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AN ANALYSIS OF INFORMATION SYSTEM (IS) SUCCESS MODELS

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Abstract

The huge penetration of technology is happening in a very fast mode these days. Adoption of information technology is gaining momentum. So to measure the success of Information System (IS) is very important; moreover the success of Information System (IS) depends upon proper execution of technology by human resources. So it becomes comparatively very complex to measure the success of Information System. At present there are various models to measure the success of Information System like Technology Acceptance Model, De-lone and Mc-Lean model of IS success and many others. This paper is mainly concerned with explaining various available models and review and analysis of those models to find out the best suited model in current scenario by comparing and discussing their relevance.

Keywords:- Information System, Models, Success, TAM, DeLone and McLean

Introduction

The aim of this paper is to provide a theoretical framework. This paper focuses on various models to study the behavioral aspect for acceptance of mobile banking, mobile banking in India and the quality of system and services provided by mobile banking apps, measurements of customer satisfaction and service quality. These models can be segregated into these two heads:

1. Models for E-service quality determinants
2. Models for Acceptance of technology and Information System success

Models for E-service quality determinants

The models for measuring service quality evolved during last three decades. There are various models available to measure the service quality dimensions now. The major four models of service quality dimensions are as under-

Nordic Model – Earliest model was given by Gronroos in 1982 and 1984, according to him there are mainly three components of service quality. These are technical quality (What customers get); informational quality (how customers get) and image build by these two qualities and other factors like word of mouth, marketing, tradition, pricing and customer needs.

This model is mainly based upon comparison of perceived performance and expected service.

Rust & Oliver (1994) refined the Nordic model and suggested three components: service product (technical quality), service delivery (functional quality), and service environment.

SERVQUAL Model

Parasuraman, Zeithaml, & Berry (1985) introduced a new model of service quality dimensions. In SERVQUAL model, they mainly focused on the gap between the expected level and delivered level of service and mainly developed five measures of service quality dimensions; Reliability, Responsiveness, Assurances, Empathy, and Tangibility.

According to (Cronin & Taylor, 1992) it is only the performance that is required to be measured to get perception of service quality, so a new model SERVPERF was introduced. This model shows that measures of SERVQUAL are not comprehensive and consistent enough to be used in various applications.

2.1.3 Multilevel model

An up gradation to the SERVQUAL model was given Dabholkar, Thorpe and Rentz in 1996. They proposed the multilevel model for service quality. They mainly proposed three level model; overall perceptions of service quality, primary dimensions, and Sub dimensions. This model was used mainly in retail store.

2.1.4 Hierarchical model

Brady and Cronin in 2001 suggested a new model for service quality by combining four models. They modified SERVQUAL (Parasuraman, et al., 1988) by defining what is needed to be reliable, responsive, empathic, assured and tangible. Brady and Cronin adopted three dimensions of service quality perception based; Interaction Quality (functional quality), Physical Environment Quality, Outcome Quality (technical quality) (Gronroos, 1984).

2.1.5 E-S-QUAL Model and E-RecS-QUAL Model

Lastly, Parasuraman, Zeithaml and Malhotra 2005 in their study found that there are two such scales that mainly captures all the dimensions of e- service quality; these are E-S-QUAL and E-RecS-QUAL. First E-S-QUAL model mainly consists of four dimensions: these are system availability, efficiency, fulfillment and privacy. System availability can be defined as systematic and correct functioning of the technical aspects of the system; Efficiency can be coined as ease of use, ease of operations and speed of getting access and usage of the system; Fulfillment is concerned with extent of items and information available and its efficiency to fulfill and process the required function: Privacy can be termed as degree of safety, security and assurance of safety

of customer satisfaction. So E-S-QUAL can be considered as one of the model mainly having all the dimensions. E-RecS-QUAL is mainly concerned with responsiveness, contact and compensation. Responsiveness can be defined as proper and effective handling of problems of the system: Contact can be defined as assistance provided by the representatives and compensation refers to the process of compensating customers for problem by the system. So these are the various dimensions that will also work as service quality dimensions of mobile banking as well.

However there were many reserchers(Wolfinbarger & Gilly, 2003) who were of the opinion that the SERVQUAL should be modified to suit the different requirements of e-commerce. There are many studies to find out the various determinants of E- Service Quality.

2.2 Models for acceptance of technology and information system success

There are many technological theories that explain behavior patterns of humans toward the acceptance and success of technology. Prediction of human behavior is considered as the main purpose of all psychological theories. There are many theories that are used widely to explain behavior; these are as given-

- 2.2.1 Theory of reasoned action (TRA) (Ajzen and Fishbein, 1980)
- 2.2.2 Theory of Planned Behavior (TPB)
- 2.2.3 Technology acceptance Model (TAM)(Davis 1989)
- 2.2.4 Diffusion of Innovation Model (DIM)(Rogers 1995)
- 2.2.5 Task Technology Fit (TTF) (Goodhne & Thompson1995)
- 2.2.6 Unified Theory of Acceptance and Usage of Technology (UTAUT)
- 2.2.7 Initial trust Model (ITM)

All these theories are there to explain the process of technology acceptance only, but there are models to find out the success of Information System also beyond these theories as well. This are-

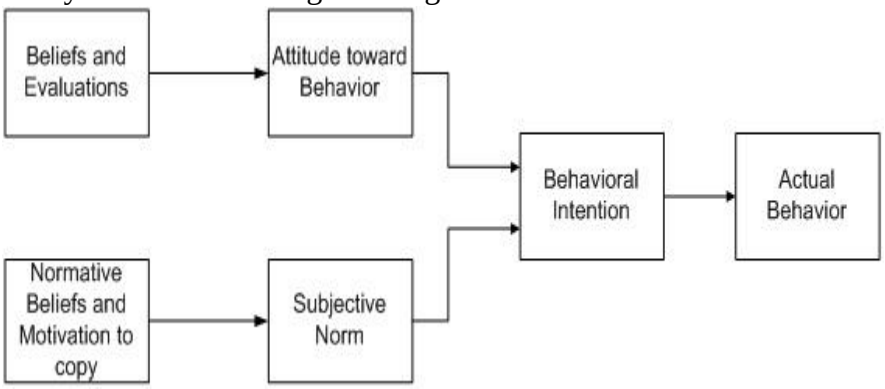
- De-Lone and Mc-Lean Model of Information System
- Updated De-Lone and Mc-Lean Model of Information System
- Gable and Sedera's Information System Impact Model

Among all these theories and models Technology Acceptance model and Theory of Planned behavior is considered as the main models to explain the acceptance of Information System and updated model of De-Lone and Mc-Lean Model of Information System as major model to explain the determinants of success of Information System. These are explained here.

2.2.1 Theory of Reasoned Actions (TRA)

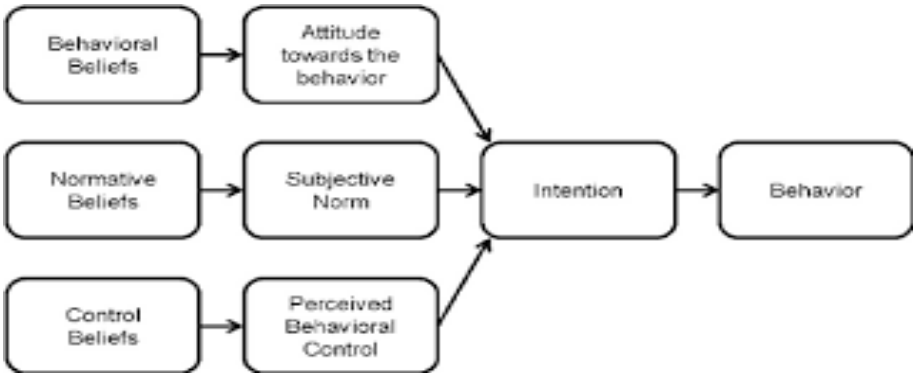
The **theory of reasoned action** (**TRA**) is one of the basic psychological models and was developed by Martin Fishbein and Icek Ajzen in 1967. It was derived from various researches of theory of attitude. The theory mainly explains the relationship between attitudes and behaviors within human action. TRA is concerned with prediction of behavior of an individual behave because of his established attitudes and behavioral intentions. Martin Fishbein and Icek Ajzen explained mainly two factors that lead to behavior intention, these are attitude (positive or negative) and subjective norms (social pressure to accept or reject something). Actions mainly depends upon individual expectations of outcomes, if one is having expectation of positive or

negative outcome; will behave accordingly. In short this theory states that attitudes (beliefs, expectations and intentions), subjective norms (what others think) are the main important parameters that help to define the behavioral intentions of individuals. The variables of this theory are shown in the given diagram.



2.2.2 Theory of Planned Behavior (TPB)

This is also one of the theories of psychology. This theory is considered as an extension of Theory of Reasoned Actions (TRA). TRA theory was concerned with voluntary behavior, but it was felt later on that all behaviors are not 100 percent controlled. So Icek Ajzen extended this theory from TRA in 1985 and a new dimension of perceived behavioral control was added in this model and came up with a new model of theory of planned behavior. This particular factor was included due to deviation in intention to behave in a certain manner and actual behavior caused due to subjective and objective norms. The theory includes three factors to explain behavior intentions and behavior; these are- attitude toward the behavior, subjective norms, and perceived behavioral control.

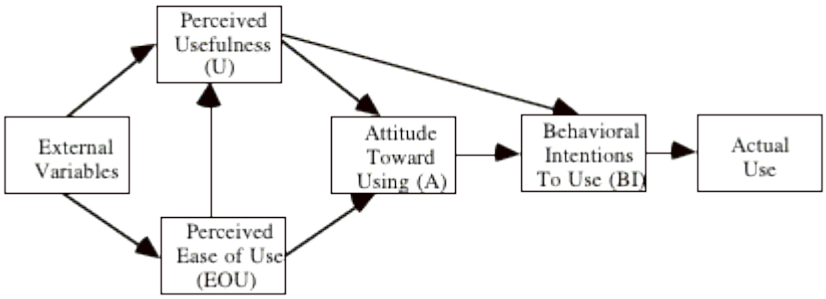


TRA theory states that intention is the main factor and best predictor of behavior. Intention is considered as cognitive representative of person's readiness to behave and is determined by three factors: this are- attitude toward behavior, subjective norms, and perceived behavioral control. Attitude is concerned with one's own beliefs, intentions and own thinking; subjective norms are concerned with what others people for whom he cares think about his behavior; Perceived

behavior control is concerned with people's perception of their own ability to perform a given behavior. All these factors lead to intention to behave. It is considered that more the positive attitude and subjective norms backed by stronger perceived control, stronger will be the persons' intention to behave in a certain manner.

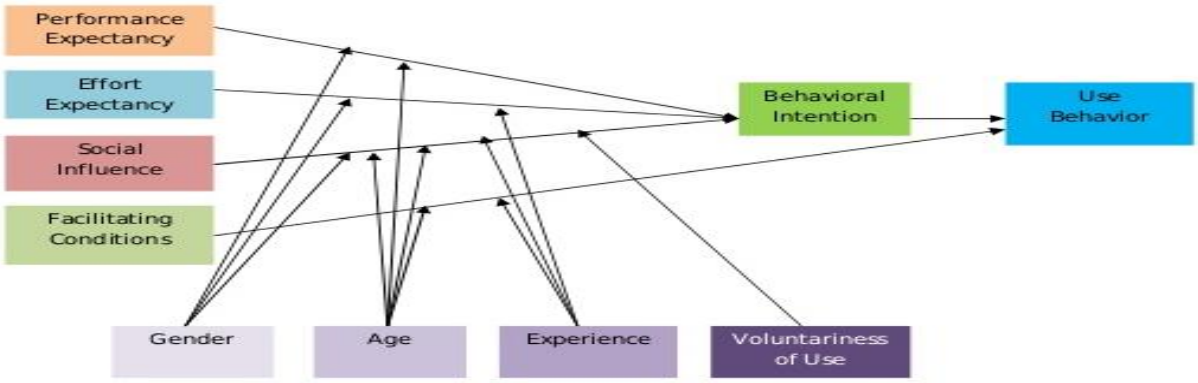
2.2.3 Technology Acceptance Model (TAM) (Davis 1989)

This particular model was introduced and developed by Davis (1989) and was mainly derived from Theory of Reasoned Actions (TRA) to explain the determinants for the acceptance of computer technology (Davis, Bogazzi, & Warshaw, "User acceptance of computer technology: a comparison of two theoretical models", 1989). TAM is considered as basic model that describes the basic history of the adoption of the technology and one of the vigorous models for technology acceptance by various users (Davis, Bogazzi, & Warshaw, 1989) (Davis, 1989). This particular model has been used as well as validated in different fields like web-based information, internet banking (Wang Y. W., 2003), E-learning (Wang, Wang, & Shee, 2007), E-commerce and many others. Among them M-learning (Huang, Lin, & Chuang, 2006) is one.
TAM *has replaced many of the* TRA's attitude measures components with the two technology acceptance measures i.e.— perceived *ease of use*, and perceived *usefulness* .In this model mainly two components perceived ease of use and perceived usefulness are established as primary components for the adoption of computer technology**.**
Perceived usefulness (PU) is defined "as chances of increment in the job performance to the user by using the specific application".
Perceived ease of use (PEoU) can be explained as "the degree to which the prospective user expects the target system to be free of effort" (Davis, Bogazzi, & Warshaw, "User acceptance of computer technology: a comparison of two theoretical models", 1989).
TAM explained that perceived ease of use and perceived usefulness both can predict the attitude (desire to use the technology) and the behavioral intention (BI) of an individual in accepting a technology.
Many researchers (Venkatesh & Davis, 2000) have conducted various researches and has expanded the variables to be studied in TAM . There are two upgraded versions of TAM model, these are- TAM2 and TAM 3 (Venkatesh & Davis, 2000) and Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh, Morris, Davis, & Davis, 2003). TAM 3 included mainly six external variables- Perceived ease of use(PEOU), Perceived usefulness(PU), behavioral intention(BI), attitude and actual use(AU) and was used in E-Commerce (Davis, 1989) (Davis, Bogazzi, & Warshaw, 1989).



2.2.4 The Unified Theory of Acceptance and Use of Technology (UTAUT)

This model is mainly a technology acceptance model to find out the degree of users' acceptance of information technology in a cohesive manner formulated by Venkatesh and others. This theory is mainly based upon four key constructs, these are- performance expectancy (PE), effort expectancy (EE), social influence (SI), and facilitating conditions (FC). These four factors are considered as independent variables in this model and dependent variables are behavioral intention and usage. Performance expectancy, effort expectancy and social influence mainly direct usage intention and behavior but facilitating conditions mainly affects users' behavior. This theory states that age, gender, experience, and voluntariness moderates the effect of all the four independent variables viz- performance expectancy (PE), effort expectancy (EE), social influence (SI), and facilitating conditions (FC). This theory was developed after reviewing various previous models and theories like theory of planned behavior, technology acceptance model, and diffusion of innovations theory, theory of reasoned action, combined theory of planned behavior and technology acceptance model, motivational model and social cognitive theory (Venkatesh, Morris, Davis, & Davis, 2003). This study mainly accounts 70 percent of variance in behavioral use and 50 percent of actual use variance. Behavioral intention is the key predictor of technology use (Venkatesh, Morris, Davis, & Davis, 2003).



The four key variables can be defined as under-

- **Performance Expectancy (PE):** PE can be defined as degree of individual belief that the given technology and system will be helpful in attaining benefits in job performance. It is considered that PE can moderate the effect on behavioral intentions (Venkatesh, Morris, Davis, & Davis, 2003).
- **Effort Expectancy (EE):** EE is defined as the degree of ease related with the use of the system. Effort Expectancy can also have an influence on behavioral intention that is hypothesized by age, gender and experience (Venkatesh, Morris, Davis, & Davis, 2003)**.**
- **Social influence (SI):** SI can be defined as attitude, belief and perception of others toward the usage of that technology by an individual (Venkatesh, Morris, Davis, &

Davis, 2003)**.** It means it depends upon what others think of that system, how important it is to use the new system? It is considered that social influence also affect the behavioral intention by age , gender, experience and volunteers of system

- **Facilitating conditions (FC):** FC can be defined as the degree availability of organizational and technical facilities and infrastructure to use the system. It also affects behavioral intention by age and experience (Venkatesh, Morris, Davis, & Davis, 2003).

2.2.5 Initial trust model

Trust plays an important role in mobile banking. Luo, Li, Zhang, & Shim, (2010) analyzed three dimensions of trust as suggested by McKnight & Chervany, (2001), these are disposition of trust, structural assurance and trust belief. Disposition of trust can be explained as a general tentency of humans to trust others and showing faith in humanity (McKnight, Chervany, & Kacmar, 2002). It can be considered as a personal trait. Structural assurance can be termed as system quality in which technical and legal structures like insurances, encryptions, regulations, promises and guarantee of completion of task. Trust belief mainly consists of the integrity, competence and benevolence of the vendor (Gefen, 2000) (McKnight, Chervany, & Kacmar, 2002). Many researchers showed that there exists direct relationship between disposition of trust and initial trust (Gefen, Karahanna, & Straub, Trust and TAM in online shopping: an integrated model, 2003), but this association mainly depends upon either individual's personal faith in humanity or on the individual strategy to deal others (McKnight & Chervany, 2001). Higher the general tendency to trust others higher will be the initial trust in M-banking**,** but disposition of trust is having significance on initial trust in case of new customers (Gefen, Karahanna, & Straub, Trust and TAM in online shopping: an integrated model, 2003) but for the existing customers who are having trust belief in banks, in their competency and benevolence they will feel more secure and they will trust the structural assurance. Perceived competency, integrity and benevolence are the components of trust and these components positively affect the adoption behavior toward mobile banking (Lin, 2011). In short both the disposition of trust and trust belief leads to structural assurance and system quality will help in establishing the trust (Gefen, Karahanna, & Straub, Trust and TAM in online shopping: an integrated model, 2003).

2.2.6 Innovation diffusion theory

This theory was mainly popularized by the work of Everett Rogers in his book *Diffusion of Innovations* firstly published in 1962 (Rogers E. M., 1962). This theory try to answer the question of why, how and at what rate technology, innovation and new ideas spread. According to Rogers there are mainly four elements that influence the spread of innovations, these are- innovation itself, time, social system and communication channels (Rogers E. , 1995).

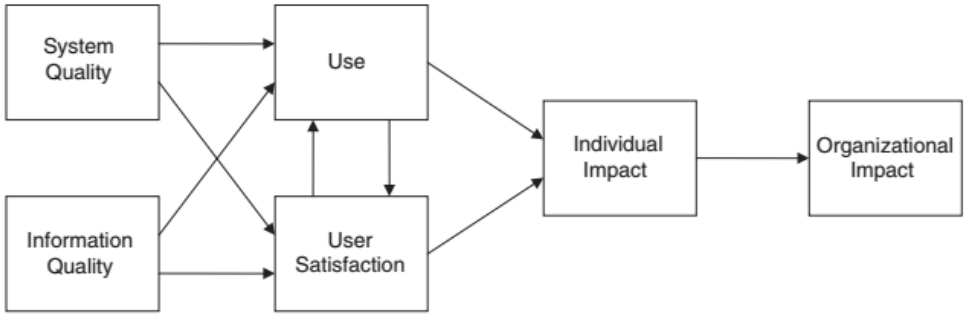
There are rapid developments and usage of new technology in mobile banking segment, so to measure the adoption behavior and pattern of mobile banking innovation Diffusion theory and Knowledge based attributes play a major role (Lin, 2011). Lin 2011 in his study examined perceived relative advantage, compatibility and ease of use as major factors in innovation to effect the adoption behavior. Researchers of Information System (IS) considered mobile banking as a major technological innovation that will help to penetrate banking transactions (Laukkanen

T. , 2007) (Herzberg, 2003)as these transactions are independent of time and place constraints, so it facilitates creation of customer values (Mallat, Rossi, & Tuunainen, 2004).

This theory (Rogers E. M., 1962) posits perceived innovation attributes (Perceived relative advantages, perceived ease of use and perceived compatibility) and knowledge based attributes like (competence, and integrity) are very important determinants to influence attitude that leads to behavioral intention to adopt mobile banking.

2.2.7 Delone And Mclean is Success Model

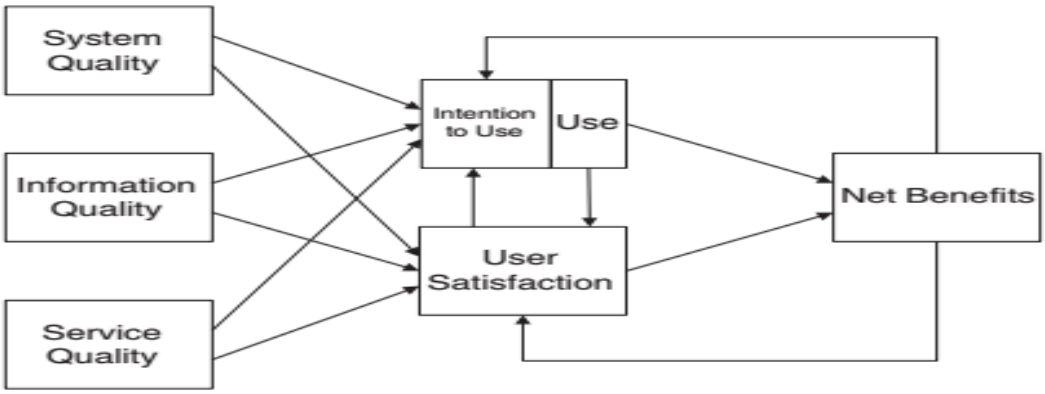
There are various models to define the success of IS, like Technology Acceptance Model, Theory of Planned Behavior and theory of Reasoned Actions, but all these models are there to elaborate the process of acceptance of technology. Merely acceptance of technology can not define success of IS, it is only a precondition. So DeLone and Mclean developed a model in 1992 to measure the success of information system. This original D&M model was based on Shannon and Weaver's 1949 model that were based on mathematical theory of communication; these models mainly identified there types of Information; technical level (accuracy, efficiency of the system), semantic level (ability to transfer desired message) and effective level (impact on receiver) (Shannon & Weaver, 1949). Later on Mason (1978) expanded effective level and added three sub categories; receipt of information, influence on recipient and influence on system. After analyzing the research publishing from 1981-1987 they established six construct to measure the success of Information System; these are, system quality, information quality, use, user satisfaction, individual impact, and organizational impact, these are interdependent variables of success measure (DeLone & McLean, 1992). This is shown in figure.



2.2.8 Updated De-Lone And Mclean Is Success Model

Further there were many researches using this model and those proposed various another variables that should be there to measure complete success of Information System of an organization. (Pitt, Watson, & Kavan, 1995) was of the view that service quality is also very important aspect to measure the success so a model from marketing literature names as SERVQUAL was proposed to be added in DeLone and McLean model; it was supported and endorsed by (Seddon, 1997), (Jiang, Klein, & Carr, 2002). Moreover; (Seddon PB, 1999) were of the view that this model not only affects individual and organization level only; but all the levels like industry, workgroup and society are also affected by the adoption of new Information System, so instead of individual and organization impact, Net benefits should be there in the

model. Next amendment in this model was regarding "Use" variable, it was felt that use should be replaced by User Satisfaction and Intention to use as increment in user satisfaction will lead to a higher intention to use, and that will affect use. The updated version of DeLone and McLean model embedded all those new variables and came up with a new model in 2003. The construct of new model is shown in figure given below.



The various variables of this model are explained as-

- **System quality** – This construct includes mainly all the desirable characteristics of an Information System like- ease of use, system reliability, system flexibility, ease of learning, and all the system features like- sophistication, intuitiveness, flexibility, and response times.
- **Information quality** – This includes desirable qualities of the output generated by the system like- conciseness, relevance, accuracy, understandability, usability, timeliness, and currency.
- **Service quality** – This shows the quality of the help and support that system users receive from IT support personnel and the IS department, like- accuracy, responsiveness,, technical competence, reliability, and empathy of the staff. It is one of the important instruments to measure service quality under SERVQUAL model (Pitt, Watson, & Kavan, 1995).
- **System use** – It is concerned with the way of utilization of the system by staff and customers. This includes nature of use, amount of use, appropriateness of use, frequency of use, purpose of use and extent of use.
- **User satisfaction** – This construct mainly defines user's satisfaction with output generated by Information System like- reports, and other support services.
- **Net benefits** – This construct includes contribution made to workgroups, individuals, companies, industries, society and nation by Information System , like- improved productivity, increased sales, improved decision, market efficiency, creation of jobs, reduction in cost, opportunities of profit making, consumer welfare and economic growth and development

Conclusion

The chapter focused on various models to study the behavioral aspect for acceptance of mobile banking, mobile banking in India and the quality of system and services provided by mobile banking apps, measurements of customer satisfaction and service quality. There are many models regarding adoption of the technology and to measure the success factor of an Information System success. After analyzing the various models and theories it is found that De-lone and Mc lean model is a robust model among all to measure the success factor of Information System. It mainly accompanies all these aspects of Information System success as system quality, service quality, information quality as well as net benefits, user satisfaction, system use etc., so this particular model is sufficient enough to measure the success of Information System.

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