Influence of the Perception of Data Security and Security Importance on Customer Usage of Internet Services

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***Abstract*—An increasing customer usage of Internet services with various devices demands a greater effort on data security and privacy issues, because more and more devices are connected and much personal information are spread more widely. However, in many cases the performance of services is more important than the provision of data security. Therefore, it would be necessary to investigate how the user perception of data security influences the usage of Internet services, which will be analyzed with a adjusted combined approach of the Technology Acceptance Model and the second model of the Unified Theory of Acceptance and Use of Technology. To support the analysis of this conceptual relationship, an evaluation of the interrelation between the perceived data security importance and the user behavior is also examined. The aim of this paper is to figure out a possible negative impact of the perception of data security and security importance on the usage of Internet services. The goal of the paper is to prove an influence of data security within an adjusted conceptual model based on the Technology Acceptance Model and the second model of the Unified Theory of Acceptance and Use of Technology. In general, a significant relationship between the perceived data security, perceived data security importance and user behavior of Internet services cannot be found. Particularly, some regressive influences are proved in the perceptions of data security importance and usage of specific services. The primary result of this paper is that from the perspective of customers the general perceived data security is significantly most influenced by the perceived email accounts security.**

***Keywords*—data security; security importance; customer usage; Internet services; mobile Internet.**

I. INTRODUCTION

During the last 10 to 15 years, more and more people use Internet services. This development leads to a rising global Internet penetration and data flow [1][2]. Furthermore, most people use mainly services for social media, broadcasting/streaming, gaming and cloud computing. Especially during the last years, people started to use the different services with various devices [3][4]. Due to this application of services the devices get connected among each other. Hence, it can be assumed that the personal user data spread to a larger degree [3]. For the customers of Internet services, it is elusive where the personal data is stored and who gets access to the data, because the smart connected devices cover a wide range of information over geographical boundaries [4][5]. Finally, the usage of Internet services by customers faces the problems of data security and privacy from the user perspective. Personal data include critical information about and intellectual properties. These data are countable assets from which enterprises, companies and also criminals can benefit [6].

In general, the users are responsible for which personal data they spread for the usage of different Internet services. Hurdle free communication, marketing measures and advertisements disclose also more personal data of the users. Furthermore, a lot of people are willing to share their personal data in ignorance of risks of data leakage and data theft to reach higher reputation and more contacts. Out of it, it can be concluded that data security and privacy gets more and more important, because more personal data is disclosed and often the users are not able to examine who gets access to their personal information and who uses them for legal and illegal motives [1]. However, it cannot be distinguished between (a) customers, who disclose their personal information and are not aware of the consequences and (b) customers, who completely know the consequences of data disclosure.

The authors will figure out what the user perception of data security and data security importance is, when they use different Internet services with various devices, especially mobile devices with wireless Internet connections. Moreover, each Internet usage is in direct connection with data security and privacy issues. For these reasons, it needs to be investigated whether a higher perception of data security and trust in a service leads to a preferred usage of this service or device [1]. Accordingly, the authors analyze what the users of Internet services do or not do to prevent unauthorized access to their personal data. Despite the issue that influence factors can possibly impact the user behavior of Internet services, the authors will focus on the relation between the perceived data security and the usage of Internet services. The authors will not deeply analyze the relation and terms of data privacy and the misuse of disclosed data.

Generally, the topic describes a global problem, because all over the world customers distribute information and companies, criminals and others use the data for their advantages. Nevertheless, the authors focused on the current situation in Germany.

In Section II, the term data security, the challenges and the used research models will be described. In Section III, the

methodology presents the theoretical approach for conducting the study based on presented research models. Following this section, the authors will present the data analysis and some key results of the survey. In Section V, the authors will critically discuss their results and problems of the survey. In the last Section, the improvements of the current research and the used survey will be described.

II. LITERATURE REVIEW

A. Data Security

Data security means that users want to keep their personal data to themselves. Here, it must be clear for them, who gets access to the personal information. Hence, no one should get access to the user's personal data, who does not have the right permission for the usage [5]. However, a lot of companies use personal data of customers, which customers spread in their Internet services, because a lot of users are not fully aware of the possible risks of sharing information [6][7]. Furthermore, they do not know which huge amount of data they produce and how they can prevent such risks [8]. This behavior could be a problem for residential users, because 56% of Internet services and platforms transmit personal information without permissions to third parties [9]. So, users should be better informed and aware of their personal data. In many cases, persons divulge information, which they may regret in a future situation. Furthermore, the data can be linked to critical personal information like credit card numbers, etc. [6][7].

Otherwise, the users also have to prevent unauthorized accesses by changing the passwords regularly, what the authors also investigate with a survey. If the users lose their access and their data is leaked, the users have to bear negative consequences up to the loss in reputation of image, business partners, relatives and friends [3].

User perspective, company perspective, companies' duties

In general, users fear: (a) capturing of passwords and accounts, (b) blackmails, (c) eavesdropping, and (d) undesired access to personal data from criminals [3]. The users want a secure transmission of data and the services should guarantee integrity, availability and confidentiality of the data and their transmission [10].

B. Challenges

The main challenge for analyzing user perceptions of data security is that all user attitudes and beliefs are completely subjective and depend on demographic (age) and cultural factors, which influence the customers' willingness to share data [6]. These discrepancies also include that each user has his perceptions of risks and prevention of risks. In many cases the people prefer to look for the performance of services instead of the security and data protection measures. To increase the customer caution concerning the disclosure and leakage of private data, services should insert several measures and rules which the customers have to comply with to use the services [11]. Furthermore, services and applications should state information about consequences of misuse and data leakage and insert different messages to make sure that the users understand the impacts of their data distribution. However, it is necessary to investigate what kind of impact the factors have on the individual perception of data security and the influence on the usage of Internet services, especially mobile services. Nonetheless, the authors will focus on the perceived data security of customers and will not evaluate the consequences of data disclosure.

C. Research Model – Technology Acceptance Model and Unified Theory of Acceptance and Use of Technology 2

For the analysis of the relation between the perception of data security and the user behavior regarding Internet services, the authors will use the Technology Acceptance Model (TAM) [12][13]. To support the findings and background research, the authors also use the Unified Theory of Acceptance and Use of Technology 2 (UTAUT2), which can be used to examine the relation of external variables and the user behavior of a new service/innovation [14]. The application of both models enables a consideration of the presented problem below in the way of an organizational and customer perspective. Due to the focus on private customers, the application of the UTAUT2 will be more useful to analyze the user acceptance of Internet services [14]. However, the longer experience and greater research background of the TAM gives the authors some implications about the acceptance and usage of Internet services, especially mobile services. Furthermore, the authors do not limit the questions in the survey for private usage. Thus, the respondents could answer for their business and private usage of services. Therefore, both models (TAM and UTAUT2) can be used for the evaluation of influences between data security issues and the usage of Internet services.

The TAM shall clarify how the customer's individual acceptance of Information Technologies (IT) can be explained and predicted [12][13]. Our paper will focus on the dependence of the usage of mobile Internet services on security issues and the acceptance of new technologies. It is currently known that the perceived usefulness has a positive impact on behavioral intentions, which leads to an actual customer usage [13]. However, perceived usefulness does not cover the user's perception, that the usage of the service will enhance his performance [12].

The UTAUT describes four key concepts (performance expectancy, effort expectancy, social influence, and facilitating conditions), which impact the consumer acceptance and behavioral intention of an innovation or technology [15][16]. Generally, it is known that the behavioral intention normally leads to a usage of the service [17]. Venkatesh et al. expand their own model with the factors hedonic motivation, price, and habit, which are classified as critical influence factors and predictors of consumer behavior and have been introduced in the UTAUT2 [14][15]. The UTAUT2 shall illustrate how the customers accept new technologies [18]. Especially the factors (a) costs, (b) usage advantage, (c) economic effort, and (d) expenditure of time are determining if a customer decides to use or not to use an innovation [18]. In the context of

this paper, the habit and experience of usage could be a possible impact factor, which is described at the end of this subchapter. The other possible influence factors are not considered in detail.

Moreover, perceived usefulness and behavioral intentions in the TAM are not able to analyze and to reflect the perceived data security, importance of data security and the adoption of Internet services, especially mobile Internet services.

In consideration of Appendix 1, Escorbar-Rodriguez and Carvajal-Trujillo adapt the UTAUT2 with the external variable trust [19], which is influenced by several further components like perceived security and perceived privacy. As mentioned above, the UTAUT2 also describes different concepts/factors as impact factors on the behavioral intention to use of an innovation or service [14].

The authors analyze the direct relationship of the perception of data security and importance of data security on the actual usage of an Internet service. As displayed in Figure 1, the hypotheses will be directly organized for the relationship of the named factors perceived data security and perceived importance of data security and the use of the Internet services. Before these relationships will be examined, the relation between the both possible impact factors will be measured too. To support the both components and to address possible data security measures by the customers. The password behavior of customers in email and Social Media accounts is analyzed as well. The frequency of password-changes is an indicator for the importance of data security. Therefore, the authors decide to design the conceptual model in the way as it can be seen in Figure 1. The password changing behavior, perceived data security and perceived importance of data security are the external variables, which directly influence the actual usage of Internet services by the customers.

Next to the described external variables, credibility as a further factor could be perceived. This factor includes the users' belief that the used systems and their according attitudes would be free of threats for privacy and security [17]. It is further known that perceived credibility positively influences the behavioral intention to use [20]. Lin et al. have figured out that data security and privacy are the most affecting factors for an acceptance and adoption of a new technology [17]. It must be expected that using mobile Internet services will often imply security or privacy threats [20].

Therefore, the authors examine how the perception of data security and the importance of data security of specific Internet services influence the usage of the services. Furthermore, the component perceived security will be supported by Zhong et al. [22], which uses perceived security as external variable to show the influence on the behavioral intention to use mobile payments.

Normally, the external variable perceived security could additionally cover customer concerns about risk (perceived risk), trust and privacy concerns [21]. The named variables also influence the customer decision of adoption. Here, especially trust plays a major role, because trust describes how the customers perceive the credible and secure information and experiences of the providers [19][23][24][25]. Based on the assumption that perceived risks and trust directly influence the usage processes [26], the customers will reduce their usage if expect a loss of privacy and a higher risk in usage [27]. Therefore, the authors will not exclude these criterions and analyze this the influence of trust as a determinant of usage behavior in a second survey [28][29].

Generally, the aim of the analysis is to illustrate how the customers perceive their data security and how they rank the importance of data security for each Internet service they use.

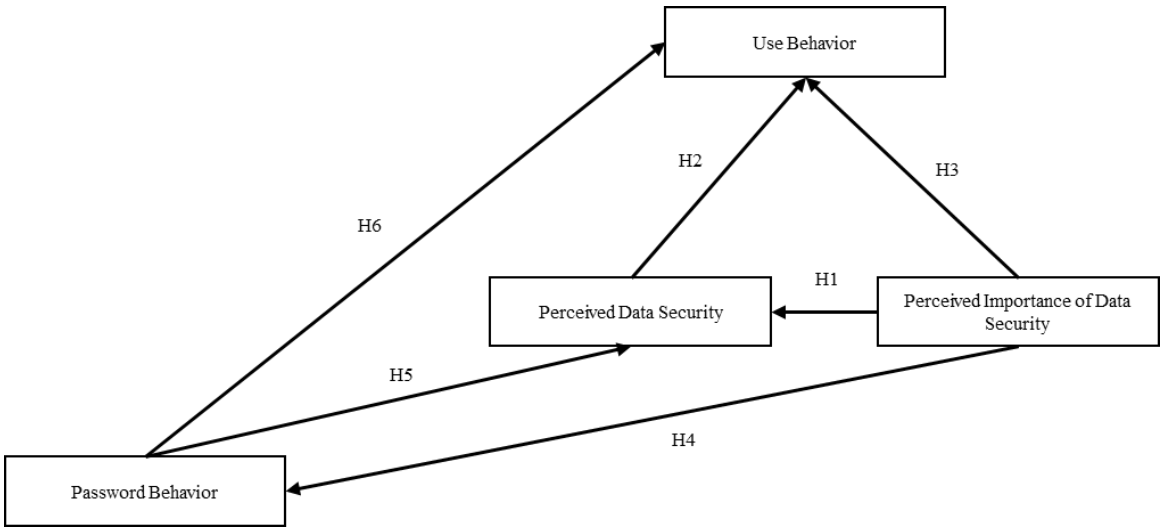

Figure 1. Conceptual Model

In comparison to the presented relationships between the estimation of perceived security, risks and trust and the usage of mobile banking or mobile payments [20][21][22], the authors consider different Internet services for the analysis of the relation between usage of services and the perceived data security and perceived importance of data security. As mentioned in the description of the conceptual model in Figure 1, both named concepts will be supported by the external password changing behavior (for emails and Social Media). Normally, the password changing behavior could be possibly a criterion of the perceived importance of data security but the authors are not sure if the customers perceive the same connection. It can be assumed that customers with a higher awareness of data security will change their passwords more regularly Therefore, the authors will analyze if the password changing behavior fits to the perceived importance of data security. Based on this examination, the authors will test if password changing behavior also relates to the perceived data security and usage behavior.

The research hypotheses of this paper are:

H1: A higher customer perception of importance of data security leads to higher perceived data security.

H2: The customer perception of data security (perceived security) has a directly positive effect on the usage of (mobile) Internet services.

H3: The customer perception of data security importance (perceived importance of data security) has a directly positive effect on the usage of (mobile) Internet services.

H4: A higher customer perception of importance of data security leads to an increasing password changing behavior.

H5: An increased customer password changing behavior leads to a higher perception of data security.

H6: An increased customer password changing behavior leads to an increased usage of (mobile) Internet services.

As mentioned, a couple of external variables could possibly describe security issues and threats in consideration of the usage of Internet services, especially mobile Internet services. For example, Chen identified that the perceived risk can be seen as one of the key drivers for the estimation of uncertainties in mobile payments [20][21][22]. Consequently, customers are paying attention to the products and their providers if they take care about the customers' transactions and personal information security in the usage of mobile payments [22]. This presented relationship is supported by different researches regarding mobile payments as important issues in the trust of services [30][31][32][33][34][35][36][37][38]. Zhong et al. and Abrahão et al. figured out that trust and perceived risk have significant influence on customer acceptance of mobile payments [20][21][22]. In consideration of the mentioned-above factors habit and motivation from the UTAUT2, Lu et al. also illustrate that the usage of mobile payment services is positively influenced by the experience and confidence of the customers [39]. This connection supports the previous descriptions and findings and will be more deeply described in the paragraph below. Moreover, an influence of trust and perceived risk on the acceptance of mobile banking is found too [40][41]. Considering the usage of mobile shopping, trust is also an important influence factor [42]. Besides mobile banking, mobile payments and mobile shopping, the perceived security issues are even higher in mobile telecommunication networks, due to the fact that mobile networks are shared mediums and different persons can use the same mobile radio cell in the same time. This structure makes the system more vulnerable for attacks within the network [43]. Zhou also figured out that especially mobile transactions are critical for the perceptions of trust [28]. The mobile network operators and providers have to take care about these issues and the introduction of security measures can mitigate uncertainties and risks [44][45][46]. The development of trust in a service is a major aim for customers and providers, because the trust in a service increase the customer convenience of the customer and normally leads to a higher performance [26][47]. So, trust needs to be developed [28]. However, especially in mobile banking the customers fear a lack of control, which results in a greater uncertainty [28]. Consequently, the literature conveys the feedback that in several cases trust and the perception of security, risks and uncertainties influence the customer user behavior. All examples and findings demonstrate that possible security issues can significant negatively influence the intention to use mobile Internet services. Therefore, the authors have set the hypotheses that a better perception in data security leads to an increased usage of services.

As mentioned above, the habit and experience with the usage of a service could be a possible impact factor regarding the issues of trust. Generally, people gain experience with a usage of the service over time, people are able to learn the working process and the handling of the service will be more familiar [15][48]. Besides the gained knowledge and increased opportunities with the application, the customers are able to develop an increased trust [46]. In the context of mobile Internet services, Venkatesh et al. test the new developed concepts of the UTAUT2 on the acceptance of mobile Internet technologies [14]. However, the findings of Venkatesh et al. describe a decreasing behavioral intention in case of rising usage experiences [14], which can be supported by the fact that old known habits and experiences cannot be easily dropped by the customers [30]. On the other hand, the expectations of customers can change if the experience with the usage of the service increases. Consequently, the impact of experiences and habits cannot be clearly predicted, due to positive and negative influences on the behavioral intentions of

usage. Therefore, the authors decide to not include this variable in this paper. Nevertheless, uncertainties and risks normally base on a lack of experience [49][50][51][52][53].

III. METHODOLOGY

To examine these hypotheses, the authors will use a survey to prove that data security issues have a negative impact on user behavior of mobile Internet services. For the analysis of the individual customer groups, separate cross-sectional surveys ("one-shot surveys") will be conducted within a short period of time [54]. Here, the answers are taken by interviewers in personal oral interviews, thus ensuring completeness and accuracy of the answers. The personal interview will be conducted on the basis of a random quota sample based on the demographic characteristics of gender and age in order to be representative of the local population [55][56]. In general, the interviewers select their test persons at public places like libraries and in the pedestrian zone in Wiesbaden (Germany) to reach a diversified and representative number of test persons. The first survey (440 completed questionnaires) which the authors use to gain information about the mobile data usage have been held in 2016, and was a pre-test, which the authors use to get information from the test persons and to verify whether the posed questions fit to answer the hypotheses and presented concepts. In 2017, another survey run with inclusion of the gained results and information to reach better analyses of the developed concepts.

The data has been analyzed based on quantitative research methods with the statistical program Statistical Package for the Social Sciences (SPSS). After the evaluation of credibility and reliability, which will be tested with the Cronbach's Alpha, the Exploratory Factor Analysis has been done to ensure the validity and to present related groups of perceptions and services. The perceived data security will be queried with the question, how the customers perceive their personal data in the virtual world (5-Point-Likert-scale: very secure to very unsecure). To cover the frequency of (mobile) Internet services usage and the perception of the importance of data security, a 5-Point-Likert-scale (very often to very few and very important to very unimportant) has been implemented [57]. Besides the consideration of the general perception of data security, the authors consider mainly the usage and perception of data security and importance of data security of the services: (a) email, (b) social media, (c) online telephony, (d) online shopping, (e) cloud computing, (f) e-learning, and (g) instant messaging. Other factors, which are included in the survey, are navigation, gaming, online baking, online administration, internet television and video on demand. Based on the fact that the behavioral intention leads in an actual customer usage [13], the analysis of the survey shall present the regression between the external variables perceived data security and user behavior and as well perceived importance of data security and user behavior. Therefore, the authors use the Ordinary Least Square Regression to test the significance of each of the named hypotheses.

IV. DATA ANALYSIS AND RESULTS

A. Descriptive Results

56.0% of the asked test persons are female and the group of persons with an age between 20 and 29 years describes an over-representation in this survey with a share of 47.4%. Based on statistical elevations, it can be noted that this age group represents only 12.2% in Germany [58]. Following previous researches activities from ARD/ZDF in 2015, the group of people between 20 to 29 years almost completely uses the Internet [59]. This situation does not comply with the aim to get a representative picture of the German market. But this high proportion of Internet users is able to reach better results for the test of the influence of data security issues on the usage of Internet services, especially mobile services. As mentioned, the most test persons use both Internet services (based on mobile networks as well as on fixed networks). Therefore, they are able to describe the perceptions of usage of services. Contrarily, only a smaller share of elder participants uses the Internet services and so these mostly cannot fully estimate their perceptions of the usage of services, behavior and their security issues. Consequently, the final direction of the data and their representative nature cannot be fully reached and confirmed.

In general, 43.6% of the participants are feeling a data uncertainty. On the opposite, only 3.5% of the interviewed persons are perceiving their data to be very secure. Following these results, which are displayed in Table I, the participants perceive the estimation and importance of data security of the services differently. Services which are related to financial payments are superiorly estimated with a higher importance of data security. In contrast, approximately half of the asked persons perceives the necessity of a high data security in the services email, social media and instant messaging.

TABLE I. Importance of Data Security.

Internet Services	Importance of Data Security
Email	56.3% very high importance
Social Media	45.6% very high importance
Online Shopping	64.3% very high importance
Online Banking	86.0% very high importance
Instant Messaging	47.3% very high importance

Supporting the illustrated perceptions of data security, the authors have included questions about the perceived necessity (a) to change the passwords for email and social media accounts, and (b) to use an anti-virus program. Over two third of interviewees (69.7% for email, 68.5% for social media) have answered that they change their passwords less than once a year. The authors conclude that they normally never change their passwords. However, 84.7% of the persons use anti-virus programs to protect their devices. Generally, the usage of the anti-virus program should not include costs, because 70.9% of the persons use the free version of the anti-virus programs. Following the numbers of McAfee, 14.5% of the German Internet users do not use an anti-virus program

[60]. Based on this study's results, the 15.3% of persons which are not using an anti-virus program indicate a similar and representative relation of the generated data.

B. Reliability and Validity

The results of the reliability and validity analyses are illustrated in Table II. Generally, the examined concepts of Internet service usage and data security are reliable and valid. Following Cronbach, the Cronbach's Alpha values have to be greater than 0.7 to present a good reliability [61][62][63]. This value has been achieved by all questions analyzing the concepts. The consideration of the exploratory factor analysis includes the assessment of Kaiser-Meyer-Olkin criterion, the significance test from Bartlett, and the examination of the cumulative variance [64][65][66][67][68]. All of the combined questions for the analysis of the determined concepts (a) perceived security, (b) security importance, and (c) user behavior (see Figure 1) have reached significant p values ($p<0.05$) in the Bartlett-Test. Furthermore, all concepts boast Kaiser-Meyer-Olkin values above the mark of 0.7 [64][65][66][67][68]. Both tests describe a good validity of the gained data. Moreover, the cumulative variances from all considered concepts are above 50%, which indicate high explanation rates of the variances in the collected data [65][66][67]. Consequently, the reliability and validity of the collected data are proved. Due to the presented differences in the demographics, the asked persons do not completely function as a representative mirror of the situation in the German market.

C. Correlation Analyses

The correlation analyses are divided in two parts. Firstly, the authors will contemplate the correlations of the perceptions of data security in general and in single service considerations. Secondly, the authors also correlate the results of the perceived importance of data security with the results of the perceived data security in general and for the single services. Thirdly, the correlations between the usage of Internet services (fixed-line and mobile) and the perceptions of data security (in general and single view) are considered.

Firstly, the general data security perception does not correlate significantly ($p>0.05$) with the individual perceptions of data security from the single services. In consideration of individual perceptions of the services, customer perceptions of data security for (a) email, (b) social media, (c) online telephony, (d) online shopping, (e) cloud computing, (f) e-learning, (g) instant messaging, and (h) online administration correlate significantly positively ($p<0.05$) with the perceptions of data security of the other services (see Table III and Appendix 2).

The correlation predicts that if a customer perceives a higher data security in the usage of email, social media, instant messaging, and online shopping, they will intensively perceive a higher data security in the other services. Equally, the customer rates the named services with a higher importance of data security.

The consideration of the correlation coefficient follows the classification that high correlation coefficients have Pearson correlation values above 0.5 [69][70]. In Table III, the data security perceptions of the following Internet services correlate strongly with each other: (1) e-learning and online administration (value 0.705), (2) instant messaging and social media (value = 0.601), (3) email and online telephony (value = 0.593), (4) email and online shopping (value = 0.546), and (5) instant messaging and online telephony (value 0.504).

Due to the values above 0.5, the authors assume that a relation between these factors exists. Consequently, the correlations do not indicate a significant connection between the general perceived data security and (a) the perceived data security for the single services and (b) importance of data security for the single services. It is doubtful if the further regression analyses may find significant regressive relationships between the named variables. Nonetheless, the correlations show that each perception of data security for each specific single service correlates positively with each other. This means if a customer perceives one service as more secure, he feels the same for other services. The same relation is valid for the perceived importance of data security.

TABLE II. Results of the Reliability and Validity Tests.

	Reliability – Cronbach's Alpha	Validity – Exploratory Factor Analysis			
		Kaiser-Meyer-Olkin	Bartlett-Test	Cumulative Variance	Highest Loadings
General Combined Usage of Internet Services	α=0.732	0.777	p<0.05	68.5% (6 Factors)	Fixed Video on Demand (0.735)
Fixed Usage of Internet Services	α=0.882	0.854	p<0.05	67.0% (3 Factors)	Email (0.885) Instant Messaging (0.865)
Mobile Usage of Internet Services	α=0.840	0.820	p<0.05	51.3% (2 Factors)	Navigation (0.811) Instant Messaging (0.771) Email (0.713)
Data Security	α=0.837	0.783	p<0.05	67.5% (4 Factors)	E-Learning (0.880) Online- Shopping (0.822) Online Banking (0.820) Online Gaming (0.805)

TABLE III. Correlation Analysis of Data Security Perceptions of selected services.

		Data Security Email	Data Security Online Telephony	Data Security Social	Data Security Online Shopping	Data Security Cloud Computing	Data Security IM	Data Security E-Learning	Data Security Administration
Data Security Email	Correlation by Pearson	1	**.593****	.435**	**.546****	.427**	.388**	.330**	.400**
	Significance (2-sided)		**.000**	.000	**.000**	.000	.000	.000	.000
Data Security Online Telephony	Correlation by Pearson	**.593****	1	.485**	.305**	.263**	**.504****	.358**	.385**
	Significance (2-sided)	**.000**		.000	.000	.000	**.000**	.000	.000
Data Security Social Media	Correlation by Pearson	.435**	.485**	1	.381**	.390**	**.601****	.275**	.276**
	Significance (2-sided)	.000	.000		.000	.000	**.000**	.000	.000
Data Security Online Shopping	Correlation by Pearson	**.546****	.305**	.381**	1	.343**	.197**	.264**	.369**
	Significance (2-sided)	**.000**	.000	.000		.000	.000	.000	.000
Data Security Cloud Computing	Correlation by Pearson	.427**	.263**	.390**	.343**	1	.249**	.345**	.400**
	Significance (2-sided)	.000	.000	.000	.000		.000	.000	.000
Data Security IM	Correlation by Pearson	.388**	**.504****	**.601****	.197**	.249**	1	.264**	.287**
	Significance (2-sided)	.000	**.000**	**.000**	.000	.000		.000	.000
Data Security E-Learning	Correlation by Pearson	.330**	.358**	.275**	.264**	.345**	.264**	1	**.705****
	Significance (2-sided)	.000	.000	.000	.000	.000	.000		**.000**
Data Security Administration	Correlation by Pearson	.400**	.385**	.276**	.369**	.400**	.287**	**.705****	1
	Significance (2-sided)	.000	.000	.000	.000	.000	.000	**.000**	

**. Correlation p=0.01 (2-sided) significant. / *. Correlation p=0.05 (2-sided) significant.

A linkage between the data security perceptions of email services, online shopping and online telephony follows the natural order, due to the fact that the online shopping and online telephony normally need an email account for the receipts of transactions and verification of the user. Therefore, the customers evaluate the same security issues on the named three services. The relations between the assessment of data security of instant messaging and social media and online telephony can also be comprehended. Based on the fact that social media platforms and online telephony providers include instant messaging systems in their service, the customers perceive similarly.

The interrelation of e-learning and online administration can be drawn in the point that both systems are based on platforms which cover personal user behavior and data.

Interestingly, the frequency of changing the email password also significantly correlates positively ($p<0.05$) with all of the individual data perceptions of the specific services. If a customer changes his password more frequently, he will feel safer in the usage of the services and rates the services with higher data security importance. However, a significant correlation between the password changing behaviors and the general perceived data security cannot be found.

It must be predicted that the perceived data security does not depend on the password changing behavior for email and Social Media accounts.

Secondly, the consideration of the usage of Internet services will be divided in the customer fixed-line application and mobile application consideration. In each consideration (mobile and fixed-line), the usage of all Internet services correlates significantly positively ($p<0.05$) with each other (see Appendix 3 and 4). It can be predicted that if a customer chooses to use one service that he will also use other Internet services. Based on the high correlation coefficients over 0.5 (fixed correlation coefficients: 0.5 to 0.7; mobile correlation coefficients 0.2 to 0.6), it can be assumed that the perceptions of data security of the specific services belong to each other and could have a linear relationship [69][70]. However, the usage of the Internet services in the fixed-line network does not correlate significantly with the usage of the Internet services in the mobile network overall. Here, the authors have to assume that the usages of the Internet services within the fixed-line and mobile networks do not directly interact with each other. This relation does not fit with the current status of knowledge, because normally there is a relationship between

the usage of Internet services in fixed-line and mobile infrastructures.

The comparison of usage and data security illustrates that the general perception of data security does not correlate significantly ($p>0.05$) with the usage of Internet services (mobile and fixed-line) (see Table IV and V). However, in consideration of the specific Internet services, the authors get some positive and negative correlations. The usage of emails correlates significantly ($p<0.05$, Pearson-value = 0.105) with the perception of data security for emails (see Table VI). Despite a lower correlation coefficient [69][70], it can be assumed that a highly perceived data security could lead to an increased usage of emails. However, the relation between this perception and the fixed usage of this service is quite stronger than the usage of this service in the mobile network. The customer ratings for the security importance are quite similar. Besides a predicted influence of the perception of data security for online shopping (fixed-line and mobile shopping) and the usage of online shopping, the authors find significantly positive correlations between the usage of online shopping and the perception of data security for the services emails ($p<0.05$, Pearson-value = 0.142) and online banking ($p<0.05$, Pearson-value = 0.144) (see Table VI). It can be assumed that a higher perception of data security concerning the safety of online banking and the email accounts could lead to a stronger usage of online shopping. Despite the low correlation coefficients (based on [69][70]), it can be noted that both services could be used if a customer decides to use online shopping platforms. Finally, especially in the usage of mobile Internet services the authors also find significantly negative correlations of social media (SM) and instant messaging (IM) with the data security perceptions of e-learning (SM: $p<0.05$, Pearson-value = -0.158; IM: $p<0.05$, Pearson-value = -0.113) and online gaming (SM: $p<0.05$, Pearson-value = -0.185; IM: $p<0.05$, Pearson-value = -0.153) (see Table VII). Here, it must be predicted that the usage of IM and SM would increase if the users perceive a decreasing data security in online gaming and e-learning. From the current point of view, a coherent argumentation cannot be included. At this point, the authors will consider this relation in the regression analysis in detail.

Additionally, the authors also analyze the correlation between the password changing behavior and the usage of the services. For the mobile and fixed services, the password changing behaviors correlate positively significant ($p<0.05$) with usage of Social Media. The correlation coefficients are spread around the value of 0.100 which mean quite weak correlations [69][70]. The prediction would be that people, which are changing their passwords more regularly, use Social Media more often.

TABLE IV. Correlation Analysis of the General Data Security Perceptions and Fixed Internet Service Usage.

		Data Security
Fix Usage Email	Correlation by Pearson	-.033
	Significance (2-sided)	.509
Fix Usage Surf	Correlation by Pearson	-.026
	Significance (2-sided)	.599
Fix Usage Online Telephony	Correlation by Pearson	.052
	Significance (2-sided)	.334
Fix Usage Video on Demand	Correlation by Pearson	.025
	Significance (2-sided)	.634
Fix Usage IPTV	Correlation by Pearson	-.006
	Significance (2-sided)	.933
Fix Usage Online Shopping	Correlation by Pearson	.014
	Significance (2-sided)	.796
Fix Usage Cloud Computing	Correlation by Pearson	.038
	Significance (2-sided)	.525
Fix Usage Social Media	Correlation by Pearson	-.021
	Significance (2-sided)	.685
Fix Usage Video Telephony	Correlation by Pearson	.009
	Significance (2-sided)	.879
Fix Usage E-Learning	Correlation by Pearson	-.016
	Significance (2-sided)	.791
Fix Usage IM	Correlation by Pearson	-.051
	Significance (2-sided)	.324
Fix Usage Navigation	Correlation by Pearson	.016
	Significance (2-sided)	.756

**. Correlation p=0.01 (2-sided) significant. /*. Correlation p=0.05 (2-sided) significant

TABLE V. Correlation Analysis of the General Data Security Perceptions and Mobile Internet Service Usage.

		Data Security
Mobile Usage Email	Correlation by Pearson	.027
	Significance (2-sided)	.578
Mobile Usage Surf	Correlation by Pearson	-.035
	Significance (2-sided)	.482
Mobile Usage Online Telephony	Correlation by Pearson	-.084
	Significance (2-sided)	.119
Mobile Usage Video on Demand	Correlation by Pearson	.007
	Significance (2-sided)	.899
Mobile Usage IPTV	Correlation by Pearson	-.066
	Significance (2-sided)	.312
Mobile Usage Online Shopping	Correlation by Pearson	-.090
	Significance (2-sided)	.086
Mobile Usage Cloud Computing	Correlation by Pearson	-.081
	Significance (2-sided)	.178
Mobile Usage Social Media	Correlation by Pearson	.013
	Significance (2-sided)	.800
Mobile Usage Video Telephony	Correlation by Pearson	.021
	Significance (2-sided)	.720
Mobile Usage E-Learning	Correlation by Pearson	.065
	Significance (2-sided)	.288
Mobile Usage IM	Correlation by Pearson	.059
	Significance (2-sided)	.255
Mobile Usage Navigation	Correlation by Pearson	-.071
	Significance (2-sided)	.172

**. Correlation p=0.01 (2-sided) significant. /*. Correlation p=0.05 (2-sided) significant

TABLE VI. Correlation Analysis of Email and Online Shopping Usage and Service Data Security Perceptions.

		Fix Usage Email	Mobile Usage Email	Fix Usage Online Shopping	Mobile Usage Online Shopping
Data Security Email	Correlation by Pearson	.105*	.047*	.142**	.011*
Data Security Online Shopping	Correlation by Pearson			.036*	.034*
Data Security Online Banking	Correlation by Pearson			.144**	.023*

**. Correlation p=0.01 (2-sided) significant. /*. Correlation p=0.05 (2-sided) significant

TABLE VII. Correlation Analysis of Mobile Social Media Usage and Service Data Security Perceptions.

		Mobile Usage Social
Data Security Gaming	Correlation by Pearson	**-.185****
	Significance (2-sided)	**.004**
Data Security E-Learning	Correlation by Pearson	**-.158****
	Significance (2-sided)	**.005**

**. Correlation p=0.01 (2-sided) significant. /*. Correlation p=0.05 (2-sided) significant

D. Regression Analyses

The regression analysis follows the same procedure as the correlation analysis. Firstly, the authors consider how the importance and perception of data security of the specific Internet services (independent variables) affect the general perception of data security (dependent variable). Following the application of the least square regression, there is a positively significant regression ($p<0.05$) between the general perception of data security and the evaluation of the data security of email services. Due to a regression coefficient value of 0.299, a higher explanatory rate is reached, which results in a good linear regression (see Table VIII). However, the r-square, which indicates the explanatory rate of the regression, is only 8.2% in this case (see Table VIII).

This value is below the targeted 10% to 20% as found in literature [67], the explanatory power of this regressive connection is quite weak. The Variance Inflation Factor (VIF), which illustrates the rate of multicollinearities, should be below the mark of 3 [64][71][72]. The VIF for this regression is 2.579, which leads to the exclusion of multicollinearities in this case.

The same significantly positively regression ($p<0.05$) can be found between the general data security perception and the importance of data security for email services. Both tests conclude that a better perceived data security for email services lead to a better estimation of the data security at all. These results are supported by the significant ($p<0.05$) regressive connection between the perception of the general data security and the perceived data security of Social Media services. However, the regression coefficient is negative (-0.278) and multicollinearities can be excluded (VIF<3). Nonetheless, the finding that the general perception of data security rises in the case that the perceived data security of the Social Media Accounts decreases, does not lead to a useful relationship between these factors and will not further considered. Considering that the other tests between the named variables also do not lead to significant connections, the authors have to conclude that the perception of data security mostly belongs to the email security. Consequently, the hypothesis H1 can be accepted for the connection with email services only. In general, hypothesis H1 has to be rejected.

The assessment of the interrelation between the password changing behavior, data security and usage of services is not the main target of the authors' analysis, but it would be useful to collect some more information which can be used for further surveys and evaluations. Interestingly, the password changing behavior does not significantly lead to a higher perceived data security ($p>0.05$). Therefore, hypothesis H5 can also be rejected.

This connection implies that the perceived data security bases on different influence factors. Furthermore, the password changing behavior also relies on different customer estimations.

The password changing behavior for emails significantly positive ($p<0.05$) affects the perceived importance of data security of email services. The reached r-square of 3.0% presents a very weak linear regressive connection between these factors. The regression coefficient with 0.174 is also quite weak. Following Petter et al., the reached VIF value of 1 infers an exclusion of multicollinearities [72]. By changing passwords for the email services more regularly, an increased perception of data security could be achieved.

The password changing behavior for social media networks significantly positively ($p<0.05$) affects the perceived importance of data security of social media services. The reached r-square of 2.2% and the regression coefficient of 0.149 illustrates a very weak linear regressive connection between these factors. Following Petter et al., the reached VIF value of 1 infers an exclusion of multicollinearities [72]. By changing passwords for the social media network services more regularly, an increased perception of data security can be reached. A further connection can be found in the positive significant regression of the password changing behavior for Social Media accounts with downloads ($p<0.05$, r-square 0.125, regression coefficient 0.253). Due to the huge volume of information distributed in the social networks, the customers are able to download a lot of materials. This means, if users take care about their personal Social Media accounts, they also use downloads. Nonetheless, the other tests do not

lead to significant results and therefore the hypothesis H4 has tu be rejected.

In the comparison of password changing behavior for emails and usage of Internet services, the password changing behavior significantly is affected by the usage of online telephony (fixed, mobile) and video on demand (mobile) in a positive way (fixed-line: r-square=12.1%, $p<0.05$, VIF close to 1; mobile: r-square=15.7%, $p<0.05$, VIF close to 1) (see Table IX). Both considerations are significant and display acceptable explanatory rates. Based on the VIF values close to 1, multicollinearities can be excluded. The more the customers use these both services, more often they change their passwords. Additionally, instant messaging in the mobile Internet usage affects negatively significantly (mobile) the changing behavior for email passwords. Here, the more the customers change their passwords the weaker they will use instant messaging in the mobile consideration (see Table IX). However, there is no reason why there is no connection to the services email or social media.

To test the hypothesis H6, the previous findings have to be analyzed from another perspective, i. e. the authors evaluate the dependence of each single service usage on the password changing behavior of customers (for emails and Social Media accounts). The hypothesis H6 has to be rejected. There are only three weak negatively significantly regressive relations between (a) the password changing behavior for emails and Social Media accounts and the mobile usage of IPTV ($p<0.05$, r-square 2.1%, coefficient -0.197), (b) online shopping ($p<0.05$, r-square 1.1%, coefficient -0.162) and (c) video telephony ($p<0.05$, r-square 1.7%, coefficient -0.161). Based on the low regression coefficients (below 0.500) and the weak values for r-square below the mark of 10%, the regressive connections are quite weak and cannot lead to an agreement of the hypothesis [69][70]. Following Petter et al., the reached VIF-values below of 3 indicate an exclusion of the multicollinearities [72]. Especially, the authors could not find any connection between the consideration of the password changing behaviors and the usage of fixed Internet services.

The consideration of the connection between Internet services usage and perception of data security and importance of data security will be divided in a fixed and mobile perspective. Table X illustrates how each single service usage in the fixed-line infrastructure is affected by the perceptions of data security and data security importance (Dependent variable = specific usage of the respective Internet services; Independent variable = perception of data security and data security importance of the specific service). The consideration indicates that the usage of Internet services with fixed-line infrastructures is not significantly influenced by the general customer perception of data security. However, for different Internet services the authors can find significantly positive regressions between the perception of data security importance of the single services and the usage of services.

As Table X illustrates, the usage of email services, online telephony and online shopping is significantly positively ($p<0.05$) influenced by the perception of data security importance for email services. Therefore, the customers intend to use email services, online telephony and online shopping if they perceive the email services to be secure and indicate a high data security importance. The connection between the usage and perception of data security importance for email services appears naturally. Also, the usage of online telephony and online shopping normally needs an account, which is generally linked to an email account. Following Schöneck and Voß, and Brosius, the r-squares between 8.7% and 10.8% and the regressions coefficients of 0.096 to 0.114 indicate quite weak significant regressions [67][70].

TABLE VIII. Regression Analysis of the General Data Security Perception and the Single Service Data Security Perceptions

Model	Not-standardized Coefficients		Sig.	VIF
	Regression Coefficient B	Standard Deviation		
Constant	3.845	.696	.000	
Password CHR Email	.018	.110	.871	2.736
Password CHR Social Media	.099	.117	.397	2.731
Data Security Email	**.299**	.140	**.034**	**2.579**
Data Security Online Telephony	-.030	.112	.785	2.068
Data Security Social Media	**-.278**	**.137**	**.043**	**2.131**
Data Security Online Shopping	.033	.131	.804	2.215
Data Security Online Banking	-.284	.172	.102	1.938
Data Security Cloud Computing	.081	.105	.441	1.824
Data Security Online Gaming	.011	.088	.902	2.111
Data Security IM	-.009	.137	.950	1.812
Data Security Downloads	-.106	.106	.318	1.665
Data Security E-Learning	.003	.105	.979	2.855
Data Security Administration	-.016	.106	.883	2.606

. a Dependent Variable: Data Security
CHR = Change Rate

Model	R	R-Square	Corrected R-Square
1	.286[a]	.082	.019

TABLE IX. Regression Analysis of the Password Changing Behavior and Usage of Internet Services

Model	R	R-Square	Corrected R-Square	Standard Deviation
1	.347[a]	.121	.031	1.110

a. Dependent Variable: Password Change Rate Email

Model	Not-standardized Coefficients		Sig.	VIF
	Regression Coefficient B	Standard Deviation		
Constant	2.622	.510	.000	
Fix Usage Online Telephony	.831	.398	.039	1.991

Model	R	R-Square	Corrected R-Square	Standard Deviation
1	.396[a]	.157	.071	1.087

a. Dependent Variable: Password Change Rate Email

Model	Not-standardized Coefficients		Sig.	VIF
	Regression Coefficient B	Standard Deviation		
Constant	2.622	.510	.000	
Mobile Usage Online Telephony	.609	.247	.015	1.584
Mobile Usage Video on Demand	.630	.255	.015	1.791
Mobile Usage_ Instant Messaging	-1.017	.431	.020	1.844

Therefore, the linear connection between the usage of these services and the estimation of the data security importance of email services can be assessed as quite weak. The VIF values below the mark of 3 exclude possible multicollinearities between the analyzed variables [64][71][72]. However, the open question is, why the perception of data security importance for emails services just affects the usage of these three named components and does not impact other Internet service usages.

The other two connections in the usage of Internet services in fixed-line infrastructures can be found in (a) the significantly positive influence ($p<0.05$) of the importance of data security on cloud computing on the usage of video on demand, and (b) the significantly positive dependence ($p<0.05$) of importance of data security on online banking and online administration on the usage of instant messaging. Due to r-squares of 10.8% and 9.8% and regression coefficients below 20%, the authors follow the estimated values for regression analyses by Schöneck and Voß and conclude quite weak regressive connections between the analyzed variables [67]. Based on the VIF below the value of 3, multicollinearities can be ruled out [64][71][72].

For case (a), the authors assume that people, who often consume videos on demand, also use clouds to save their videos, pictures and data, which they produce and consume. In the customers' mind, the usage of video on demand is influenced by the perception of data security importance for cloud computing. The only possibility to explain the circumstance would be that the customers need higher data security to consume and produce more videos. In this case, more and more people, who consume videos on demand, will also produce more and more own videos.

For case (b), no useful connection is evident. Generally, administration (e g. employment office) inform their customers with short messages services, which can be linked to the use of instant messages and so a relation to the usage of services can be predicted. Here, it can be assumed that the customers want a secure news exchange, because the information of the administrations are normally personal. Due to the fact, the highest regression coefficient is 0.162, this possible relation should be analyzed by further research. The connection to online banking could be that banks often send authentication codes per short or instant messages. With the authentication codes, the customers are able to do their transactions. Therefore, customers perceive a higher data security importance, because people are taking care that no other third party can enter this communication and can possibly copy critically personal information.

Considering the usage of the Internet services in the mobile infrastructure in Table XI, there is a significant influence ($p<0.05$) between perceived data security and the usage of navigation services. However, the regression coefficient of 0.042 and a r-square of 10.0% indicate a quite weak linear regression (the coefficient value is close to 0 instead of close to 1) between these variables. Following Schöneck and Voß, the r-square for should be higher than 20% (at least 10%) [67]. Following Hagl, and Brosius, the linear regression between the variables is weak [69][70]. Based on a VIF value below 3, multicollinearities can be ruled out [72]. The authors assume that customers use navigation services. However, the most people do not want to be tracked. Therefore, a safer perception of data security could induce higher usage rates. In contrast to the importance of emails in the fixed-line usage of Internet services, the mobile Internet services usage is dominated by the application of instant messaging. For the services, instant messaging, e-learning and social media, the data security importance of instant messaging significantly impacts ($p<0.05$) all three named factors. Based on regression coefficient factors, which are ranging between -0.154 (E-Learning negatively) and 0.101 (social media positively), the linear regression values are also quite weak. The r-squares reach values between 10.0% and 18.9%, which also do not imply good regressive interrelations. Following Petter et al.,

the VIF values below 3 leads to an exclusion of multicollinearities [72]. The relation between the perception of data security importance and usage of instant messaging is obvious. As mentioned in literature, the perception of the security of one service should influence the usage of this service. So, this connection should follow the natural order. Also, the connection between social media and the perception of data security importance can be deduced by the issue that the most people communicate with instant messaging through social media platforms. Mostly, people demand that their messages are being transferred securely and without interruptions or eavesdropping by a third party. The interrelation with e-learning cannot be explained at this point and needs further research.

The other two connections concerning the usage of Internet services in mobile infrastructures can be found in (a) the significantly negative influence ($p<0.05$) of the importance of data security for email services on the usage of online telephony, and (b) the significantly positive dependence ($p<0.05$) of importance of data security for online gaming on the usage of video on demand. Due to r-squares of 10.2% and 8.6% and regression coefficients below 20%, the authors follow the estimated values for regression analyses by Schöneck and Voß and conclude quite weak regressive relations between the analyzed variables [67]. Based on the VIF below the value of 3, multicollinearities can be ruled out [64][71][72]. Both cases cannot be explained from the current point of view. Normally, a positive relation between online telephony and the importance of data security for email services exists (like in the fixed-line consideration) but, the negative interrelation does not lead to a useful explanation in the current moment. A similar argumentation could be performed for the connection of video demand usage and the importance of data security for online gaming services. The authors cannot identify a meaningful influence of this perception on the usage of video on demand. Therefore, this result will not be considered in this paper. The above mentioned possible negative relations between IM and SM and e-learning and online gaming cannot be supported. Therefore, it can be concluded that the above-mentioned correlations depend on third unknown factors.

Consequently, the authors only find few regressive relationships between perceived data security, perceived importance of data security and the usage of Internet services. In the whole consideration, the authors have to reject the hypotheses H2 and H3.

V. DISCUSSION

The analysis within this paper considers how the test persons evaluate the importance of data security.

As mentioned above, nearly 70% of the interviewed persons have indicated that they do change their password less than once a year. It can be expected that they more or less never change their primary passwords.

From this point of view, the authors conclude: (1) the most people are not aware of the importance of data security and the safety of their personal data or they do not care about the possible risks, or (2) they do not understand the relation between the password changing behavior and the data security. The authors assume that the people (a) do not care about, (b) are not aware of the consequences, or (c) are too lazy to take care about these issues.

The majority of nearly 85% uses anti-virus programs to protect their devices. However, in the most cases (round about 70%) people are not willing to pay money for security of their devices. However, the people do not take care about that normally the free version of an anti-virus program has a smaller program scope and possibly some necessary elements for the protection of the devices are not implemented.

This paper examines the influence of the perception and importance of data security regarding the usage of Internet services, especially mobile Internet services.

The presented findings in the previous chapter indicate that a general interrelation between the perception of data security, data security importance and the usage of Internet services cannot be found. However, in the consideration of single services and their perception and importance of data securities, some positive and negative regressions could be found. But often the natural service data perception does not fit with the usage of the service (see Tables IV and V). The missing connections support the absence of direct relationships between the analyzed variables. Therefore, the authors have to reject all hypotheses in general.

Though, the particular single relations between the usage and the perception/importance of data security of the specific services could induce that a possible relation between these variables exist. The data security of email services seems to be the most important factor for customers. Since the overall data security of the customers is essentially influenced by their assessment of the data security of emails as well as the significance of this data security. These lead to the conclusion that if customers feel a higher email security they will use more Internet services (independent of the infrastructure). This relation is supported by the fact that people on a fixed-line connection often communicate via emails. In contrast to the fixed-line usage, mobile instant messaging takes the same position as the explained email services importance for the fixed-line infrastructures. Based on the fact that a lot of people use instant messengers like WhatsApp, Facebook Messenger, Line and others per mobile phone, obviously the services with highest importance also gain the highest data security importance. Other possible variables and services can also have an influence but further research would be needed.

Hence, the authors do not reject the hypotheses completely. It can be noted that the perceived data security for emails significantly influences the general perception of data security. However, the previous findings indicate that further research is necessary. The comparison of fixed with mobile Internet usage in connection with estimation of data security does not yield useful results.

TABLE X. Regression Analysis of Usage, Data Security and Data Security Importance of Internet Services in the Fixed-Line Network.

Services Fixed-Line Usage	Test of Perceived Security Importance	Test of Perceived Data Security
Usage Email	Dependent Variable: Usage of Email Services Independent Variable: Data Security Importance of Email Services Regression: $p<0.05$ R-square = 8.7% Coefficient = 0.114 VIF<3	No Significance
Usage Online Telephony	Dependent Variable: Usage of Online Telephony Independent Variable: Data Security Importance of Email Services Regression: $p<0.05$ R-square = 10.8% Coefficient = 0.096 VIF<3	No Significance
Usage Video on Demand	Dependent Variable: Usage of Video on Demand Independent Variable: Data Security Importance of Cloud Services Regression: $p<0.05$ R-square = 10.8% Coefficient = 0.062 VIF<3	No Significance
Usage IPTV	No Significance	No Significance
Usage Online Shopping	Dependent Variable: Usage of Online Shopping Independent Variable: Data Security Importance of Email Services Regression: $p<0.05$ R-square = 10.2% Coefficient = 0.103 VIF<3	No Significance
Usage Cloud_ Computing	No Significance	No Significance
Usage Social Media	No Significance	No Significance
Usage E-Learning	No Significance	No Significance
Usage Instant Messaging	Dependent Variable: Usage of Online Telephony Independent Variables: Data Security Importance of Online Banking and E-Government Services Regression: $p<0.05$ R-square = 9.8% Coefficient = 0.162 (Banking) Coefficient = 0.089 (Online Administration) VIF<3	No Significance
Usage Online Gaming	No Significance	No Significance
Usage Navigation	No Significance	No Significance

Therefore, no significant differences in the usage or in the perception of data security can be found. The authors do not find a significant connection between the perception of data security in general and in particular (regarding the specific services). The presented literature, which discloses different significant connections between the perceived trust/perceived risk and the behavioral intention to use mobile payments and mobile banking, show significantly better results. In comparison to these findings, the authors aim to explain how the discrepancy between the own and external results can be comprehended. One possible difference in the results bases on the importance of data security. The different questions for data security importance possibly inhibit the significance of the perception of data security. The results for the perceived security could be therefore affected and overwhelmed by the concept of data security importance. Secondly, the TAM and UTAUT2 normally use the external variables as impact factors for the behavioral intention to use [12][13][14]. The adaptation of the model with a direct influence of perceived security and user behavior can possibly lead to the discrepancies. It must be considered that this relation possibly does not exist. Furthermore, the authors did not include questions to prove the other concepts of the TAM and the UTAUT2 in the questionnaire, which would possibly be able to support the findings of the data security analysis.

Thirdly, the combined consideration of the influence on multiple mobile services, which all have different conditions and customer evaluations in direction of data security, user-friendliness and technical requirements poses the problems of potentially not being able to examine all factors in one analysis.

TABLE XI. Regression Analysis of Usage, Data Security and Data Security Importance of Internet Services in the Mobile Network.

Services Mobile Usage	Test of Perceived Security Importance	Test of Perceived Data Security
Usage Email	No Significance	No Significance
Usage Online Telephony	Dependent Variable: Usage of Online Telephony Independent Variable: Data Security Importance of Email Services Regression: $p<0.05$ R-square = 10.2% Coefficient = -0.136 VIF<3	No Significance
Usage Video on Demand	Dependent Variable: Usage of Video on Demand Independent Variable: Data Security Importance of Online Gaming Services Regression: $p<0.05$ R-square = 8.6% Coefficient = 0.095 VIF<3	No Significance
Usage IPTV	No Significance	No Significance
Usage Online Shopping	No Significance	No Significance
Usage Cloud Computing	No Significance	No Significance
Usage Social Media	Dependent Variable: Usage of Social Media Independent Variable: Data Security Importance of Instant Messaging Services Regression: $p<0.05$ R-square = 13.5% Coefficient = 0.101 VIF<3	No Significance
Usage E-Learning	Dependent Variable: Usage of E-Learning Independent Variables: Data Security Importance of Instant Messaging and Online Gaming Services Regression: $p<0.05$ R-square = 18.9% Coefficient = -0.154 (IM) Coefficient = -0.111 (Gaming) VIF<3	No Significance
Usage Instant Messaging	Dependent Variable: Usage of Instant Messaging Independent Variables: Data Security Importance of Instant Messaging Regression: $p<0.05$ R-square = 10.0% Coefficient = 0.056 VIF<3	No Significance
Usage Online Gaming	No Significance	No Significance
Usage Navigation	No Significance	Dependent Variable: General Data Security Independent Variables: Data Security Importance of Navigation Regression: $p<0.05$ R-square = 10.0% Coefficient = 0.042 VIF<3

The fourth issue could be that the test persons, who are mainly between 20 and 29 years old, are very affine in the usage of mobile services and possibly do not take care very much for data security. Due to their affinity, the people use the services and increase their experience. In connection to the explanations in the literature review, an increased experience can lead to a higher behavioral intention. Furthermore, the overrepresentation of this age group also influences significantly the whole results of the survey. If other age groups would have nearly the same proportion on test persons, the results could be quite different.

Furthermore, more experience will diminish possible uncertainties and risk with usage of the different mobile services. The last issue could be found in the questions of the survey, because some of the questions are not suitable to generate the desired information concerning the presented concepts.

Therefore, the authors have decided to collect all these open issues to improve the own research and to carry out another survey. The shortly explained open issues and different possible improvements for a second survey will be presented in the following section.

VI. IMPROVEMENTS AND FURTHER APPROACH

Generally, the presented results cannot fully describe the influence of data security issues on the usage of specific Internet services. However, the results enable finding a general perception of data security on the usage of specific Internet services. Nevertheless, the perception of data security respective of single services has shown that an influence of data security issues on the usage of specific Internet services can be comprehended.

However, the first survey has to be seen as a pre-test as some questions do not lead to the aimed findings and cannot illustrate possible relationships. To reach better results for the examination of the named concepts, the authors will do a second survey. The second questionnaire will include some improvements to get closer to the perception of perceived credibility, perceived security, initial trust and firms' reputation. Especially the firms' reputation will be important, because researches found out that reputation increases trust in mobile banking [40][44][73][74]. This relation may also fit in the consideration of the usage of other services. These implications can be used for the estimations of the relation between trust and the usage of mobile Internet services.

Based on the findings that (a) the perceived credibility and (b) the initial trust will play a major role if customers decide to use a system or service, the authors will include these two components in the consisting model. In consideration of the presented problem, perceived credibility will cover the questions how the customers estimate and perceive reliability of the fixed and mobile Internet network, services and content providers.

As mentioned above, perceived credibility covers (a) the users' beliefs that the used systems would be free of threats for privacy and security and (b) their according attitudes, which is known to positively influence the behavioral intention to use the systems [17][20]. The authors relate to the perceived credibility with the initial trust, as known through the literature.

Based on this relationship, initial trust indicates how the customers feel their data safe by the providers based on the estimation of the questions to perceived credibility. To support these findings, the concepts of perceived data security and perceived importance of data security will be related with initial trust too. On the base of the literature, the authors adapt the previous model in the way that they relate initial trust directly to the use behavior of an Internet services, instead of the behavioral intention to use.

Besides the analysis of the relationships in the TAM, the improvements are necessary to closer analyze the issues of data security and trust from the perspective of the UTAUT2. The questions need to be tailored to the findings of perceived credibility which shall support the previous findings of perceived security. This approach is needed to prioritize the focus on the consumer perspective instead of an organizational perspective. Nevertheless, the main focus of this work is to examine the influence of data security in general and in relation to the single services. Here, the authors examine the user perception of data security regarding single Internet services. This approach also enables the analysis of the difference between the general and single service perception of data security.

Therefore, the other concepts like perceived ease of use, performance expectancy, social influence, habit, effort expectancy, trust propensity, and structural assurance are not considered in detail [12][13][14]. As described above, the focus of the research and the analysis is on the concepts of perceived credibility, perceived security, initial trust and firms' reputation.

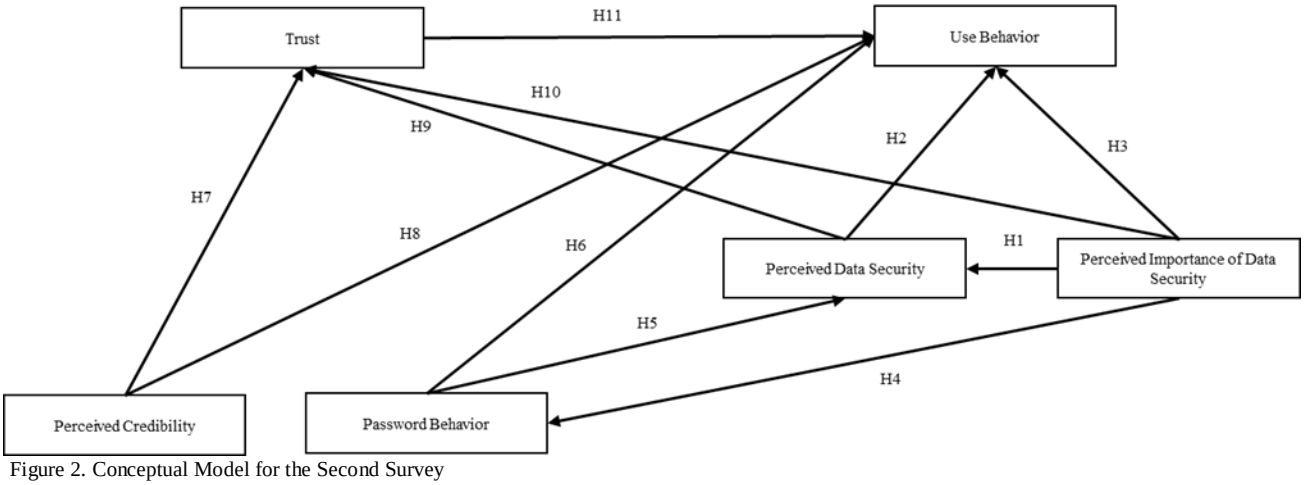

Figure 2. Conceptual Model for the Second Survey

This approach could possibly lead to reduced results and information from the second survey, due to the issue that the authors do not include the other used concepts from the UTAUT2 and the TAM. But the authors try to focus on the assessment of the single influence of data security (regarding trust and credibility) on the customer usage of Internet services.

The authors are aware of the fact that this approach might not lead to the aimed results, due to the small number of considered concepts and the non-observance of moderators.

In contrast to the first survey, the second survey includes the frequency of Internet services usage. Here, the authors share the opinion that this approach gives a better overview of the usage of services and possibly how data security issues impact the frequency of usage.

In order to cover the perceived credibility about the used system, in this paper the fixed and mobile telecommunication networks, the second survey includes questions about how the customers perceive the security of the infrastructure and how the network operators use the gained data from the customer. These questions should also cover how the customers perceive that the infrastructure is free of risks. Furthermore, the customer estimation of the network operators enables a possible assessment of enterprises' trustworthiness and adhere the accepted rules from customer perspective [75]. Consequently, the authors are testing the concepts from TAM and UTAUT2 in combined questions.

Finally, the difference to the previous study will be underlined by the analysis of other impact factors like culture values and traditions. The general idea of this paper should be to examine a relationship between the perception of data security and usage of Internet services, especially of mobile Internet services.

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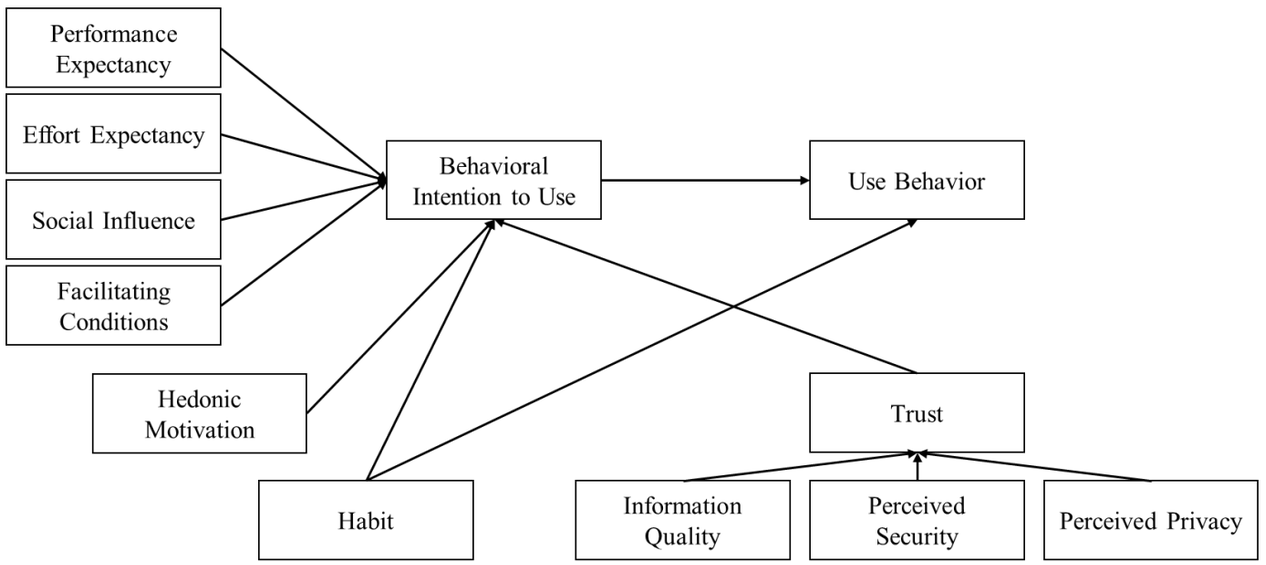
Appendix 1. Adapted UTAUT2 following [14][15][19]



Source: Venkatesh et al., and Escorbar-Rodriguez and Carvajal-Trujillo [14][15][19]

Appendix 2. Correlation Analysis of Data Security Perceptions of all Considered Services.

		Data Security	Data Security Email	Data Security Online Telephony	Data Security Social Media	Data Security Online Shopping	Data Security Online Banking	Data Security Cloud Compu-ting	Data Security Online Gaming	Data Security IM	Data Security Down-loads	Data Security E-Learning	Data Security Admin-istration
Data Security Email	Correlation by Pearson	.025	1	.593**	.435**	.546**	.398**	.427**	.290**	.388**	.365**	.330**	.400**
	Sign. (2-sided)	.607		.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
Data Security Online Telephony	Correlation by Pearson	-.043	.593**	1	.485**	.305**	.191**	.263**	.355**	.504**	.353**	.358**	.385**
	Sign. (2-sided)	.383	.000		.000	.000	.000	.000	.000	.000	.000	.000	.000
Data Security Social Media	Correlation by Pearson	-.072	.435**	.485**	1	.381**	.259**	.390**	.204**	.601**	.412**	.275**	.276**
	Sign. (2-sided)	.163	.000	.000		.000	.000	.000	.001	.000	.000	.000	.000
Data Security Online Shopping	Correlation by Pearson	-.029	.546**	.305**	.381**	1	.521**	.343**	.213**	.197**	.367**	.264**	.369**
	Sign. (2-sided)	.560	.000	.000	.000		.000	.000	.001	.000	.000	.000	.000
Data Security Online Banking	Correlation by Pearson	-.099	.398**	.191**	.259**	.521**	1	.467**	-.004	.130*	.177**	.041	.160**
	Sign. (2-sided)	.054	.000	.000	.000	.000		.000	.947	.014	.001	.462	.005
Data Security Cloud Comp	Correlation by Pearson	.003	.427**	.263**	.390**	.343**	.467**	1	.438**	.249**	.321**	.345**	.400**
	Sign. (2-sided)	.954	.000	.000	.000	.000	.000		.000	.000	.000	.000	.000
Data Security Online Gaming	Correlation by Pearson	.041	.290**	.355**	.204**	.213**	-.004	.438**	1	.244**	.441**	.572**	.486**
	Sign. (2-sided)	.527	.000	.000	.001	.001	.947	.000		.000	.000	.000	.000
Data Security IM	Correlation by Pearson	-.059	.388**	.504**	.601**	.197**	.130*	.249**	.244**	1	.427**	.264**	.287**
	Sign. (2-sided)	.251	.000	.000	.000	.000	.014	.000	.000		.000	.000	.000
Data Security Downloads	Correlation by Pearson	-.072	.365**	.353**	.412**	.367**	.177**	.321**	.441**	.427**	1	.440**	.364**
	Sign. (2-sided)	.155	.000	.000	.000	.000	.001	.000	.000	.000		.000	.000
Data Security E-Learning	Correlation by Pearson	-.016	.330**	.358**	.275**	.264**	.041	.345**	.572**	.264**	.440**	1	.705**
	Sign. (2-sided)	.776	.000	.000	.000	.000	.462	.000	.000	.000	.000		.000
Data Security Administration	Correlation by Pearson	-.020	.400**	.385**	.276**	.369**	.160**	.400**	.486**	.287**	.364**	.705**	1
	Sign. (2-sided)	.726	.000	.000	.000	.000	.005	.000	.000	.000	.000	.000	

**. Correlation p=0.01 (2-sided) significant. /*. Correlation p=0.05 (2-sided) significant.

Appendix 3. Correlation Analysis of Internet Services Usage in Fixed Infrastructures.

		Fix Usage Email	Fix Usage Surf	Fix Usage Online Telephony	Fix Usage Video on Demand	Fix Usage IPTV	Fix Usage Online Shopping	Fix Usage Cloud Compu-ting	Fix Usage Social Media	Fix Usage Video Telephony	Fix Usage E-Learn-ing	Fix Usage IM	Fix Usage Naviga-tion
Fix Usage Email	Correlation by Pearson	1	.705**	.550**	.550**	.222**	.508**	.530**	.538**	.432**	.590**	.201**	.324**
	Sign. (2-sided)		.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
Fix Usage Surf	Correlation by Pearson	.705**	1	.640**	.656**	.320**	.563**	.477**	.557**	.407**	.480**	.195**	.295**
	Sign. (2-sided)	.000		.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
Fix Usage Online Telephony	Correlation by Pearson	.550**	.640**	1	.681**	.457**	.707**	.512**	.458**	.393**	.468**	.136*	.236**
	Sign. (2-sided)	.000	.000		.000	.000	.000	.000	.000	.000	.000	.014	.000
Fix Usage Video on Demand	Correlation by Pearson	.550**	.656**	.681**	1	.526**	.588**	.543**	.557**	.435**	.397**	.187**	.242**
	Sign. (2-sided)	.000	.000	.000		.000	.000	.000	.000	.000	.000	.000	.000
Fix Usage IPTV	Correlation by Pearson	.222**	.320**	.457**	.526**	1	.513**	.324**	.296**	.456**	.252**	.093	.177**
	Sign. (2-sided)	.000	.000	.000	.000		.000	.000	.000	.000	.001	.158	.007
Fix Usage Online Shopping	Correlation by Pearson	.508**	.563**	.707**	.588**	.513**	1	.364**	.480**	.399**	.442**	.186**	.301**
	Sign. (2-sided)	.000	.000	.000	.000	.000		.000	.000	.000	.000	.000	.000
Fix Usage Cloud Computing	Correlation by Pearson	.530**	.477**	.512**	.543**	.324**	.364**	1	.549**	.433**	.512**	.214**	.230**
	Sign. (2-sided)	.000	.000	.000	.000	.000	.000		.000	.000	.000	.000	.000
Fix Usage Social Media	Correlation by Pearson	.538**	.557**	.458**	.557**	.296**	.480**	.549**	1	.486**	.505**	.287**	.394**
	Sign. (2-sided)	.000	.000	.000	.000	.000	.000	.000		.000	.000	.000	.000
Fix Usage Video Telephony	Correlation by Pearson	.432**	.407**	.393**	.435**	.456**	.399**	.433**	.486**	1	.434**	.255**	.295**
	Sign. (2-sided)	.000	.000	.000	.000	.000	.000	.000	.000		.000	.000	.000
Fix Usage E-Learning	Correlation by Pearson	.590**	.480**	.468**	.397**	.252**	.442**	.512**	.505**	.434**	1	.257**	.361**
	Sign. (2-sided)	.000	.000	.000	.000	.001	.000	.000	.000	.000		.000	.000
Fix Usage IM	Correlation by Pearson	.201**	.195**	.136*	.187**	.093	.186**	.214**	.287**	.255**	.257**	1	.373**
	Sign. (2-sided)	.000	.000	.014	.000	.158	.000	.000	.000	.000	.000		.000
Fix Usage Navigation	Correlation by Pearson	.324**	.295**	.236**	.242**	.177**	.301**	.230**	.394**	.295**	.361**	.373**	1
	Sign. (2-sided)	.000	.000	.000	.000	.007	.000	.000	.000	.000	.000	.000	

**. Correlation p=0.01 (2-sided) significant. /*. Correlation p=0.05 (2-sided) significant.

Appendix 4. Correlation Analysis of Internet Services Usage in Mobile Infrastructures.

		Mobile Usage Email	Mobile Usage Surf	Mobile Usage Online Telephony	Mobile Usage Video on Demand	Mobile Usage IPTV	Mobile Usage Online Shopping	Mobile Usage Cloud Compu-ting	Mobile Usage Social Media	Mobile Usage Video Telephony	Mobile Usage E-Learn-ing	Mobile Usage IM	Mobile Usage Naviga-tion
Mobile Usage Email	Correlation by Pearson	1	.552**	.261**	.281**	.085	.361**	.217**	.370**	.272**	.417**	.243**	.444**
	Sign. (2-sided)		.000	.000	.000	.186	.000	.000	.000	.000	.000	.000	.000
Mobile Usage Surf	Correlation by Pearson	.552**	1	.306**	.411**	.154*	.409**	.208**	.371**	.260**	.372**	.217**	.467**
	Sign. (2-sided)	.000		.000	.000	.016	.000	.000	.000	.000	.000	.000	.000
Mobile Usage Online Telephony	Correlation by Pearson	.261**	.306**	1	.420**	.389**	.444**	.330**	.236**	.279**	.295**	.088	.208**
	Sign. (2-sided)	.000	.000		.000	.000	.000	.000	.000	.000	.000	.116	.000
Mobile Usage Video on Demand	Correlation by Pearson	.281**	.411**	.420**	1	.405**	.382**	.331**	.301**	.418**	.364**	.134*	.244**
	Sign. (2-sided)	.000	.000	.000		.000	.000	.000	.000	.000	.000	.012	.000
Mobile Usage IPTV	Correlation by Pearson	.085	.154*	.389**	.405**	1	.362**	.236**	.124	.358**	.177*	.030	.089
	Sign. (2-sided)	.186	.016	.000	.000		.000	.001	.062	.000	.016	.649	.178
Mobile Usage Online Shopping	Correlation by Pearson	.361**	.409**	.444**	.382**	.362**	1	.386**	.335**	.398**	.338**	.127*	.284**
	Sign. (2-sided)	.000	.000	.000	.000	.000		.000	.000	.000	.000	.018	.000
Mobile Usage Cloud Computing	Correlation by Pearson	.217**	.208**	.330**	.331**	.236**	.386**	1	.200**	.352**	.358**	.160**	.162**
	Sign. (2-sided)	.000	.000	.000	.000	.001	.000		.001	.000	.000	.008	.008
Mobile Usage Social Media	Correlation by Pearson	.370**	.371**	.236**	.301**	.124	.335**	.200**	1	.282**	.428**	.368**	.447**
	Sign. (2-sided)	.000	.000	.000	.000	.062	.000	.001		.000	.000	.000	.000
Mobile Usage Video Telephony	Correlation by Pearson	.272**	.260**	.279**	.418**	.358**	.398**	.352**	.282**	1	.355**	.213**	.219**
	Sign. (2-sided)	.000	.000	.000	.000	.000	.000	.000	.000		.000	.000	.000
Mobile Usage E-Learning	Correlation by Pearson	.417**	.372**	.295**	.364**	.177*	.338**	.358**	.428**	.355**	1	.249**	.323**
	Sign. (2-sided)	.000	.000	.000	.000	.016	.000	.000	.000	.000		.000	.000
Mobile Usage IM	Correlation by Pearson	.243**	.217**	.088	.134*	.030	.127*	.160**	.368**	.213**	.249**	1	.481**
	Sign. (2-sided)	.000	.000	.116	.012	.649	.018	.008	.000	.000	.000		.000
Mobile Usage Navigation	Correlation by Pearson	.444**	.467**	.208**	.244**	.089	.284**	.162**	.447**	.219**	.323**	.481**	1
	Sign. (2-sided)	.000	.000	.000	.000	.178	.000	.008	.000	.000	.000	.000	

**. Correlation p=0.01 (2-sided) significant. /*. Correlation p=0.05 (2-sided) significant.