



Interactive Systems in the Student-Bank Relationship: A Research on the Views of the University of Bucharest Students on the Utility and Adaptability of HCI Technologies

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Abstract. The analysis of how students interact with the virtual banking space through ATMs provides both banks that create and offer targeted clients customized banking services as well as HCI Banking technology designers, verifiable data about the utility and the adaptability to customer requirements of these technologies.

The present study is based on research conducted through interviews and questionnaires addressed to students from the University of Bucharest, which examines how the computer-based interface facilitates or hampers students' access to specialized services dedicated to them (bank accounts, debit or credit cards, other bank services).

The motivation for the study lies in the following considerations: students who are today's clients of a bank must be attracted and maintained as tomorrow's clients of the same bank; students are very receptive to new information technologies, understand and use them more easily than other categories of clients and can provide credible feedback on HCI; banks use the co-branding strategy (association with institutions or companies) to provide students with various types of benefits (free of charge services or discounts for shows and events).

The research is reflected in the analysis of the factors that stimulate the use of HCI technologies by students in relation to a bank and so, present study is both a quantitative and qualitative analysis of data collected by applying a questionnaire to the Romanian students of the University of Bucharest that hold an ATM cards.

The results aim to highlight the relevance of understanding the needs of student-users in the process of designing or improving both banking services and related supportive HCI technologies.

Keywords: Automated Teller Machine · Compatibility and consistency · Flexibility · Perceptual limitation · Utility and user guidance

1 Introduction

As an important factor in recent developments in financial globalization, the development of new technologies and innovation in the IT field are currently setting a decisive imprint on the mechanisms of financial circuits in the economy, on the decision-making and action of corporate or household investors. In this regard, the analysis of Human-Computer Interaction in financial field is intended to reflect the degree of standardization of financial operations and easy access for investors and households to the use and understanding of financial instruments and procedures.

The present study is based on research conducted through interviews and questionnaires addressed to students from the University of Bucharest, which examines how the computer-based interface facilitates or hampers students' access to specialized services dedicated to them (bank accounts, debit or credit cards, other bank services).

The motivation for the study lies in the following considerations: students who are today's clients of a bank must be attracted and maintained as tomorrow's clients of the same bank; students are very receptive to new information technologies, understand and use them more easily than other categories of clients and can provide credible feedback on HCI; banks use the co-branding strategy (association with institutions or companies) to provide students with various types of benefits (free of charge services or discounts for shows, restaurants, events).

The present research is both a quantitative and qualitative analysis of data collected by applying a questionnaire to the Romanian students of the University of Bucharest that hold one or more ATM cards. The questionnaire was formulated based on some of the questions from Purdue Usability Testing Questionnaire (PUTQ) made by Lin et al. (1997) with 7 scale Likert answers, socio-demographical questions and some general questions about possessing a bank card.

The quantitative analysis is divided in two parts. At the beginning we will develop an exploratory statistical analysis in order to see general elements of sample design and ATM use. In the second part we will construct an exploratory factor analysis (EFA) to investigate elements that are not so easily measured or can not be measured directly to determine the factors that can influence the use of ATM.

2 Literature Review

The scientific literature consulted by the authors in this field includes several papers that are highlighted to be noted in the context of this study undertaken either as starting points in the analysis performed or as milestones during the research.

In the paper "A Survey on Human Computer Interaction Technology for ATM" (Zhang et al. 2013) the authors analyse the Human-Computer Interaction Technology for Automated Teller Machine, as a result of troubles in using ATM and numerous surveys on ATM's design in scientific literature regarding the shortcomings of ATMs. The research focus on the improvement of ATM based on several approaches: user-centered design for ATM, optimal menu design for ATM, solving the usability problems and specific users' needs, and secure design for ATM.

Curran and King (2008) study the ATM navigation menus for a mixture of UK banks in order to find and suggest “a ‘best-of-breed’ ATM menu” as being “more usable and efficient system than the existing ATMs investigated” having as target solving the problems of card reinsertion into ATM and speeding up transaction times.

A study of Camilli et al. (2011) “investigated the relation among user experience, usability and the introduction of customized functions (based on users’ profiles) in a bank’s ATM system interface”.

The issue regarding security of using ATM was investigated by Moeckel (2011) who underline that “in contrast to earlier studies, the interplay of security and usability without a separation of factors” determine the decision makers of a bank “to understand the effects of changes in security or usability”.

Another study made by a group of Brazilians’ researcher and named “Automated Teller Machines’ adoption: an application of the technology acceptance model” tries “to evaluate the applicability of an adapted version of the Technology Acceptance Model (TAM) to the Automated Teller Machines (ATM) adoption” (Costa et al. 2007). The authors underline the TAM model “has been broadly used to identify the antecedents to behavioral intention”.

The authors El-Haddad and Almahmeed highlighted in their study that “Many advanced ATM machines offer an abundance of additional services including cash and cheque deposits, ability to pay bills at terminal, top-up pay as you go mobile phone and purchasing tickets such as train or concert tickets” (El-Haddad and Almahmeed 1992).

Calayag et al. (2018) reveal in their survey that “the study [...] aims to determine which factors have the significant effect on the interaction between humans and ATMs, and to evaluate the usability of the said ATMs and its effectiveness to users”.

Particularly importance have researches on ATM users with physical or visual deficiencies, such as that of Omari and Zachary (2013) considering the mitigation of “digital exclusion of the visually impaired” by implementing assistive technologies, and also improved usability, accessibility and security of ATM regarding this segment of bank customers.

As regards the client’s choice of the bank to conduct their own transactions, a study on the situation in Romania showed that “the number of ATM (automatic teller machines) booths has been found to be the most important selection criteria for bank customers from Romania” (Katircioglu et al. 2011). The study also highlighted as important factors in choosing a bank aspects like: “extensive ATM services, availability of telephone and internet banking, giving personal attention to customers, reputation and image of the banks, confidentiality of the bank for customer records, appearance of staff to be presentable and the number of branch offices around the country”.

A distinct research regarding the interaction student-ATM is “The acceptance and use of Automated Teller Machines (ATMs) by undergraduate students” (Galadanci and Abdulwahab 2016) that analyse some HCI characteristics like “Performance Expectancy - the degree to which an individual believes that using the system will help him or her to attain gains in job performance; Effort Expectancy - the degree of ease associated with the use of the system; Behavioral Intention - the degree to which an individual will engage in a particular behavior” in order to validate a model for ATM systems available for students in university campus.

3 Characteristics of ATM Marketplace in Romania and Human Behavior

The ATM marketplace in Romania in the year 2018 was characterized by a 5.2% reduction over a period of 18 months as a result of the relocation of the retail business to the online environment, as evidenced by Business Review based on data centralized by the National Bank of Romania. According to the NBR, the number of ATMs decreased from 11,669 units in September 2016 to 11,058 units in March 2018 (Melenciuc 2018).

In spite of this evolution, ATM customer demand increased “from 61 million to 63 million (quarterly), while the number of active banking cards in Romania increased by 11.4% to 12.8 million” (Melenciuc 2018). The fact that cash payments are still widely used in Romania is also demonstrated by the fact that “the total value of the currency in circulation increased by 11.8% between June 2017 and June 2018 to RON 65 billion (EUR 14 billion)” (Melenciuc 2018). The decrease in the number of ATMs is explained by the need to reduce ATM network costs, but also inexplicable as a result of the reduction of some 15,000 jobs in the last ten years, as banking competition is growing to attract new customers.

The client’s requirement for ATM cash transactions and hence the increase in the number of ATMs in operation is justified by the advantages offered by this type of electromechanical device such as: quick cash withdrawal, easy getting a bank card, account balance inquiry, deposit cash, transfer funds between accounts within the same bank, pay for utility bills, no less than security features, universally acceptance, time saving, overseas withdrawal and 24/7 operational.

Considering those characteristics, a speech of Yves Mersch, member of the Executive Board of the European Central Bank for Project Syndicate underline that “growth in overall demand for cash is outpacing nominal GDP growth” in European Union and “the differences among member states are pronounced: the share of cash transactions ranges from 42% in Finland to 92% in Malta. [...] the public’s commitment to cash remains strong – and is becoming stronger” (Mersch 2017). As a result, it is normal to see differences between countries as well as within regions or cities of a country in terms of demand for cash transactions.

A particular impact on the use of ATMs in Romania by the population, especially by the students, has the level of financial knowledge of individuals. According to a study conduct by Provident, a financial company, on a sample of 1,265 respondents aged between 21 and 65, “more than 38% of Romanians say they are not informed about how to manage their money and only 17% of them believe they have a medium to good level of financial knowledge” (Deacu 2018). [...] “Thus, on a scale of 1 to 10, from very weak to very good, an average of almost 17% of Romanians assess their financial knowledge from medium to good. Nearly 40% say they have financial knowledge under 5, on the same scale” (Deacu 2018). Provident Financial Romania is part of the UK International Personal Finance Group (IPF) that has 2.4 million customers in 9 countries across Europe, as well as in Mexico and Australia.

Another study entitled “The Financial Behavior of Romanians”, highlighted “the need for permanent information in the field of financial education, in order to better

manage personal finances”. Also “91% of respondents claim that it is very important to constantly update their financial knowledge for good personal budget management” (OTP Bank 2018). The study was conducted by OTP Bank Romania, through the Right to Education Foundation, from August to September 2018, by online questioning of 1,000 people over the age of 18. About half of respondents (48%) have higher education and 16% higher economics.

In this respect, the research below undertakes an analysis of the factors that stimulate the use of HCI technologies by students in relation to a bank: access 24 h a day and 7 days out of 7; multiplication of human-computer interaction techniques; ease of use of various banking products and services; providing computer assistance in entering data; financial assistance and counseling offered by the ATM in the selection and use of banking products/services; ensuring the security of data transmission and ATM transactions.

To the same extent, following this research, the bank is interested in a number of aspects that interfere with the bank-student relationship: collecting personal information about the usage habits of banking products/services; information on home and residence, information on age and income level, information on behavior in the use of banking products/services (good-payer/bad-payer), information about the client’s lifestyle (inclinations for saving/accessing credit). HCI provides the bank with an efficient system for collecting student information (the average account balance, the number and type of operations he/she orders, the selection of banking products and services and the frequency of their use, with implications for innovation/abandonment of products/banking services by quantifying some parameters such as: the volume of operations, the cost and return associated with those products/services, the security conditions as well as tax issues.

4 Romanian Students Behavior on Using ATM

4.1 Methodology of Research

In this section the authors will develop a quantitative research in order to draw attention to the challenges and also to the strong and the weak points that come in the interaction of bank customers with ATM (Automated Teller Machine). In this regard, we developed first a statistical research among students from University of Bucharest, Department of Public Administration and Business. We developed a semi-structured questionnaire by using a selection of questions from Purdue Usability Testing Questionnaire (PUTQ) made by Lin et al. (1997) with 7 scale Likert answers, and by introducing socio-demographical and general questions about using an ATM in correlation with a bank card.

The survey was conducted online in the last week of the semester during the classes and it was optional, only for those students who wanted to participate by completing the questionnaire. Answering to all questions from the proposed questionnaire was mandatory so they were unable to hand over the questionnaire without answering all the questions.

The study presented in this section is divided in two parts. At the beginning there is an exploratory statistical analysis in order to see general elements of sample design and bank card use. In the second part of the study we will construct an exploratory factor analysis (EFA). Generally, EFA allows researchers to investigate elements that are not so easily measured or can not be measured directly. This type of variables are called latent variables. In order to measure them we can use observed values known as manifest variables. In our study for manifest variables we will use some question about ATM with Likert scale answers. Based on this manifest variables we will design some latent variables called also as factors and we will name those factors.

4.2 The Sample

The sample size includes a number of 208 students that agreed to participate to the study. The distribution of the respondents by socio-demographic factors is explained below. Respondents were between the ages of 19 and 35, so the average age was 21.59 years and standard deviation was 2.33 years. There were 148 (71%) female and 60 (29%) male students that participated to the study. According to the results, 99 (48%) students were from Bucharest and the other 109 (52%) were from different regions of the country. In terms of educational level, 56 (27%) students were enroled in masteral studies while others 152 (73%) were enrolled in bachelor studies (Fig. 1).

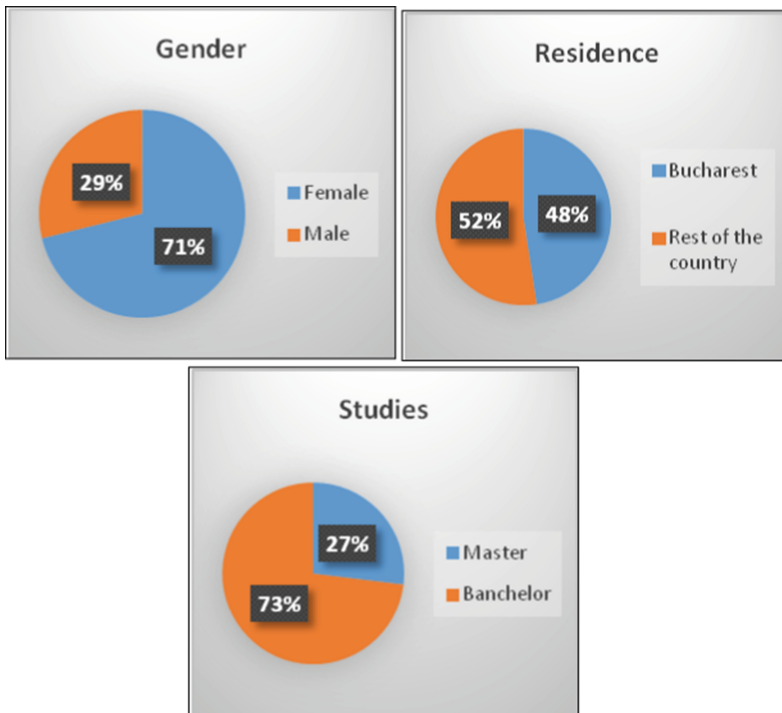


Fig. 1. Gender, residence and studies of the respondents

4.3 Exploratory Statistical Analysis for ATM

In terms of income the analysis of answers revealed that: 26 students have an income between 0 and 500 RON, 39 students - between 500 and 1,000 RON, 36 students - between 1,000 and 1,500 RON, 36 students - between 1,500 and 2,000 RON, 29 students - between 2,000 and 2,500 RON, 16 students - between 2,500 and 3,000 RON, 10 students - between 3,000 and 3,500 RON and 16 students have an income bigger than 3500 RON.

As the main sources of income for the surveyed students were featured: the wage for 113 students, the scholarship for 28 of them and the money given by parents for 78 students; two of them checked all of these answers and another two checked scholarship and parents.

Most of the students involved in the study have decided to open a bank account to receive the scholarship (60 students), full time job salary (61 students), money from the parents (45 students), part time job salary (37 students), and two students said that bank publicity made them to open a bank account.

We also asked them if they poses a mobile phone, computer or laptop and a social media account. It seems that all students involved in this study declared they have a mobile phone, 7 declared they do not own a computer or laptop and 4 that do not have a social media account.

From all respondents, 165 students said they have a debit card, 41 a credit card and 2 a shopping fidelity card. In terms of the frequency of use of the bank card, 55 students said they use it daily, 43 - once a week, 37 - every two days, 30 - once a month, 27 - three times a week and 16 - every two weeks.

The vast majority of students (105) think they have a saving-oriented behavior, 76 of them think they have a consumption-oriented behavior based on their own money, 18 of them think they are oriented towards investing and only 9 of them use credit card most of the time.

The frequency with which students use an ATM is presented below (Fig. 2): once a month (60 students), daily (44 students), once a week (44 students), three times a week (25 students), every two weeks (23 students) and every two days (12 students).

The reasons why the students use ATM are presented as follows (Fig. 3): avoid carrying to much cash in the wallet (90 students), avoid bank queues (77 students), pay for purchases at merchants (27 students) and make transactions during the bank's downtime (14 students).

The ATM is also used for bills payment (57 students from total), checking current balance of the bank account (171 student from total), extract money from the bank account (109 students from total), deposit money on the bank account (130 students from total), prepaid card recharging for mobile phone (80 students from total), exchange money (8 students from total).

Further we will conduct the exploratory factor analysis using the questions from Purdue Usability Testing Questionnaire with 7 scale Likert answers. Exploratory factor analysis is a technique used to identify the correlation among variables in a dataset. It provides a factor structure and there is no need for a-priori theory. Using this statistical technique, the problematic variables can be eliminated from the study in order to reach the final result.

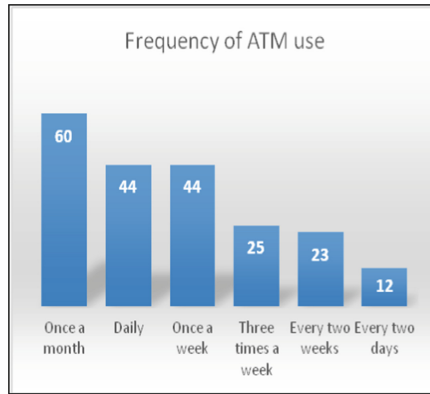


Fig. 2. Frequency in ATM usage

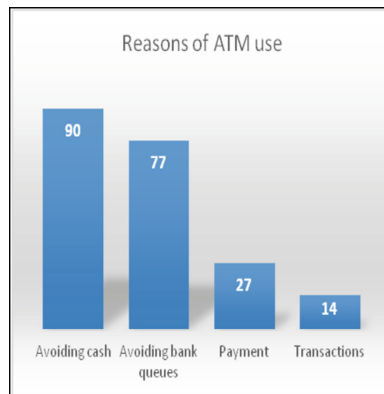


Fig. 3. Reasons for students to use ATM

4.4 Exploratory Factor Analysis (EFA) in the Case of ATM Usage

We will make this exploratory factor analysis using R Studio and some specific packages from R. The R package to conduct factor analysis is “psych”. This package was developed by William Revelle in 2018 (Revelle 2018). The main reason this package was built was to make some analysis about personality, psychometric theory and experimental psychology but of course it can be used in all fields not only in psychology.

At the beginning we will check the adequacy of using factor analysis. For this we will take into account the following elements: criterion of sample size adequacy (Comrey and Lee 1992), Kaiser-Meyer-Olkin’s test and Bartlett’s test. Our sample has 208 respondents so criterion of sample size adequacy is satisfied. We can see below the results of those two tests.

Further we will develop Kaiser-Meyer-Olkin’s test (KMO) with the purpose to determine whether there is a significant number of factors in the dataset. This test is

used as a sampling adequacy criterion. Besides the indicator called KMO we will determine individual measures of sampling adequacy for each item (MSA). According to Kaiser (1974), if KMO is less than 0.5 is unacceptable, [0.5, 0.6) is miserable, [0.6, 0.7) is mediocre, [0.7, 0.8) is middling, [0.8, 0.9) is meritorious, [0.9, 1.0) is marvelous. In our case $KMO = 0.835261$ so we can say that there are a significant number of factors in the dataset.

The next step in checking the adequacy of using factor analysis is Bartlett's test (Snedecor and Cochran 1989) that determine if the correlation matrix is an identity matrix. Using R Studio we determined that the probability associated to the test is less than 0.05 so the null hypothesis that all off-diagonal correlations are zero is falsified. In this case we can say that is appropriate to use factor analysis in our study.

Further, we will determine the number of factors that we should use in factorial analysis. For this we consider "fa.parallel" function from R package mentioned earlier, "psych" (Revelle 2018). The result obtained said: "Parallel analysis suggests that the number of factors = 5 and the number of components = NA" and shows us that we should use maximum 5 factors. On the screen plot for parallel analysis (Fig. 4) we can observe a blue line that show eigenvalues of actual data and two red lines that show simulated and resampled data.

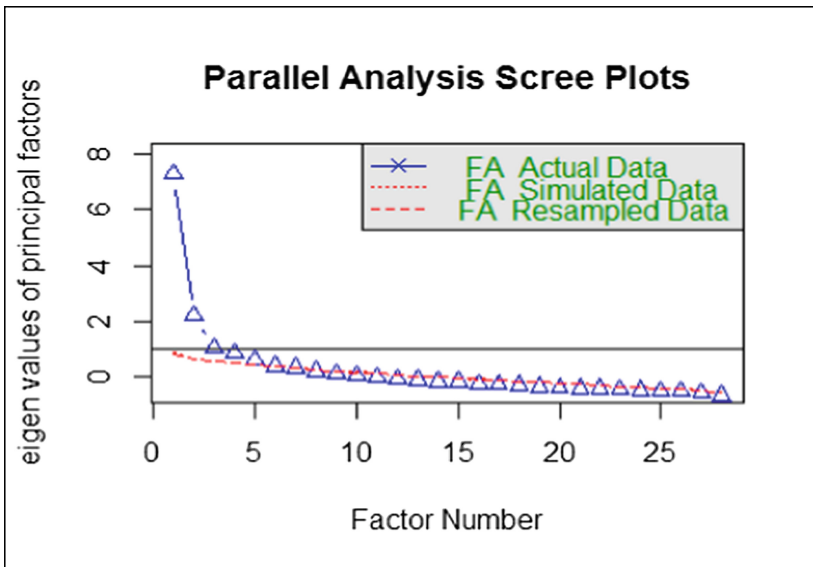


Fig. 4. The parallel analysis scree plot

We can also see on the graphic the inflection point, that point where the gap between simulated data and actual data tends to be minimum. According to this graph and the result of parallel analysis, we can choose anywhere between 2 and 5 factors. So, we choose to use 5 factors to develop the factorial analysis. The results are presented in Table 1.

Table 1. Exploratory factor analysis

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Factor Analysis using method = minres
Call: fa(r = data, nfactors = 5, rotate = "oblimin",
fm = "minres")
Standardized loadings (pattern matrix) based upon
correlation matrix

      MR2 MR1 MR4 MR3 MR5
SS loadings      3.43 3.26 3.10 1.86 1.73
Proportion Var   0.12 0.12 0.11 0.07 0.06
Cumulative Var   0.12 0.24 0.35 0.42 0.48
Proportion Explained 0.26 0.24 0.23 0.14 0.13
Cumulative Proportion 0.26 0.50 0.73 0.87 1.00

With factor correlations of
      MR2 MR1 MR4 MR3 MR5
MR2 1.00 0.20 0.39 0.15 0.32
MR1 0.20 1.00 0.46 0.28 0.10
MR4 0.39 0.46 1.00 0.24 0.21
MR3 0.15 0.28 0.24 1.00 0.01
MR5 0.32 0.10 0.21 0.01 1.00

Mean item complexity = 1.7
Test of the hypothesis that 5 factors are sufficient.

The degrees of freedom for the null model are 378 and
the objective function was 13.26 with Chi Square of
2609.33

The degrees of freedom for the model are 248 and the
objective function was 2.87

The root mean square of the residuals (RMSR) is 0.05
The df corrected root mean square of the residuals is
0.06

The harmonic number of observations is 208 with the
empirical chi square 327.85 with prob < 5e-04
The total number of observations was 208 with
Likelihood chi Square = 555.49 with prob < 1.3e-25

Tucker Lewis Index of factoring reliability = 0.906
RMSEA index = 0.02 and the 90 % confidence intervals are
0.069 0.086
BIC = -768.22
Fit based upon off diagonal values = 0.97
Measures of factor score adequacy

MR1 MR4 MR3 MR5 MR2
Correlation of (regression) scores with factors 0.94
0.92 0.92 0.90 0.86
Multiple R square of scores with factors 0.88
0.85 0.85 0.82 0.74
Minimum correlation of possible factor scores 0.75
0.70 0.71 0.63 0.48
    
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In Table 1 the root mean square of residuals (RMSR) is 0.05. Theory says that this value should be closer to 0. In our case we can say that it's value of 0.05 is acceptable. Root mean square error of approximation (RMSEA) is 0.02. This indicator shows good model fit if it's value is less than 0.05. The last indicator that we check is Tucker Lewis Index (TLI) which is 0.906, bigger than 0.9 as statistical rules says. Next step is to consider loadings more than 0.3 and to determine the variable that belong to each factor (Table 2).

Table 2. Factors determined using EFA

Loadings:					
	MR2	MR1	MR4	MR3	MR5
q19.1	0.855				
q19.2	0.628				
q19.3	0.582				
q19.4	0.645				
q19.5	0.779				
q19.6	0.493				
q19.7	0.416				
q19.8					0.334
q19.9		0.359			
q19.10		0.407			
q19.11		0.381			
q19.12			0.689		
q19.13			0.740		
q19.14			0.701		
q19.15			0.639		
q19.16			0.357		
q19.17			0.325		
q19.18		0.302			
q19.19					0.601
q19.20		0.571			
q19.21		0.543			
q19.22		0.786			
q19.23		0.601			
q19.24		0.596			
q19.25					0.567
q19.26				0.686	
q19.27				0.318	
q19.28				0.853	
SS loadings	MR2	MR1	MR4	MR3	MR5
Proportion Var	3.078	2.813	2.585	1.677	1.509
Cumulative Var	0.110	0.100	0.092	0.060	0.054
	0.110	0.210	0.303	0.363	0.416

The next step in exploratory factor analysis is to name the factors we obtained. For factor 1 we have questions from 1 to 7 that correspond to consistency and flexibility of ATM. For factor 2 we have questions that correspond to errors that can appear and how can people deal with them. For factor 3 we have questions that correspond to clarity of

messages, screen luminosity and color and logical information. For factor 4 we have questions that correspond to security of the actions. For factor 5 we have questions that correspond to user guidance. So, we can name our factors as it follows: “compatibility and consistency”, “flexibility”, “perceptual limitation”, “security” and “user guidance”. Once we determined that we will work with 5 factors, we will test further the confidence that we have in this model. For this we will compute Cronbach alpha coefficient (Tavakol and Dennick 2011). If the value is bigger than 0.7 we can trust in the result obtained. In this case Cronbach alpha is 0.8988915 so the analyze that we developed up to this moment is trustable.

4.5 Results

Using exploratory factor analysis we determine 5 factors that can influence using of ATM. This factors are: “compatibility and consistency” as factor no. 1, “flexibility” as factor no. 2, “perceptual limitation” as factor no. 3, “security” as factor no. 4 and “user guidance” as factor no. 5.

5 Conclusions

Both qualitative and quantitative analysis have attempted to examine how the computer-based interface (in particular, the automatic teller machine - ATM) facilitates or hampers students’ access to specialized services dedicated to them by credit institutions (bank accounts, debit or credit cards, other bank services) and also to analyze what factors stimulate the use of HCI technologies by students in relation to a bank.

Using a 7 scale Likert for questions from Purdue Usability Testing Questionnaire we tried to underline the challenges and also strong and weak point that come in the interaction of people with ATM. Even not all students have a bank account, all of them have a bank card (debit card, credit card or shopping fidelity card). The main reason students are using an ATM is avoiding keeping cash in the wallet. They also uses ATM to check the current balance of the bank account or to deposit ar extract money from the bank account. It seems that majority of students uses bank card every day and the ATM once a week.

The results presented above reflect five important factors that can influence using of ATM: “compatibility and consistency” as factor no. 1, “flexibility” as factor no. 2, “perceptual limitation” as factor no. 3, “security” as factor no. 4 and “user guidance” as factor no. 5.

The research highlighted the main strengths of ATM in terms of their use by students, such as access 24 h a day and 7 days out of 7, ease of use of various banking products and services, and ensuring the security of data transmission and computer transactions. As weak points were noted lack of providing ATM assistance in entering data and lack of financial assistance and counseling offered by the ATM in the selection and use of banking products/services.

Considering the bank’s interest in presenting the main features of the student-bank relationship through ATMs, the research highlighted the following aspects: personal information about the usage habits of banking products/services, information on home

and residence, information on age and income level, information on behavior in the use of banking products/services (good-payer/bad-payer), and information about the client's lifestyle (inclinations for saving/accessing credit).

5.1 Limitations

The authors of the present study recognize the limits of their research, restrictions which, as far as possible, they want to restrict them in future research. A first highlight of the study's limits is that the analysis and research results were much improved and more valuable if the sample aimed at a larger, more comprehensive number of students coming from other faculties at the University of Bucharest or even from other universities from the capital. Also, the choice of questions from the PUTQ questionnaire was limited to some questions considered more important for initial research, so future research should be based on applying all these questions to get a broader view, better outcomes. Another disadvantage of the study is the poor selection of students with disabilities who have a higher weight in the sample, which would have led to a closer reflection on the reality of the use of HCI technologies in the student-bank relationship in Romania. In this regard, future researches should consider possible ATM features like: the spread of bank computer terminals; multiplication of human-computer interaction techniques (voice, pencil etc.) and access to interactive systems for students with physical/visual disabilities. Among the shortcomings, one can also note that the students' desire for access to additional services necessary in their opinion has not been fully investigated.

These limitations of research were due, first, to the long time to be given to the questionnaire completion and, secondly, to the subjectivity, the lack of concentration or even the indifference of the students to give realistic answers to a questionnaire requiring a long time to complete. Another cause consist of possible limitary use of multiple statistical and econometric methods/tools by the researchers.

5.2 Future Research Directions

As a result of the limits of the present research, as well as of the dynamics of innovations on the HCI technologies market in banking, the authors are considering some aspects in future research.

First of all, it is necessary to consider aspects related to the elaboration and application of the questionnaire, such as the employment of the whole PUTQ questionnaire, not just a selection of questions; better articulation of general, absolutely essential questions with those regarding HCI and HCI technologies; better choice and diversification of questions regarding HCI that better target the context and current development of the ATM market in Romania; as well as taking into account the possibility of wider expression of students' opinions on ATM services by asking open answer questions.

Secondly, an action needed for future analyzes is to increase the research sample and to give more weight to students with disabilities of various types.

No less important, thirdly, is the attempt to attract Romanian banks likely interested in the results of the questionnaire and to be involved in the process of dissemination,

information gathering and analysis of this questionnaire, as well as, of course, the use of such information obtained for the benefit of both banks and student clients.

Topics that cannot be overlooked could be the issues of ATM usage costs (the possibility of reducing customer use costs), of the cost of improving HCI technologies for ATMs, of the cost of implementing improved ATM networks, maintenance and security of ATM operation. Although these aspects are largely confidential and can not be in the hands of the researchers, an overall assessment of these can be made with the help of the interested banks in Romania.

5.3 Bank Implications

A wide range of studies and reports highlighted the banking industry trends for 2019 and further. Between those trends one can enroll next-gen chatbots (chatbot, short for chatterbot, “is a computer program that simulates human conversation through voice commands or text chats or both”) (Investopedia 2019), blockchain technology, improved security and the rise of robots and machine learning (Quantzig 2019). Some authors (Cornell 2019) have confident predictions in the future of ATMs as “contactless ATM and payment transactions will gain traction” and also “bank branches will continue to shrink”. All these predictions about the dynamics of HCI technologies and their implementation in the banking field make it necessary to consider the views of Romanian banks in future research.

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