

# Investigating the Influential Factors towards Mobile Services Adoption in Greece

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**Abstract:** This study presents a conceptual framework that combines perceived ease of use, perceived usefulness, innovativeness and trust in order to examine their influence on the mobile services' adoption intention in the Greek environment. The proposed conceptual framework is empirically tested using data collected from a survey with questionnaires addressed to 445 consumers. The methodologies applied include factor analysis in order to check the validity of the variables, classify and reduce questions into sub-variables if possible, and calculate factor loadings. Then, stepwise regression analysis is implemented to assess the best predictors among the aforementioned variables, which possibly affect the consumers' adoption intention. The findings show that all the variables (perceived ease of use, perceived usefulness, and innovativeness) have a statistically significant effect on people's adoption intention with the exception of trust. The implication of this work to both researchers and practitioners is discussed.

**Keywords:** innovativeness, trust, m-services, adoption intention, m-commerce

## I. Introduction

The transition from the cabled internet and the electronic services to the wireless internet and the mobile services is a fact. Thanks to the progress of the wireless communication technologies and devices (smartphones, PDAs, Palmtops, etc.), there is an increasing interest from both the industry and the public sector in exploring the expanding possibilities of their businesses or the betterment in the fulfillment of the individuals' every day needs.

The mobile data services mainly refer to the communication services (e-mails, SMS, MMS, etc.), web information services (weather information, sports, banking information, news, etc.), database services (telephone directories, map guides, etc.), entertainment (ringtones, videos, games, etc.) and commercial transactions (buying products, making reservations, banking, stock trading, etc.) [1].

The adoption of the mobile data services in Greece would be expected to be wide. Based on the results of the company "Focus Bari" presented in the conference Info Com World (2009), 91% of the population owns a mobile device and 18% uses the mobile phone as their exclusive means of communication. According to the mobile research team of a Greek university, however, 4 out of 5 Greeks have never used any of the aforementioned services, whereas the majority of the users seldom utilize such services [2]. The results of the same survey showed that the users are motivated to adopt the mobile data services, as long as these services are easy to learn and help to enhance with the time management on a personal or business level. In contrast, the

Greeks are skeptic to use mobile data services due to the cost and benefit imbalance, the actual financial cost of their use (the absolute amount of money they need to spend) and the possible inappropriate use of personal data.

The research question for a number of studies around the topic of mobile services refers to the driving factors that affect the consumers' willingness to adopt them. Multiple models have been suggested in scientific sources to examine the users' intentions and predict their behaviour towards new technologies [3]. In these theories a number of factors have been taken into account, such as perceived ease of use, perceived usefulness, social norms, self-efficacy, cost, etc. [3]-[5].

Prior studies in behavioral science and psychology have shown that personal traits, such as innovativeness, and psychological concerns, such as the fear of trusting something new, can be potential explanatory variables in technology acceptance [1]. The object of this study is to construct an instrument in order to provide an explanation of the determinants of mobile data services acceptance. The study suggests a model that shows how its constructs influence the individuals' adoption towards the above services. Such a framework would be helpful not only for consumers' behavioral prediction, but also for researchers and practitioners to identify the factors influencing internal beliefs and attitudes.

The paper is organized in four sections. In section 2, there is an explanation of the hypotheses formed based on literature review and the description of the constructs that are included in the theoretical framework. This is followed by Section 3, which describes the applied methodology and presents the survey's results. The final section concludes with a discussion commenting on the data gathered and recommends some ideas for future research directions.

## II. Conceptual Framework and Research Hypotheses

A survey research is conducted using a questionnaire to examine the factors that affect the users' behavioral intention to adopt mobile data services. Based on the literature review, the conceptual framework is formulated (Figure 1). The framework includes the following variables (Table 1): M-Services Adoption Intention, Perceived Usefulness, Perceived Ease of Use, Innovativeness and Trust. In this section, the variables are explained, as well as, the related hypotheses.

#### A. *M-services Adoption Intention:*

In most of the well-established models of behavioral intention theories, such as the Technology Adoption Model (TAM) and The Theory of Reasoned Action (TRA), there has been an attempt to examine the factors that affect the consumers' decision on using a technology studied [5]. Fishbein and Ajzen first defined the term "Behavioral Intention" to depict "a person's subjective probability that he will perform some behavior" [6]. Davis also followed up with this idea to give shape to TAM [7], which finally concluded to the "Actual System Use". Based on these concepts, in the paper herein, there is a construct included in the proposed framework entitled "m-services adoption intention" to describe a person's subjective probability that he or she will perform mobile data services.

#### B. *Perceived Usefulness:*

"Perceived usefulness" has been an instrumental construct in many of the technology adoption models that have been proposed since 1989, when Davis first used this term. It was defined as "the degree to which a person believes that using a particular system would enhance his or her job performance" [7]. Perceived usefulness has been included as a construct in a number of surveys for different types of technologies and systems, such as mobile payments [8], mobile commerce [9], mobile data services in China [10], application frameworks [11], and in general in researches for new technologies [4], [5], [12], [13]. In all the above studies, the perceived usefulness of the technology concerned influenced positively individuals' adoption intention of this technology. Thus, it is reasonably expected that the same relationship between the framework's constructs could also be applied to the present study. Therefore:

H1: Perceived Usefulness will have a positive effect on m-services adoption intention.

#### C. *Perceived Ease of Use:*

Additionally to perceived usefulness, "Perceived Ease of Use" has been a vital concept in many of technology adoption models, too. It was defined as "the degree to which a person believes that using a particular system would be free of effort" [7]. It has been included as a construct in a number of studies for different types of technologies and systems, such as mobile data services in China [10], application frameworks [11], and generally new technologies [4], [5], [12], [13]. In all the above studies, the perceived ease of use of the technology concerned has a direct positive effect on the behavioral intention to use each technology studied every time. Thus, regarding the behavioral intention to use the mobile data services, it is hypothesized that:

H2: Perceived Ease of Use will have a positive effect on m-services adoption intention.

#### D. *Trust:*

In previous studies, trust has been a significant factor in influencing consumers' behavior towards a specific technology, especially when it comes to cases of uncertain environments, such as e-commerce [14]-[17]. It is strongly recommended that trust should also be examined as a driving

factor in the area of mobile commerce [9]. Mobile commerce is exposed to greater danger of insecurity than e-commerce and therefore the importance of trust is relatively higher in m-commerce [17].

In order to define and measure trust, there have been many suggestions in literature attributing it to meanings like privacy protection permitting a user to choose how his or her personal information is used [18], or perceived credibility showing that one partner believes that the other partner has the required expertise to perform a job effectively and reliably [19]-[20]. Pavlou [16] stated that "trust in e-commerce is the belief that allows consumers to willingly become vulnerable to the online retailers after having considering the retailers' characteristics" including goodwill trust (benevolence) and credibility (honesty, reliability, and integrity). In [9] Min et al. divided the entity of trust in two sub-entities: trust in technology and trust in service providers. Trust in technology redirects to technical protocols, transaction standards, regulating policies, and payment systems [9], whereas, according to the analysis for e-commerce services in [18], trust in service providers refers to ability- the user's perception of provider's competencies and knowledge salient to the expected behaviour, integrity- the user's perception that the service providers will adhere to a set of principles or rules of exchange acceptable to the users during and after the exchange, and benevolence- the service provider is believed to intend doing good to the users, beyond its own profit motive.

In this study, by trust we refer to the security in mobile payments when needed, to confidentiality of personal data (such as sending credit card details while using mobile services), to trustworthiness in the results after a mobile service is conducted and to the integrity of the terms of use of the mobile services.

Min et al. [9] studying mobile commerce, Pavlou [16] examining consumers' acceptance of electronic commerce, Wei et al. [17] analyzing the m-commerce adoption in Malaysia, Suh & Han [21] contributing to e-banking, and Gefen & Straub [14] talking about B2C e-Services detected a positive influence of trust on consumers' behavioral intention. In specific, Pavlou said that: "trust reduces behavioral uncertainty related to the actions of the Web retailer, giving a consumer a perception of some control over a potentially uncertain transaction. This sense of overall control over their on-line transactions influences consumers' purchase intentions positively"[16]. Thus, it is reasonable to assume that there is also a positive relationship between trust and behavioral intention when it comes to the adoption of mobile commerce services in Greece. So the following hypothesis can be stated:

H3: Trust will have a positive effect on consumers' m-services adoption intention.

#### E. *Innovativeness:*

Innovativeness in IT is the "willingness of an individual to try out any new information technology" [22], [23]. In free interpretation in the field of technology acceptance, innovation refers to the degree of interest in trying a new thing, new concept, or innovative product or service [24].

Innovativeness as a personality trait has been correlated with technology adoption in previous studies as an integrated factor along with optimism, discomfort and insecurity in the framework of the Technology Readiness Index (TRI) theory [25]. Individuals, who are respected by their peers for their first-hand knowledge of an innovation and are considered as competent technically, consider the complexity of technology less troublesome suggesting a direct positive effect on perceived ease of use [26]. It is also concluded that innovativeness has a positive impact on perceived ease of use and negative impact on perceived usefulness regarding the adoption process of IT from service employees by Walczuch et al. [25]. Kuo & Yen in [27] also examined the relationship of innovativeness with perceived ease of use and perceived usefulness. Their study showed that innovativeness influences positively the perceived ease of use of 3G mobile value-added services, whereas the influence on perceived usefulness of 3G mobile value-added services is

insignificant. Lu et al. [1] studied the influence of personal innovativeness and social influence on wireless internet services and found that they do not have a direct significant effect on user intention to adopt the wireless internet services via their mobile devices. Innovativeness has also been examined as a factor influencing the use of Internet [28]. Chen and Tong in [29] discussed the importance of innovation for the mobile telecom industry, as well as, Ainin et al. in [30] showed that personal innovativeness reflects on the adoption intention of mobile banking in Malaysia.

The positive results of studies around the direct effect of innovativeness on mobile commerce in Singapore [31] and on mobile shopping [32] have aroused the curiosity of the writers to examine the effect that innovativeness has on the adoption of mobile services in the Greek market. Based on the above literature, the following hypothesis can be stated:

H4: Innovativeness will have a positive effect on consumers' m-services adoption intention.

| Research Variables            | Conceptual Definition  | Operational Definition  |
|-------------------------------|--|---|
| M-services Adoption Intention | "A person's subjective probability that he or she will perform some m-services" [6].   | AI1: I intend to use/continue using m-services in the near future<br>AI2: I believe my interest towards m-services will increase in the future<br>AI3: I intend to use m-services as much as possible<br>AI4: I recommend others to use m-services  |
| Perceived Usefulness          | "The degree to which a person believes that using m-services would enhance his or her job performance" [7].  | PU1: I think using m-services makes it easier for me to conduct transactions<br>PU2: I think using m-services makes it easier for me to follow up my transactions<br>PU3: I think using m-services increases my productivity<br>PU4: I think using m-services increases my effectiveness<br>PU5: I think using m-services increases my efficiency |
| Perceived Ease of Use         | "The degree to which a person believes that using m-services would be free of effort" [7].   | PEU1: I think using m-services is easy<br>PEU2: I think learning to use m-services is easy<br>PEU3: I think finding what I want via m-services is easy<br>PEU4: I think becoming skillful at using m-services is easy   |
| Trust                         | The security in mobile payments, the confidentiality of personal data, the trustworthiness in the results of the m-services and the integrity of the terms of use of the m-services. | TR1: I think using m-services in monetary transactions is safe<br>TR2: I think my personal data are in confidence while using m-services<br>TR3: I think the terms of use are strictly followed while using m-services<br>TR4: I think using m-services for my transactions is trustworthy  |
| Innovativeness                | "The willingness of an individual to try out any new information technology" [23].   | INN1: I am usually among the first to try m-services<br>INN2: I am eager to learn about new technologies<br>INN3: I am eager to try new technologies<br>INN4: My friends and neighbours often come to me for advice about new technologies and innovation   |

Table 1. The conceptual and operational definitions of the research variables

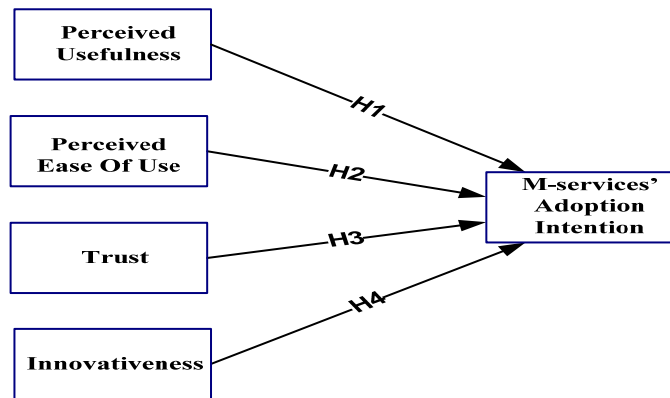


Figure 1. Conceptual Framework

### III. Methodology & Results

Data were collected through a questionnaire both in a hard-copy form distributed to a random sample of people and in an electronic version of it. The electronic questionnaire was uploaded on a website for one month - January 15th to February 15th 2010. Additionally, an e-mail was sent to members of various lists (students and non-students) asking to respond to the questions and it was also posted on two popular social networks, Facebook and Twitter. Regarding applied questions, they are based on prior surveys approved for their validity and reliability. The questionnaire was pretested before being widely distributed, whereas a pilot study using a sample of thirty responses helped to identify possible problems in terms of clarity and accuracy. Thus, comments and feedback from respondents improved the final

presentation of the items. Fifty-seven participants gave incomplete answers and their results were dropped from the study. Finally, a total of 445 consumers from Greece provided data for the study.

In order to test the conceptual framework, a data analysis was conducted in two stages; the first step employed factor analysis using principal component analysis (PCA) and orthogonal rotation (VARIMAX), followed by stepwise regression analysis to examine the four hypotheses.

#### A. Demographics and Descriptive statistics

The respondents comprised the population of interest were 229 (51.5%) male and 216 (48.5%) female. The vast majority of them (88.1%) were between 18-34 years old and have received higher education studies (358 - 80.4%). The comprehensive demographic characteristics of the sample are presented in Table 2.

| Demographics          | Frequency | Percent (%) | Demographics              | Frequency | Percent (%) |
|-----------------------|-----------|-------------|---------------------------|-----------|-------------|
| <b>Gender</b>         |           |             | <b>Occupation</b>         |           |             |
| Male                  | 229       | 51.5%       | Student                   | 178       | 40.1%       |
| Female                | 216       | 48.5%       | Private Employee          | 84        | 18.9%       |
|                       |           |             | Public Servant            | 48        | 10.8%       |
|                       |           |             | Freelancer                | 78        | 17.6%       |
|                       |           |             | Unemployed                | 24        | 5.4%        |
|                       |           |             | Other                     | 33        | 7.2%        |
| <b>Age</b>            |           |             | <b>Monthly Income (€)</b> |           |             |
| 18-24                 | 157       | 35.3%       | <600                      | 102       | 22.8%       |
| 25-34                 | 235       | 52.8%       | 601-900                   | 80        | 18.0%       |
| 35-44                 | 40        | 9.0%        | 901-1200                  | 55        | 12.4%       |
| >44                   | 13        | 2.9%        | 1201-1500                 | 62        | 13.9%       |
|                       |           |             | 1501-1800                 | 23        | 5.2%        |
|                       |           |             | 1801-2400                 | 20        | 4.5%        |
|                       |           |             | >2400                     | 18        | 4.1%        |
|                       |           |             | I don't answer            | 85        | 19.1%       |
| <b>Education</b>      |           |             |                           |           |             |
| Elementary school     | 4         | 0.9%        |                           |           |             |
| High school           | 83        | 18.7%       |                           |           |             |
| University/Tech. Col. | 213       | 47.9%       |                           |           |             |
| Master/PhD            | 145       | 32.5%       |                           |           |             |

Table 2. Demographic characteristics of the respondents

### B. Operationalization of the Variables

Operational definitions of the study instruments are shown in Table 1. For each variable, a multiple-item scale was developed where each item was measured based on a 5-point Likert scale, ranging from 1-“Completely Disagree” to 5-“Completely Agree”. In specific, four items were used to measure perceived ease of use, trust, innovativeness and m-services adoption intention, whereas five items were used to measure perceived usefulness.

### C. Data validity and reliability

Factor analysis was applied to test the validity of the variables, classify and reduce questions into sub-variables when possible, and calculate factor loadings. Specifically, the principal component analysis (PCA) using orthogonal rotation (VARIMAX) was firstly performed to assess the underlying structure of the data. The PCA method is particularly suited to summarize the most of the original information (variance) in a minimum number of factors for prediction purposes [33]. Orthogonal extraction, using VARIMAX rotation, suited for research goals and the need to reduce a large number of variables to a smaller set of uncorrelated variables. Additionally, VARIMAX rotation attempts to minimize the number of variables that have high loadings on a factor; hence enhancing the interpretability of the factors [33].

Nevertheless, in order to test the appropriateness of the data for factor analysis, several measures were applied to the entire population matrix. Specifically, Bartlett’s test of sphericity ( $p = 0.000$ ) confirmed the statistical probability that the correlation matrix has significant correlations among the variables, whereas the result of Kaiser-Meyer-Olkin

(KMO) measure of sampling adequacy was 0.902, which is meritorious. Additionally, the measure of sampling adequacy (MSA) values all exceeds 0.50 for both the overall test and each individual variable [33]. All the aforementioned measures indicated the suitability of factor analysis.

By applying the Kaiser eigenvalues criterion, five factors extracted that collectively explained (with eigenvalues 7.854, 2.046, 1.944, 1.667 and 1.403 respectively) 71.022% of the variance in all items, whereas all the communalities were greater than 0.50, ranging from 0.549 to 0.837, providing sufficient explanation [33]. Regarding construct validity, which testifies how well the results obtained from the use of the measure fit the theories around which the test is designed [20], it was tested by the use of two broadly applied tests, convergent and discriminant validity. In specific, “convergent validity is demonstrated if the items load strongly ( $>0.50$ ) on their associated factors, whereas discriminant validity is achieved if each item loads stronger on its associated factor than on any other factor” [33]. Table 3 shows that all items have loading greater than 0.50 and load stronger on their associated factors than on other factors. Thus, convergent and discriminant validity are demonstrated. The five factors (perceived usefulness, trust, and innovativeness, perceived ease of use and m-services adoption intention) proved to be relatively easy to interpret, owing to the strong variable loadings. Finally, construct reliability (or internal consistency) was assessed using Cronbach’s alpha. Table 3 also shows that values ranged from 0.771 to 0.913. According to [33], scores greater than 0.70 are considered acceptable for field research.

| Items                   | Factors/Variables    |                               |                  |                  |                       |
|-------------------------|----------------------|-------------------------------|------------------|------------------|-----------------------|
|                         | Perceived Usefulness | M-Services Adoption Intention | Trust            | Innovativeness   | Perceived Ease of Use |
| PEOU1                   | 0.107                | 0.070                         | 0.054            | 0.106            | <b>0.807</b>          |
| PEOU2                   | 0.030                | 0.000                         | 0.041            | 0.056            | <b>0.817</b>          |
| PEOU3                   | 0.164                | 0.220                         | 0.118            | 0.045            | <b>0.677</b>          |
| PEOU4                   | 0.196                | 0.091                         | 0.107            | 0.242            | <b>0.680</b>          |
| PU1                     | <b>0.651</b>         | 0.288                         | 0.143            | 0.122            | 0.321                 |
| PU2                     | <b>0.795</b>         | 0.179                         | 0.183            | 0.189            | 0.106                 |
| PU3                     | <b>0.850</b>         | 0.156                         | 0.220            | 0.141            | 0.137                 |
| PU4                     | <b>0.824</b>         | 0.214                         | 0.158            | 0.065            | 0.091                 |
| PU5                     | <b>0.839</b>         | 0.156                         | 0.190            | 0.165            | 0.088                 |
| TR1                     | 0.209                | 0.200                         | <b>0.772</b>     | 0.113            | 0.056                 |
| TR2                     | 0.103                | 0.063                         | <b>0.842</b>     | 0.078            | 0.000                 |
| TR3                     | 0.156                | 0.073                         | <b>0.798</b>     | 0.111            | 0.155                 |
| TR4                     | 0.282                | 0.147                         | <b>0.689</b>     | 0.119            | 0.154                 |
| INN1                    | 0.199                | 0.349                         | 0.305            | <b>0.582</b>     | 0.017                 |
| INN2                    | 0.163                | 0.182                         | 0.119            | <b>0.827</b>     | 0.141                 |
| INN3                    | 0.109                | 0.194                         | 0.111            | <b>0.854</b>     | 0.127                 |
| INN4                    | 0.130                | 0.156                         | 0.042            | <b>0.797</b>     | 0.070                 |
| AI1                     | 0.188                | <b>0.806</b>                  | 0.158            | 0.193            | 0.120                 |
| AI2                     | 0.210                | <b>0.807</b>                  | 0.120            | 0.181            | 0.071                 |
| AI3                     | 0.209                | <b>0.856</b>                  | 0.117            | 0.180            | 0.123                 |
| AI4                     | 0.203                | <b>0.765</b>                  | 0.101            | 0.223            | 0.112                 |
| <b>Cronbach’s alpha</b> | <b>a = 0.913</b>     | <b>a = 0.894</b>              | <b>a = 0.836</b> | <b>a = 0.838</b> | <b>a = 0.771</b>      |

Table 3. Rotated Component Matrix

| Model | R                  | R Square | Adjusted R Square | Std. Error of the Estimate | Change Statistics |          |     |     |               |
|-------|--------------------|----------|-------------------|----------------------------|-------------------|----------|-----|-----|---------------|
|       |                    |          |                   |                            | R Square Change   | F Change | df1 | df2 | Sig. F Change |
| 1     | 0.526              | 0.277    | 0.275             | 0.72875                    | 0.277             | 169.710  | 1   | 443 | 0.000         |
| 2     | 0.614              | 0.377    | 0.374             | 0.67740                    | 0.100             | 70.706   | 1   | 442 | 0.000         |
| 3     | 0.619 <sup>a</sup> | 0.383    | 0.379             | 0.67473                    | 0.006             | 4.509    | 1   | 441 | 0.034         |

<sup>a</sup> Predictors: (constant), innovativeness, perceived usefulness, perceived ease of use

Table 4. Results of the stepwise regression analysis

#### D. Hypotheses' testing

A stepwise regression analysis was conducted to assess the best predictors among the independent variables believed to impact on m-services adoption intention. Additionally, it revealed which of the four hypotheses were supported. According to [33], stepwise regression is considered as the most popular sequential approach to variable selection. The results presented in Table 4 indicate that 38.3% of the variance in m-services adoption intention is explained by three predictors in the model. Innovativeness has the highest explanatory value of 27.7% ( $b = 0.364$ ,  $t = 8.697$ ,  $p = 0.000$ ), followed by perceived usefulness 10% ( $b = 0.322$ ,  $t = 7.428$ ,  $p = 0.000$ ) and perceived ease of use 0.6% ( $b = 0.087$ ,  $t = 2.124$ ,  $p = 0.034$ ). From the four hypotheses only one, namely H3 (the impact of trust on m-services adoption intention), was not supported.

## IV. Conclusions & Discussion

Mobile services, such as entertainment, communication or purchasing services, are deemed as important for saving time and accomplishing tasks from anywhere, anytime. The adoption, however, of these services is not mindless. The consumers seem to set a number of criteria- either consciously or unconsciously- in order to actually use these services. Prior studies in several countries, for example, conclude to usefulness and ease of use as the pioneer attributes of the m-services leading to their adoption. Based on the literature studied, this paper explores four variables chosen from the technological, psychological and behavioral field.

The analysis of the data gathered revealed that innovativeness, perceived usefulness and perceived ease of use have a statistically significant influence on m-services. These three entities as a whole could give a possible explanation of the variables that might affect the success of the m-services. As a result, researchers and practitioners should take them into consideration in their effort to succeed with the m-services in the Greek market. For example, mobile application developers could give extra emphasis on constructing innovative services in order to achieve higher adoption rates. Commonly, the content providers should be focused on improving the the services' ease of use, as well as, their useful implementation in individuals' interactions.

Additionally, they should take into account the influential degree of each factor. More specific, according to the results, innovativeness has a higher intention impact than the rest of the factors. It is noteworthy, the fact that trust is excluded from the final suggestions. This could be possibly explained assuming that m-service providers strike as reliable to the

Greek consumers. This is a positive sign for the m-services' future; their adoption is not

Ending this paper, it should be mentioned that this study comprises the first part of an ongoing research aiming to shed light on the broad topic of m-services. The survey has two basic limitations: it is restricted to the examination of only four constructs, and it is confined to the Greek territory. In future research, the framework could be enriched with more factors integrated in order to have a more holistic view of m-services inclination. Additionally, the results can be compared to related studies conducted in other countries. A cross-cultural study would be of high interest to identify the different perceptions deriving from the nations' unique characteristics. Countries' technology background, traditions, and way of living might affect citizens' perceptions and attitudes towards mobile services' adoption. Moreover, the proposed conceptual framework could be formed differently if investigating this paper's four hypotheses concerning only one age field, or educational level, occupation, monthly income, or gender. Then, comparisons between the final models of each demographic fields would give fruitful implications. Finally, a more in depth study can be accomplished to give explanations why Greeks are not influenced by trust.

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