The Effect of ICT Capabilities on the Experience of Using e-Services in Banks

Gjoko Stamenkov and Zamir Dika

***Abstract*—The main goal of the Resource-based View is to explain the prerequisites for obtaining and sustaining a competitive advantage. How the capabilities related to the Resource-based View are influencing Experience, Satisfaction and Loyalty of internal users of E-services is not a researched topic. Therefore we undertook our research to determine this influence. We found that a positive relationship exists between ICT Capabilities and Experience. Experience is mediating the effect from ICT Capabilities on Satisfaction and Loyalty. Capabilities related to business issues have a stronger effect on ICT Capabilities than capabilities related to the ICT issues.**

***Index Terms*—E-service, ICT capabilities, resource-based view.**

I. Introduction

The dominant research in the literature of a strategic management and strategic planning is related to the competitive advantage. The relationship between resources and a competitive advantage is the basis for Resource-based View [1]. To be the source of a sustainable competitive advantage, resources must be valuable, rare, imperfectly imitable and non-substitutable.

According to the Resource-based View, the company's resources consist of all assets, capabilities, organizational processes, the company's attributes, information, knowledge etc. that are controlled by the company with the aim of improving efficiency and effectiveness in business strategy implementation [1].

The main goal of the Resource-based View is to explain the prerequisites for obtaining and sustaining a competitive advantage. When value creating strategy is not simultaneously implemented by the competitors, in that case the company has a competitive advantage. But, if competitor companies are unable to duplicate the benefits of the value creating strategy, then the company possesses a sustained competitive advantage [1]. According to the Resource-based View, for one resource to be the source of a sustained competitive advantage it must have four attributes: the resource must be valuable, it must be rare, imperfectly imitable and substitute for the valuable resource should not exist.

There is a distinction between resources and capabilities [2]. Resources are the input into the production process and they include capital equipment, skills of employees, patents etc. On the other hand, capability is the capacity for a team of resources to perform some task. The capabilities are built on top of the existing resources. The competitive advantage on the market is based on a company's capabilities. Finally, a strategy is based on the competitive advantage and the company's resources and capabilities.

The performance effects of IT, based on the Resource-based View, are the focus of the research stated in [3]. The key IT-based resources are classified in three types of resources: the tangible resources including IT infrastructure, human IT resources consisting of technical and managerial IT skills, and intangible IT-enabled resources such as knowledge assets, customer orientation and synergy. As a result of the research, the focus for future researches is suggested to be put on developing better metrics for evaluating IT resources, such as implementation of SERVQUAL instrument used as a tool for determining the quality of Information Systems and IT effectiveness.

Using Resource-based View, the effects that five different IT resources and capabilities have on the performance of the customer service process are investigated [4]. The first class of IT-related resources includes raw IT spending, technical IT skills and generic information technologies used in customer service process. The second class consists of two capabilities that are crucial factors influencing how the first class of resources is used: shared knowledge and IT infrastructure flexibility. The main goal of the research was to explore whether the mentioned resources and capabilities could explain the variance in performance of the customer service unit. The focus should be on IS/IT capabilities that are core to the business future capacity, not on IS/IT as core or non-core [5].

The goal of our study is to determine the relation between ICT Capabilities, as assessed by the internal users, and their experience, satisfaction and loyalty. We conducted two analysis: in the first analysis, ICT Capabilities are defined as a reflective construct, while in the second analysis they are defined as a formative construct [6], [7], [8]. The research is based on the presented articles.

The research is part of the bigger research project to define the relationship between Business/IT Alignment, Service Climate, ICT Capabilities and other constructs as predictors, and Quality Assurance as an effect.

We set forth the following hypotheses for our study:

Hypothesis 1: There is a positive relationship between the ICT Capabilities and the Experience of the internal users from using E-services.

Hypothesis 2: The Experience of the internal users from consuming E-services is mediating the effect from ICT Capabilities to the Satisfaction and Loyalty of the internal

Manuscript received June 24, 2012; revised August 9, 2012.

Gjoko Stamenkov is with the field of ICT, ICT governance, information security and project management.

Zamir Dika is with the several universities and his research interest is in the field of information systems.

users.

Hypothesis 3: ICT Capability consists of two factors: the first one captures the ICT capability that is related to business issues, while the second factor captures the ICT capability that is related to more technical issues.

To test the hypotheses we conducted research and we developed a model presented in the following section.

II. Method

The population for the study is comprised of employees in the banks of the Republic of Macedonia. The sample is taken from one of the biggest banks. The criteria for inclusion in the sample are: the bank employee should use E-Services with the goal of fulfilling his job duties and he should have a university degree. The members from the ICT department are not included in the sample. The rationale for such criteria is to include only the internal customers of the IT services provided inside the bank.

The research method is the quantitative research – a survey. The questionnaire was accessible inside the local intranet. It was expected to receive at least 15 responded questionnaires from each department.

We collected 126 questionnaires. The listwise deletion method is used for solving the missing data problem, which yields the sample size of 112 respondents.

The ratio that defines the number of respondents per parameter is 5, 9 (112/19) in our model [9]. The number of indicators presented in the model is 19. The ratio is smaller than the number of 15 for each parameter as specified to minimize the problems with deviations from normality [10].

The model consists of six constructs: CAP, CAPD, CAPB, EXP, SAT and LOY.

The operationalization of the three constructs that are related to the ICT capabilities (CAP, CAPB, and CAPD) is defined based on the Resource-based View. The construct CAP is a second-order latent construct. The first-order factors, CAPB and CAPD, pertain to the capabilities that are inclined towards business capabilities and technical capabilities of the ICT Department, respectively. Four indicators of the latent construct CAPD are related to the level of satisfaction from the ICT infrastructure in the bank (CAPD1) [2], [3]], the level of IT skills in the ICT department (CAPD2) [2], [3], the issue whether the ICT department is following and adapting to the market requirements (CAPD3) [3] as well as the issue whether ICT managers understand the business processes (CAPD4) [4]. Four indicators of the latent construct CAPB are related to the level of managerial ICT skills (CAPB1) [2], [3], [11], the level of understanding between managers in the ICT department and the business units regarding the issue of how to use ICT to improve services provided to customers (CAPB2) [4], the issue whether managers in the customer service unit recognize the potential of IT as a tool for increasing productivity of the customer service representatives (CAPB3) [4] as well as the issue whether managers in the customer service unit recognize the potential of IT as a tool for improving the quality of a service delivered by the customer service (CAPB4) [4].

The three indicators for Satisfaction (SAT) indicate the level of satisfaction (SAT1) and the level of happiness from using E-Services (SAT2), as well as the level of satisfied needs from the fulfillment of tasks (SAT3). The latent construct Experience (EXP) is related to the level of positive experience (EXP1), the fulfilled expectations (EXP2) and experienced benefits (EXP3), while Loyalty (LOY) is related to the positive thinking about E-Services (LOY1), recommending bank services to others (LOY2) and the opinion whether users will do more business with the bank (LOY3).

We have included two additional indicators. The indicators CAPG1 and CAPG2 are presented to satisfy the requirements for emitting two paths to two other indicators for assessing the model with second-order constructs taken as formative indicators [7], [12]. The indicator CAPG1 is related to the perceived improvement of ICT Capabilities in the course of time, while CAPG2 is related to the overall opinion about the level of ICT Capabilities.

The main criterion for defining the number of measurement levels is how well subjects can discriminate between level of stimuli. Any measure that can assume fifteen [13] or eleven [14] distinct scale points can be regarded as a continuous variable. We accept the number of measurement levels to be 15 because we want to be more compliant with the requirements for continuous variable, and to offer more options to respondents. Assessing the item with 1 means that the respondent does not agree strongly with the expressed sentence, scoring 8 means that the respondent has neutral opinion, and scoring 15 means that the respondents strongly support the expressed sentence.

The model is over-identified and the minimum is achieved as presented in Table I.

TABLE I: Degrees of Freedom

Number of distinct sample moments:	105
Number of distinct parameters to be estimated:	38
Degrees of freedom (105 – 38):	67

III. Results

The analysis of the measurement model is performed with a Confirmatory Factor Analysis – CFA. The structural model is analyzed with a Structural Equation Model – SEM. We use the program AMOS 18 for performing both CFA and SEM analysis. We use CFA and SEM because the model that is subject of this study is extract from the bigger model for Quality Assurance of E-services and we want to be consistent with the further analysis that we are going to perform. Regression analysis is not appropriate for analysis of the model, because one construct is the dependent variable for one part of the model, but in the same time that particular construct is the independent variable for the other part of the model. The regression analysis is not equipped for performing such analysis simultaneously [10].

The input in the program AMOS 18 is an Excel file with deleted rows that contain missing data. The estimation technique is the maximum likelihood estimation – MLE.

A. Descriptive Statistics

Table II presents the descriptive statistics including mean, standard deviation, skewness and kurtosis. High kurtosis can influence normality of the data [15].

The skew index (SI) is less than 2 for all variables, except for the indicators LOY2 *SI*=-2,155 and LOY3 *SI*=-2,206, but they are still much lower than the cutoff value of 3 [16]. The kurtosis index (KI) is less than 3 for all indicators, with the exception of the indicators LOY2 with *KI*=3,662 and LOY3 with *KI*=3,883. Both indexes prove that the data do not deviate from the multivariate normality [15].

TABLE II: DESCTIPTIVE STATISTICS.

Indicator	*Mean*	*STD*	*Skew*	*Kurtosis*
CAPD1	12,94	2,399	-,934	-,491
CAPD2	13,05	2,489	-1,290	,839
CAPD3	13,13	2,481	-1,429	1,517
CAPD4	13,06	2,562	-1,288	,781
CAPB1	12,81	2,868	-1,423	1,602
CAPB2	12,75	2,792	-1,367	1,144
CAPB3	13,12	2,471	-1,457	1,459
CAPB4	12,98	2,571	-1,485	1,489
CAPG1	13,53	2,246	-1,581	1,351
CAPG2	13,18	2,432	-1,402	,997
SAT1	13,37	2,218	-1,332	,602
SAT2	12,39	2,833	-,781	-,729
SAT3	13,37	2,105	-1,434	1,170
EXP1	13,53	2,152	-1,526	1,168
EXP2	12,92	2,275	-,942	-,317
EXP3	13,80	1,854	-1,658	1,968
LOY1	13,27	2,325	-1,427	,947
LOY2	14,05	1,878	-2,155	3,662
LOY3	14,02	1,908	-2,206	3,883

B. Measurement Model

The measurement model presented in Fig. 1 is a congeneric model satisfying the following requirements: constructs are unidimensional with all cross-loadings constrained at zero, with no covariance between construct error variances and no covariance within construct error variances [10].

The measurement model was tested for construct validity.

All factor loadings of indicators on corresponding factors are above 0,644, which is the smallest factor loading of the indicator SAT2 on the SAT construct. In the terminology of AMOS the factor loading is the Standardized Regression Weight.

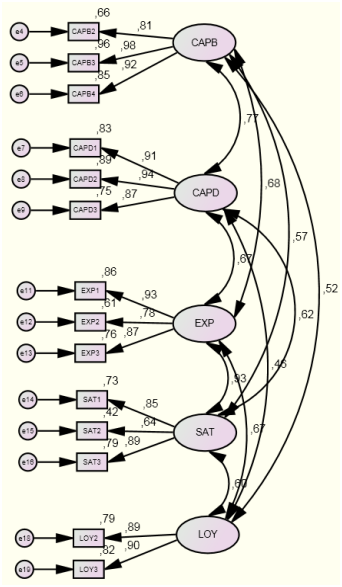

Fig. 1. Measurement model.

The Average Variance Extracted is calculated as the mean variance extracted for the indicators loading on a construct [10]. All AVEs are higher than 0,646 for our model. Standardized Regression Weights and AVEs prove the convergent validity.

The discriminant validity is problematic for one pair of constructs, SAT and EXP. Their squared correlation is higher than the AVE of the same constructs. The reason for this is that Satisfaction and Experience are similar constructs. We do not intervene in the measurement model because CFA fit of the measurement model is very good.

All values in the Standardized Residual Covariances matrix are much lower than the cutoff value of |2, 5|. The highest Standardized Residual Covariance has a value of 1,207. According to the Standardized Residual Covariances, no problematic issue has been detected within the model.

The fit of the initial measurement model MM has the following indices: *CMIN*=264,631, *CMIN/DF*=2,428, *CFI*=0,912, *RMSEA*=0,113. The model fit is not good. The Standardized Residual Covariances do not show any major problem. Modification indices provide information about lots of cross-loadings. Most of the cross-loadings are loadings from the indicator LOY1 to the several other latent constructs. We conclude that the indicator LOY1 is the best candidate for removal from the model with the goal of improving the model fit.

The alternative measurement model MM1 without LOY1 has slightly better fit indices: *CMIN*=195,460, *CMIN/DF*=2,079, *CFI*=0,938, *RMSEA*=0,099. All Standardized Residual Covariances are below the cutoff value of |2, 5|. The modification indices show several cross-loadings, with the highest Modification index of 7,438 for cross-loading of CAPB1 on another indicator CAPD4. The indicator CAPB1 is removed.

According to the criteria [10][15] the fit of the new modified measurement model MM2 is good: *CMIN*=145,569, *CMIN/DF*=1,820, *CFI*=0,957, *RMSEA*=0,086. The Modification indices show several cross-loadings of the indicator CAPD4. As the fit of the model is good, there is no mandatory requirement to remove additional indicator.

However, the removal of the indicator CAPD4 provides better fit. The final measurement model MM3 without the indicator CAPD4 has the following fit indices: CMIN=107,029, CMIN/DF=1,597, CFI=0,971, RMSEA=0,073. The comparison among the fit indices of all models is presented in Table III. The final measurement model is presented in Fig. 1 (indicators LOY1, CAPB1 and CAPD4 are removed and are not presented).

TABLE III: FIT OF MEASUREMENT MODELS

Indicator	*MM*	*MM1*	*MM2*	*MM2*
CMIN	264,631	195,460	145,569	107,029
DF	109	94	80	67
CMID/DF	2,428	2,079	1,820	1,597
CFI	0,912	0,938	0,957	0,971
RMSEA	0,113	0,099	0,086	0,073

C. Structural Model – CAP as a Reflective Construct

In our Structural model (Fig. 2) the observed 14 indicators are endogenous variables. The unobserved endogenous variables are the following latent constructs: CAPB, CAPD, EXP, SAT and LOY. Unobserved exogenous variables are the error variances of all indicators and residuals of the five unobserved endogenous variables.

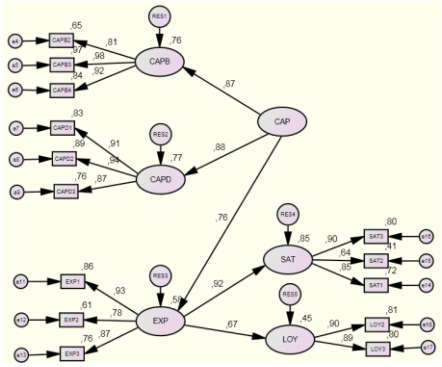

Fig. 2. Structural model with reflective cap.

We tested two alternative models. The first structural model SM1 has direct paths from CAP to EXP, SAT and LOY (CAP→EXP, CAP→SAT and CAP→LOY). The second model SM2 has direct paths from CAP to EXP, from EXP to SAT and from SAT to LOY (CAP→EXP, EXP→SAT and SAT→LOY). The best fit is obtained with the model SM, which is our initial model from Fig. 2. Table IV presents the fit indices of the initial structural model SM and two alternative models, SM1 and SM2.

TABLE IV: FIT OF STRUCTURAL MODELS WITH REFLECTIVE CAP

Indicator	*SM*	*SM1*	*SM2*
CMIN	110,416	144,507	115,871
DF	72	72	72
CMID/DF	1,534	2,007	1,609
CFI	0,973	0,948	0,969
RMSEA	0,069	0,095	0,074

D. Structural Model – CAP as a Formative Construct

We analyzed the model presented in Fig. 3 with the construct CAP not considered as a reflective, but as a formative construct. The main concern regarding the formative constructs is whether they capture a complete domain. The domain researched here are the ICT Capabilities. Our indicators are divided in two domains: one related to IT, and the other related to business issues. Models SM1 (CAP→EXP, CAP→SAT and CAP→LOY) and SM2 (CAP→EXP, EXP→SAT and SAT→LOY) are the same as for the structural model presented in Fig. 2 where CAP is a latent factor.

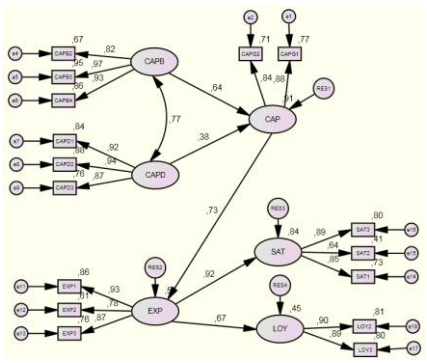

Fig. 3. Structural model with formative cap.

The model fit is presented in Table V. RMSEA is not within the expected range. The fit of the model is relatively good. We are interested in the Standardized Regression Weights of CAPD→CAP that has a value of 0,38, and CAPB→CAP that has a value of 0,64.

TABLE V. FIT OF STRUCTURAL MODELS WITH FORMATIVE CAP

Indicator	*SM*	*SM1*	*SM2*
CMIN	207,789	305,929	213,132
DF	98	98	98
CMIN/DF	2,120	3,122	2,175
CFI	0,936	0,879	0,933
RMSEA	0,100	0,138	0,103

IV. DISCUSSION

The focus of the study is put on the effect of ICT Capabilities on Experience, Satisfaction and Loyalty of internal users of E-Services in banks. We used information only from internal users.

Our hypotheses are supported by the fit indices of the measurement and the structural model, as well as by the Standardized Regression Weights.

The model showed the worst fit when Satisfaction and Loyalty regressed directly to the ICT Capabilities. The mediation role of the Satisfaction from Experience towards Loyalty also provided a good model fit, but the initial model has the best fit.

The ICT Capabilities are positively influencing Experience when using E-Services. Obtaining positive Experience leads to bigger Satisfaction and bigger Loyalty. Experience is influencing Satisfaction on a higher level than Loyalty. Experience can be mingled with Satisfaction, which is proved by the discriminant validity, but they are different concepts.

Based on the Structural model with Formative CAP, capabilities related to business issues have a stronger effect on ICT Capabilities, than the ICT issues do. This means that not only technical IT should be developed, but nurturing ICT business capabilities will pay off on a long run. The companies must focus their efforts and attention towards achieving higher level of managerial ICT skills, they must focus on achieving mutual understanding between the business units and the ICT department, and they must comprehend ICT as a tool for increasing productivity and improving quality of services. We tested the direct relation between Capabilities and Experience in our model.

V. Conclusion

From the results and discussion we can conclude that hypotheses are supported: there is a positive relationship between ICT Capabilities and Experience of the internal users of using E-Services; the experience is mediating the effect from ICT Capabilities to the Satisfaction and Loyalty, and finally, two factors are influencing ICT Capabilities – the first one is business oriented, while the second one is focused on the technical capabilities of the ICT Department. Companies must show due care and due diligence by developing business capabilities along with the capabilities related to the technical ICT issues.

Future researches should focus on performing multi-group analysis across two different samples of the different populations [16] that will satisfy the requirement of the triangulation [17].

References

[1] J. Barney, "Firm resources and sustained competitive advantage," *Journal of Management*, vol.17, no.1, pp. 99-120, 1991.

[2] R. M. Grant, "The resource-based theory of competitive advantage: Implications for strategy formulation," *California Management Review*, vol. 33, no. 3, pp. 114-135, 1991.

[3] A. S. Bharadwaj, "A resource-based perspective on information technology capability and firm performance," *MIS Quarterly*, vol. 24, no. 1, pp. 169-196, 2000.

[4] G. Ray, W. A. Muhanna, and J. B. Barney, "Information technology and the performance of the customer service process: A resource-based analysis," *MIS Quarterly*, vol. 29, no. 4, pp. 625-652, 2005.

[5] D. F. Feeny and L. P. Willcocks, "Core IS capabilities for exploiting information technology," *Sloan Management Review*, vol. 39, no. 3, pp. 9-21, 1998.

[6] A. Diamantopoulos and H. M. Winklhofer, "Index construction with formative indicators: An alternative to scale development," *Journal of Marketing Research*, vol. 38, pp. 269-77, 2001.

[7] C. B. Jarvis, S. B. MacKenzie, and P. M. Podsakoff, "A critical review of construct indicators and measurement model misspecification in marketing and consumer research," *Journal of Consumer Research*, vol. 30, pp. 199-218, 2003.

[8] S. Petter, D. Straub, and A. Rai, "Specifying formative constructs in information systems research," *MIS Quarterly*, vol. 31, no. 4, pp. 623-56, 2007.

[9] D. L. Jackson, "Revisiting sample size and number of parameter estimates: Some support for the N: q hypothesis," *Structural Equation Modeling*, vol. 10, no. 1, pp. 128-141, 2003.

[10] J. F. Hair, W. C. Black, B. J. Babin, and R. E. Anderson, *Multivariate Data Analysis*, Seventh edition, Upper Saddle River, N. J.:Prentice-Hall, 2009.

[11] F. J. Mata, W. L. Fuerst, and J. B. Barney, "Information technology and sustained competitive advantage: A resource–based analysis," *MIS Quarterly*, vol. 19, no. 4, pp. 487-505, 1995.

[12] R. C. MacCallum and M. W. Browne, "The use of causal indicators in covariance structure models: Some practical issues," *Psychological Bulletin*, vol. 114, no. 3, pp. 533-541, 1993.

[13] R. E. Schumacker and R. G. Lomax, *A Beginner's Guide to Structural Equation Modelling*, 2nd Edition, New Jersey: Lawrence Erlbaum Associates, 2004.

[14] J. C. Nunnally and I. H. Bernstein, *Psychometric Theory*, 3rd Edition, McGraw-Hill, 1994.

[15] R. B. Kline, *Principles and Practice of Structural Equation Modeling*, Third Edition, the Guilford Press: New York, 2011.

[16] R. P. Bagozzi and Y. Yi, "On the evalation of structural equation models," *Academy of Marketing Sciences*, vol. 16, no. 1, 1988.

[17] S. Mathison, "Why triangulate," *Educational Researcher*, vol. 17, no. 2, pp. 13-17, 1988.

Gjoko Stamenkov acquired BS in the field of Electrical Engineering at the Ss. Cyril and Methodius University, Republic of Macedonia in 1988 and MBA at the City College, Thessaloniki, Greece, Affiliated Institution of the University of Sheffield, UK in 2005. In 2011 he acquired PhD in Computer Sciences at the Faculty of Contemporary Sciences and Technologies at the South East European University in the Republic of Macedonia. He is working now as an independent consultant in the field of ICT, ICT governance, information security and project management.

Zamir Dika obtained BS at the Technical University at the Prishtina University, Republic of Kosovo in 1991 and finished his post-graduate studies at the Polytechnic University in Tirana. In 1997 he acquired the title Doctor of Science. He has worked as an assistant at the Prishtina University, as lecturer at the Tetovo University, and now he is a full-time professor at the South East European University in the Republic of Macedonia. He is a visiting professor in several universities and his research interest is in the field of information systems.