# Drivers for the Actual Usage of Cloud Services: An Examination of Influencing Factors for Digital Natives

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**Abstract.** Cloud Computing has been gaining significant relevance throughout the business as well as the private environment. With several factors responsible for this adoption, this paper explores the influence of the perceived usefulness, perceived ease of use, trust, costs and age on the actual usage of Cloud services. The focus is set on the group of digital natives whereat attitudinal differences amongst them are examined in a survey. Correlation analyses show that the factors perceived usefulness, perceived ease of use, trust and age influence the actual usage of Cloud services, whereas the factor costs has no statistically significant relationship with the actual usage.

**Keywords:** Cloud Computing, cloud services, digital natives, technology acceptance model, influencing factors, technology adoption.

## 1 Introduction

For the last couple of years Cloud Computing has been one of the fastest growing business segments of the IT industry [1, 2]. Areas of application can be found both in the business and in the private environment. For companies it is becoming more and more crucial to keep costs low to remain competitive in the globalized economy. As the ratio of IT expenditures plays a vital role, the investigation of novel opportunities to lower them is of high interest for them. Cloud Computing is one of those opportunities [3, 4]. The increasing adoption of Cloud Computing is also reflected in revenues gained by Cloud Service Providers (CSPs) [5]. Nevertheless, the attitude towards Cloud Computing among companies as well as individuals is still quite divergent. According to a recent study, the number of supporters and opponents is growing in a comparable way. The waverers are taking up position little by little, likewise on both sides [6]. The reasons for this are manifold and the influencing factors are still subject of investigation in both research and economy [7]. One of the factors influencing the individual's attitude towards Cloud Computing might derive from the gap regarding accessibility and skills to use these technologies, the so-called "digital divide" [8]. This leads to the situation that individuals who grew up in the digital age and use these technologies in their daily life are often more technologically adept [9].

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Within this paper the authors focus on the investigation of influencing factors for the actual usage of Cloud services among people who grew up in the digital age, termed as the "digital natives" [10]. The research objective was to examine the attitudes of individuals within this age group towards the use of Cloud Computing services under consideration of their age and several other factors.

The remainder of this paper is arranged as follows: Section two deals with the clarification of essential terms used within the paper to establish a consistent understanding. Section three outlines the research methodology leading to the conduction of a survey. Section four covers the results of the survey and discusses the findings. Finally, the paper is concluded in section five.

## 2 Definition of Key Terms

This section provides an overview of the key terms which is dealt with in this paper in order to establish a consistent understanding. The focus is set on the more recent and complex terms Cloud Computing, followed by the concept of the digital divide and the related terms digital natives and digital immigrants.

### 2.1 Cloud Computing

Both academic and applied research provide a variety of definitions for Cloud Computing [11, 12]. The definition provided by Mell and Grance from the National Institute of Standards and Technology (the so-called NIST definition) [13] is the most popular one which most other definitions refer to [11]. According to the NIST definition, "*Cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction. This cloud model is composed of five essential characteristics, three service models, and four deployment models.*" [13] The first mentioned essential characteristics are:

- *on-demand self-service*: automatic provision of computing capabilities
- *broad network access*: services are provided over the network and available for different platforms
- *resource pooling*: dynamic allocation of services from a shared pool for multiple tenants
- *rapid elasticity*: rapid or even automatic provisioning and releasing of resources depending on the actual demand
- *measured service*: automatic management and monitoring of resource usage by consumer and provider

The three types of service models are [13]:

- *Software as a Service (SaaS)*: applications and software are provided.
- *Platform as a Service (PaaS)*: basic infrastructure is provided, including an operating system
- *Infrastructure as a Service (IaaS)*: basic hardware and networking resources are provided.

The NIST definition furthermore recognizes the following deployment models [13]:

- *private cloud*: the provided services are exclusively available for one organization.
- *community cloud*: exclusive allocation of services to a defined group of users.
- *public cloud*: services are provided for general public.
- *hybrid cloud*: a combination of two or more of the other models which work independently but are connected to enable portability of data, applications etc.

Even though further aspects have been identified in literature [11, 12], the NIST definition is considered as sufficient and accurate enough to provide a common understanding of the term Cloud Computing in the context of this paper.

### 2.2 Digital Divide, Digital Natives and Digital Immigrants

In the digital age the use of information technology (IT) is increasingly a basic requirement for access to all kind of information and for participation in social and economic life. The term "digital divide" hereby describes "*the perceived disadvantage of those who either are unable or do not choose to make use of these technologies in their daily life*" [8]. Discussions about the digital divide, its background and its impact are taking place in political as well as in academic communities [14]. A digital divide can emerge from different origins like:

- the gap between industrialized countries and developing countries [15]
- the gap between rich and poor countries [16]
- the gap between individuals, households, businesses and geographic areas at different socio-economic levels with regard to both opportunities to access IT and their use of the internet for a wide variety of activities [17]
- the disparity in access across classifications of race, gender, age, income and education to telephone, personal computers and the internet [18]
- the gap between the media-savvy, multitasking younger Web 2.0 generation and others that need to familiarize themselves with these technologies, also called the Digital Divide 2.0 [19].

Another approach for a conceptualization of the digital divide is the differentiation between *digital access divide*, *digital skill and use divide* and *digital outcome divide*, each of them divisible into the three levels individual, organizational and global [20, 21].

As this brief literature review has shown, there exist multiple definitions and forms of digital divides. For the purpose of this research the focus is on the disparity in access across individuals of different ages which are roughly defined as digital natives and digital immigrants. This paper examines amongst others the factor *age* as a possible reason for differences in the actual usage of Cloud services. These age groups are commonly split into the digital natives and the digital immigrants. Digital natives are defined as people who were born into the digital age, after 1980, and therefore grew up having access to networked digital technologies and strong computer skills and knowledge [10, 22]. Digital immigrants are defined as people who were born before 1980 and therefore came in contact with digital technologies later in their lives [22]. The classification into these two groups has also been subject of criticism. Wang et al. for

example suggest the application of "*a continuum rather than a rigid dichotomy between digital natives and digital immigrants*" [14]. Within this paper the authors investigate particularly the group of digital natives.

## 3 Research Methodology

The modus operandi of the undertaken investigation comprised four main steps. (i) In the first step suitable factors influencing the actual usage of Cloud services were identified. The factors *perceived usefulness, perceived ease of use, trust* and *costs* as well as *age* were chosen for examination. (ii) Five hypotheses aiming at the before mentioned factors were formulated. (iii) A quantitative survey was carried out to test these hypotheses. (iv) The data gained from the survey was subject to correlation analyses followed by an interpretation of the results.

### 3.1 Influencing Factors

Well established theories on the adoption of technological innovations formed the basis for identifying influencing factors on the usage of Cloud services. For the context of this research, factors from the perspective of the individual's perception were of primary interest. For this reason the two main factors *perceived ease of use* and *perceived usefulness* provided by Davis' Technology Acceptance Model [23] were selected. Davis' model illustrates factors influencing the behavior of individuals towards novel technologies. The chain of factors starts with the external stimulus *system design features* which influences the cognitive responses *perceived ease of use* and *perceived usefulness*. It is these two factors which directly influence the affective response *attitude towards using* and thereby the behavioral response *actual system use*. Additionally, the factors *trust* and *costs* are subject of investigation as they also were already identified as important factors concerning the adoption of Cloud Computing [7]. Finally, as already mentioned, the research also examined the *age* as a driver for the adoption of Cloud services.

### 3.2 Formulation of Hypotheses

In the second step of the investigation five hypotheses were formulated addressing the five factors *perceived usefulness*, *perceived ease of use*, *trust*, *costs* and *age*:

1. The greater the perceived usefulness of Cloud services, the higher their actual usage.
2. The greater the perceived ease of use of Cloud services, the higher their actual usage.
3. The greater the trust in Cloud services, the higher their actual usage.
4. The higher the costs involved in using Cloud services, the lower their actual usage.
5. The younger the individual, the more likely is the actual usage of Cloud services.

These five hypotheses were the main subject of examination within the subsequent survey.

### 3.3 Testing of Hypotheses and Conduction of the Survey

In order to test the hypotheses a quantitative survey was conducted. To measure the factors several questions were formulated. These predefined questions were included into a tool for online surveys (SoSci Survey). The invitation link was spread via e-mail and additionally via social media among the Austrian population. The survey was executed in German language and open for the period of 10 days (Aug. 18-28, 2013). Limiting its scope to the Austrian population helped to avoid interfering influences for example from geographical or cultural factors which could have appeared by broadening the target group. In the course of the survey a total of 32 questions were asked, two of which aiming at hypothesis H1 [u1, u2], four of which aiming at hypothesis H2 [e1-e4], two aiming at H3 [t1, t2], two aiming at H4 [c1, c2] and one question aiming at H5 [a1]. Further questions were asked concerning the general attitude towards technology, availability and image. The following questions were asked concerning the particular hypotheses:

- [u1] Are Dropbox, Google Docs, iCloud or similar services useful or could they be useful for your daily tasks? (H1)
- [u2] Do you think that Cloud services are able to increase your performance in a certain task? (H1)
- [e1] Storing data in the Cloud does not cause any effort, almost by itself. (H2)
- [e2] I know how to store my data in the Cloud. (H2)
- [e3] Accessing my data is facilitated by Cloud services because they are available everywhere. (H2)
- [e4] Utilization of Cloud services is more complicated than storing data locally. (H2)
- [t1] How secure do you think is data stored in the Cloud (Dropbox, Google Drive, etc.) against access by third parties? (H3)
- [t2] How secure do you think is private data stored in the Cloud (Dropbox, Google Drive, etc.) against data loss? (H3)
- [c1] Do you think a backup of your computer or smartphone in the Cloud is cheaper than a local backup? (H4)
- [c2] Do you think it is cheaper to recover data after a hardware failure from the Cloud than from a local storage? (H4)
- [a1] What is your year of birth? (H5)

Furthermore the participants were asked about their actual usage of Cloud services:

- [au] Do you use Cloud services like Dropbox, iCloud, Amazon EC2, Google Docs, Google Drive etc.?

The participants were asked to choose their answer on a 4-point Likert scale (Cf. frequency tables 1 - 3 in the next section). For the birth year [a1] they had radio buttons to choose from and for the actual usage [au] they had to choose between three options

("no", "yes – one", and "yes – multiple"). The answers to these questions were subject of correlation analyses. The results of the survey are presented in section 4 followed by their interpretation and discussion.

# 4 Results and Discussion of Findings

## 4.1 Overview and Frequency Analyses

The survey provided a total of 246 completed questionnaires. 44 participants were born before 1980 and thus classified as digital immigrants; the remaining 202 were digital natives. Focusing on the group of digital natives only, received inputs by participants born before 1980 were not included in further examinations. Details concerning the distribution of years of birth are shown in Fig. 1.

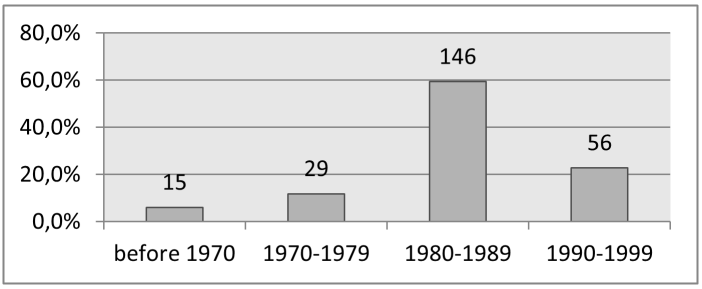


**Fig. 1.** Frequency distribution of years of birth

The frequency analyses shown in the following tables provide an overview of the responses. To avoid non-reliable responses the participants were also given the choice of "no opinion" or "cannot answer", therefore the number of valid cases varies.

**Table 1.** Frequency analyses (perceived usefulness and costs)

| | | [u1] | | [u2] | | [c1] | | [c2] | |
|---|---|---|---|---|---|---|---|---|---|
| | | frequency | % | frequency | % | frequency | % | frequency | % |
| Valid | yes | 105 | 52,0 | 74 | 36,6 | 25 | 12,4 | 56 | 27,7 |
| | rather yes | 61 | 30,2 | 70 | 34,7 | 69 | 34,2 | 69 | 34,2 |
| | rather no | 22 | 10,9 | 32 | 15,8 | 53 | 26,2 | 29 | 14,4 |
| | no | 7 | 3,5 | 6 | 3,0 | 30 | 14,9 | 17 | 8,4 |
| | total | 195 | 96,5 | 182 | 90,1 | 177 | 87,6 | 171 | 84,7 |
| Missing | no opinion | 7 | 3,5 | 20 | 9,9 | 25 | 12,4 | 31 | 15,3 |
| Total | | 202 | 100,0 | 202 | 100,0 | 202 | 100,0 | 202 | 100,0 |

**Table 2.** Frequency analyses (perceived ease of use)

| | | [e1] | | [e2] | | [e3] | | [e4] | |
|---|---|---|---|---|---|---|---|---|---|
| | | frequency | % | frequency | % | frequency | % | frequency | % |
| Valid | agree | 81 | 40,1 | 136 | 67,3 | 134 | 66,3 | 14 | 6,9 |
| | somewhat agree | 89 | 44,1 | 42 | 20,8 | 48 | 23,8 | 50 | 24,8 |
| | somewhat disagree | 12 | 5,9 | 2 | 1,0 | 3 | 1,5 | 56 | 27,7 |
| | disagree | 2 | 1,0 | 13 | 6,4 | 0 | 0,0 | 62 | 30,7 |
| | total | 184 | 91,1 | 193 | 95,5 | 185 | 91,6 | 182 | 90,1 |
| Missing | cannot answer | 18 | 8,9 | 9 | 4,5 | 17 | 8,4 | 20 | 9,9 |
| total | | 202 | 100,0 | 202 | 100,0 | 202 | 100,0 | 202 | 100,0 |

**Table 3.** Frequency analyses (trust)

| | | [t1] | | [t2] | |
|---|---|---|---|---|---|
| | | frequency | % | frequency | % |
| valid | secure | 5 | 2,5 | 62 | 30,7 |
| | rather secure | 77 | 38,1 | 104 | 51,5 |
| | rather insecure | 84 | 41,6 | 21 | 10,4 |
| | insecure | 26 | 12,9 | 9 | 4,5 |
| | total | 192 | 95,0 | 196 | 97,0 |
| missing | no opinion | 10 | 5,0 | 6 | 3,0 |
| total | | 202 | 100,0 | 202 | 100,0 |

**Table 4.** Frequency analyses (actual usage)

| | | [au] | |
|---|---|---|---|
| | | frequency | % |
| valid | yes, multiple | 121 | 59,9 |
| | yes, one of them | 61 | 30,2 |
| | no | 19 | 9,4 |
| | total | 201 | 99,5 |
| missing | cannot answer | 1 | ,5 |
| total | | 202 | 100,0 |

Within the next step the collected data was analyzed with regard to correlations. The results of the correlation analyses are shown in the following subsection.

### 4.2 Results of the Correlation Analyses

To unveil influencing factors on actual usage of Cloud services, several correlation analyses were conducted. Kendall's tau-b was chosen as correlation coefficient as raw data was of ordinal level. The answers to the questions [u1, u2, e1-4, t1, t2, c1, c2, a1] presented in subsection 3.3 were tested concerning correlations with the answers to question [au].

**Table 5.** Results of the correlation analysis concerning the actual usage [au]

| | | [u1] | [u2] | [e1] | [e2] | [e3] | [e4] | [t1] | [t2] | [c1] | [c2] | [a1] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| [au] | r | **,371**$^{**}$ | **,285**$^{**}$ | ,115 | **,244**$^{**}$ | ,093 | **-,188**$^{**}$ | **,136**$^{*}$ | **,140**$^{*}$ | -,020 | -,004 | **,180**$^{**}$ |
| | p | ,000 | ,000 | ,050 | ,000 | ,099 | ,003 | ,021 | ,018 | ,384 | ,479 | ,004 |
| | N | 195 | 182 | 184 | 193 | 184 | 182 | 191 | 195 | 177 | 171 | 201 |

r = Correlation coefficient (Kendall's tau-b), p = Significance level, N = Number of valid cases
**. The correlation is significant at a level of 0,01 (both sides).
*. The correlation is significant at a level of 0,05 (both sides).

**The Influence of Perceived Usefulness on Actual Usage.** As Table 5 shows, both questions aiming at the perceived usefulness of Cloud services show a significant statistical correlation with the actual usage of Cloud services. Therefore hypothesis H1 (the greater the perceived usefulness of Cloud services, the higher their actual usage) is supported by the survey result. Usefulness for daily tasks and the ability to increase performance have a positive influence on the actual usage of Cloud services.

**The Influence of Perceived Ease of Use on Actual Usage.** Concerning the perceived ease of use, the two questions [e2] and [e4] showed a significant correlation with the actual usage. The knowledge how to store data in the Cloud [e2] positively contributes to an actual usage. The negative correlation of [au] with [e4] reveals that the more complicated it is to use Cloud services the less is their actual usage. This means that the ease of use of Cloud services also influences the actual usage in a positive way. Hypothesis H2 (the greater the perceived ease of use of Cloud services, the higher their actual usage) is supported too.

**The Influence of Trust on Actual Usage.** The factor trust was addressed from two perspectives within the survey: Question [t1] aimed at trust in the meaning of privacy and security against access by third parties whereas question [t2] aimed at trust in the reliability of Cloud services and data safety concerning protection against data loss. As the frequency analysis revealed, the participants of the survey are by the majority quite positive about the safety of data stored in the Cloud whereas privacy and data security is still a more critical issue. Additionally, the correlation analysis showed that increased trust – regardless from which of the two perspectives – induces increased usage of Cloud services. Thus, trust is an important factor for the actual usage and hypothesis H3 is supported.

**The Influence of Costs on Actual Usage.** Questions concerning the factor costs did not show significant statistical correlation with the actual usage of Cloud services. Hypothesis H4 is not supported by the survey result which leads to the conclusion that costs have no significant influence on the actual usage of Cloud services.

**The Influence of Age on Actual Usage.** Concerning the factor age the conducted correlation analysis revealed that within the group of digital natives, it is the individuals born before 1990 who adopt Cloud services more intensely than those born after 1990. Hence, the initially proposed hypothesis H5 (the younger the individual, the more likely is the actual usage) was not supported. Instead, the correlation analysis revealed that older digital natives show a higher usage of Cloud services than younger digital natives. This result shows the importance of a more fine grained investigation into the group of digital natives to reflect an accurate view of the differences among multiple age groups. This supports the suggestion of Wang et al. stating that it is not sufficient to solely differentiate between the groups of digital natives and digital immigrants [14].

**Table 6.** Key statements of the survey

| Percent | Statement |
|---|---|
| 86.6 % | declared themselves as interested in technology. |
| 86.6 % | concern themselves with the topic Cloud Computing. |
| 90.1 % | use at least one Cloud service. |
| 40.6 % | think private data stored in the Cloud is secure against access by third parties. |
| 82.2 % | think private data stored in the Cloud is secure against data loss. |
| 46.6 % | think Cloud backups of computers or smartphones are cheaper than local backups. |
| 61.9 % | think recovering data after a hardware failure causing data loss can be cheaper from a Cloud storage than from local storages. |
| 82.2 % | think Cloud services are useful for their daily jobs. |
| 71.3 % | think Cloud services increase their performance. |
| 84.2 % | declared that storing data in the Cloud does not cause any effort. |
| 31.7 % | think it is easier to store data locally. |
| 88.1 % | know how to store data in the Cloud. |
| 90.1 % | think Cloud services make access to data easier through ubiquitous availability. |

## 5 Conclusion

This paper investigates factors influencing the actual usage of Cloud services among individuals. Five factors were derived from scientific literature dealing with the adoption and diffusion of innovations. A quantitative survey was conducted to reveal insights whereat the focus was set on the age group born after 1980, the so-called digital natives. The results indicate that the factors perceived usefulness, perceived ease of use, trust and age influence the actual usage of Cloud services, whereas the factor costs has no statistically significant relationship with the actual usage. Concerning the age it could be assessed, that individuals within the age group of those born before 1990 are actually more willing to use Cloud services than those born after 1990. The following Table 6 summarizes the managerial results of the survey.

The results also suggest that the classification into the two groups of digital natives and digital immigrants is not sufficient in the context of technological innovations like Cloud Computing. The considered age group of digital natives within this examination provides opportunities for researchers to undertake future investigations at a larger scale. Furthermore, the inclusion of a broader range of possible influencing factors might lead to a more complete set of factors relevant for the adoption of Cloud services among individuals.

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