| | .65 and more | | |
| vi) Localization of house hold<br>*Reference variable : lives in a popular residential area* | .Popular area | -Leave in popular areas | 1 |
| | .Residential area | -Does not leave in popular areas | 0 |
| | .High standing area | | |
| vii) Lifestyle of respondent | | - .Desktop/laptop computers | 0 or 1 |
| | | .Televisions | 0 or 1 |
| | | .Cable/satellite TV channels | 0 or 1 |
| | | .CD/ DVD/ MP3 drives | 0 or 1 |
| | | .Fixed and mobile phones | 0 or 1 |
| | | .Digital and video camera | 0 or 1 |
| viii) Type of training  (ease) | | .Formal | 0 or 1 |
| | | .Informal | 0 or 1 |
| ix) Training  (ease) | | .Private centre | 1 or 0 |
| | | .Community centre | 1 or 0 |
| | | .Associations/Friends | 1 or 0 |
| | | .Family | 1 or 0 |
| | | .University/school/ secondary school/ high school | 1 or 0 |
| x) Competences  (ease) | | .For internet users | 1 or 0 |
| | | .For the choice of a cyber | 1 or 0 |
| | | .For the   choice of an internet provider | 1 or 0 |

| | | | |
|---|---|---|---|
| xi) Raisons of uses (utility) | | .Personal activities | 1 or 0 |
| | | .Professional activities | 1 or 0 |
| | | .Part of my train | 1 or 0 |
| xii) Motivation (utility) | | .By curiosity | 1 or 0 |
| | | .In order not to be different from others | 1 or 0 |
| | | .In order to be different from others | 1 or 0 |
| | | .Requirements of my job | 1 or 0 |
| | | .Requirements of my studies | 1 or 0 |
| | | .Because it is important for me | 1or 0 |

(1)   1 if yes and 0 if no

# Appendix 2: Results of the computer renting model

| Explanatory and reference variables | Modalités | Computer renting model | | | | |
|---|---|---|---|---|---|---|
| | | Frequency access to computer out of home | | | | |
| | | Socioeconomic model | Localization model | Lifestyle model | Perceived utility model | Perceived ease model |
| i) Personal income of the respondent reference variable having an income higher than 100.000 | | 0,159*** (0,002) | 0,171*** (0,001) | 0,157*** (0.006) | -0,012 (0,864) | -0,014 (0,847) |
| ii) Socio-professional category of respondent reference variable: does not have a professional occupation | | 0,037 (0,191) | 0,026 (0,368) | 0,036 (0.215) | 0,011 (0,755) | 0,009 (0,801) |
| iii) level of education of respondent *Reference variable : having a level less than secondary* | - Training: general/professional/none -high school .GCE.A/GCEA+2/GCEA+3+4/.GCE+5 | 0,170* (0,181) 0,067** (0,123) | 0,212* (0,100) 0,056 (0,212) | 0,165 (0,219) 0,029 (0,537) | 0,016 (0,914) 0,007 (0,905) | 0,003 (0,986) 0,011 (0,849) |
| iv) Language . | French : read | 0,222 (0,480) | 0,245 (0,427) | 0,057 (0,854) | 0,179 (0,649) | 0,190 (0,625) |
| | .French : spoken | -0,139* (0,658) | -0,097 (0,754) | 0,111 (0,720) | -0,075 (0,844) | -0,106 (0,779) |
| | .English : read | 0,172 (0,308) | 0,209 (0,223) | 0,1720 (0,317) | 0,263 (0,196) | 0,297 (0,149) |
| | .English : spoken | 0,048 (0,749) | 0,088 (0,564) | 0,081 (0,603) | 0,152 (0,397) | 0,129 (0,472) |
| vi) Age *Reference variable : being 65 years and plus* | | -0,152* (0,072) | -0,137 (0,111) | -0,133 (0,139) | -0,219 * (0,061) | -0,214 * (0, 071) |
| vii) Localization *Reference variable : lives in a popular areas* | . Residential area .High class residential areas | | -0,223* (0,079) | -0,289** (0,028) | -0,324* (0,073) | -0,289 (0,115) |
| xi) Lifestyle of respondent | Desktops and laptops - Television | | | 0,713*** (0,000) | 0,784*** (0.000) | 0,776*** (0,000) |

| | | | | | | |
|---|---|---|---|---|---|---|
| - | | | | 0,298 (0,326) | -1,037 *** (0,002) | -1,017 *** (0,002) |
| | -Satellite and cable TV | | | -0,073 (0,626) | -0,004 (0,981) | -0,012 (0,942) |
| | -CD/DVD/MP3 drives | | | -0,0671 (0,667) | 0,137 (0,461) | 0,103 (0,579) |
| | -Fixed and mobile phones | | | 0,211 (0,337) | 0,371 (0,192) | 0,361 (0,208) |
| | Digital camera/ video camera | | | -0,004 (0,982) | -0,386* (0,100) | -0,377 (0,111) |
| xii) Type of training | . Formal | | | | 0,050 (0,841) | 0 ,068 (0,784) |
| - | .Informal | | | | -0,189 (0,433) | -.188 (0.435) |
| x) training - | .Centre privé payant .Centre public communautaire .Associations .Amis .Famille | | | | 0,593 (0,007) 0,308 (0,114) 0,298 (0,284) 0,066 (0,758) | 0,585 (0,008) 0,340* (0.083) 0,329 (0,235) 0,038 (0,859) |
| xiii) Raisons d'utilisation | .Activités personnelles .Activités professionnelles dans le cadre de ma formation | | | | -0,463** (0,013) 1,353 *** (0,000) -0,096 (0,572) | -0,479** (0,011) 1,322*** (0.000) -0,088 (0,604) |
| Xii) Difficulté d'utilisation | - Avez-vous parfois recours à des tiers | | | | | -0,498** (0,041) |

\*\*\* significance level equal to 10%     \*\* significance level equal to 5%

  \* significance level equal to 1%   (.) Wald statistics

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