

## S CURVE TRAJECTORIES OF E MONEY INNOVATIONS IN INDIA

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CA Darshana Khakhar\*

### ABSTRACT

*New technology in banking is transferring the financial world and the traditional banking is now a days rapidly changing. One of the latest banking technologies is block chain technology. It decentralizes the Indian banking system from central bank. Banks may not be playing any role in the system which will be shared between networks of computers. This paper studies the process of technological changes in the banking system by focusing more on innovations especially in electronic money in India. In particular, the study aims to gain understanding if block chain technology using virtual currencies like Bitcoin would bring about a paradigmatic shift toward a cashless society. Focus is on the rapid development of ATM, debit cards, credit cards, electronic fund transfer and Bitcoin in India. For analysis and comparing the development in banking area, technology S curve and Schumpeter's model of economic development are used. It can be concluded from the research that there is a shift towards cashless society in India.*

**KEYWORDS:** *Bitcoin, Payment System, Cashless, Innovation, Technology, S-curve.*

### Introduction

This paper attempts to find whether the Indian banking system is ready for cashless transactions. This study focuses on the financial innovations and in particular the electronic money innovations in order to find whether Indian banking system is ready for the cash less society. The paper primarily tries to locate the current development in Indian payment system from cash, notes and cheques to electronic money or digital money like ATM, debit cards, credit cards, electronic fund transfer at the point-of-sale (EFTPOS), M Wallet, Mobile Banking and Bitcoin—the latest development of electronic money that has been pushed by countries around the world in attempts to be a cashless society and on the other hand it also attempts to find the position of Indian money payment system in S curve of technological innovation.

### Conceptual Framework

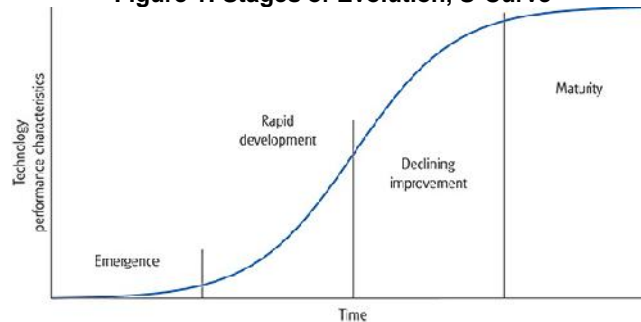
- **Technology Evolution and Diffusion**

This section focuses on the two primary factors that affects the useful life of any given technology – technology evolution and technology diffusion.

**Technology Evolution:** S-curve model is used to find how technology evolves over time. S-curves are utilized by scholastics and innovation forecasters to foresee how and when an upper limit of a given technology is reached. Technology evolution is changes in performance characteristics of a particular innovation after some time. History demonstrates that once a new technology is introduced, development in performance characteristics has a tendency to be slow, trailed by a time of rapid growth, pursued again by decline as the technology plateaus. The technology evolution can be clarified through the accompanying four phases: emergence, rapid improvement, declining improvement and maturity. These stages are represented in Figure 1, along with S-curve that maps the changes in performance characteristics over time.

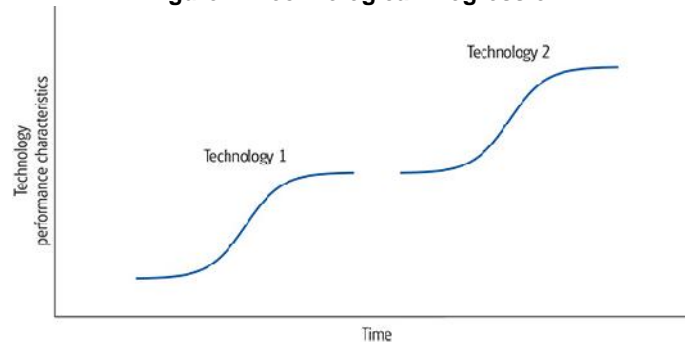
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\* Assistant Professor, Faculty of Management, GLS University, Ahmedabad, Gujarat, India.

**Figure 1: Stages of Evolution, S-Curve**

In the beginning times of improvement, an innovation works far underneath its potential, in light of delay in learning processes. Once that slack period is survived and the know-how connected with a given technology turns out to be better comprehended, there is a high development in the technology usage. It becomes simpler for the final users to use it. The rapid development seen in the second stage slows down in stage 3 and in the long run levels in stage 4 as the technology approaches its highest point. Generally all technological developments shows a similar pattern of growth as that seen in the S-curve. While the directions for different innovations contrast, practically all technological improvements show comparable example of development as that seen in the general S-curve in Figure 1.

Technology evolution is a theory that describes the radical transformation of society through technological development, technological progression is the overall process of invention, and innovation and diffusion by which new technologies emerge making older technologies obsolete. Figure 2 illustrates technological progression.

**Figure 2: Technological Progression**

After many revisions in the technologies, users of the technology after a point become dependent on those technologies and hence the usage come at its peak level over a certain period of time. This is the point in time when future improvements are no longer possible. This is even because every technology has some limited scope of improvement in its performance after which its further improvement is not possible. Once a technology has reached its potential, improvements in characteristics have to wait until the next radical innovation which will make the earlier technology obsolete then. The S-curve for Technology 2 represents the next version of technology, which makes the prior version of the technology obsolete.

**Technology Diffusion:** Technology diffusion is the process by which innovations spread within and across economies and consumers start adopt a particular technology over time. The technology diffusion process is well described by Moore (2014) as the Technology Adoption Life Cycle (TALC). According to TALC initially a technology is adopted by Innovators, then Early Adopters, then the Early Majority, the Late Majority, and finally the Laggards. According to his study.

**Innovators** are very much aggressive at adopting new technologies. They sometimes adopt before a formal marketing programme has been launched. Innovators are often technologists themselves. In any given market, there are only a few innovators, but their adoption of the technology is important because it is only after some consumers have used in the market which leads to acceptance and encouragement to others in the market.

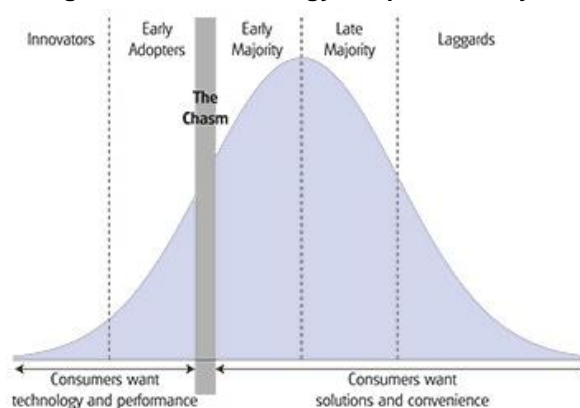
**Early Adopters** accept new technologies early in the life cycle, but they are not technologists like the Innovators. Rather, they appreciate the benefits that new technologies offer and rely on their insight in making buying decisions.

**Early Majority** are similar to Early Adopters in their appreciation of the benefits technology offers, but their decision of adopting a technology is based on whether it is well accepted by others. They understand that some technologies come and go, so they wait and see how other consumers are using before adopting it.

**Late Majority** are the last segment of the population that will wait until a technology has become an established standard. They purchase and use new technologies only after it is readily and easily adopted by all.

**Laggards** have nothing to do with new technology, for both personal and economic reasons. They adopt technology only when technology is now an established product and it is in the need of an hour to use it. According to the TALC model as shown in the figure 3 given below, which shows the number of users who have adopted a given technology?

**Figure 3: The Technology Adoption Life Cycle**



When a technology is in the first stage, it is not accepted by all the consumers because in the early stage cannot meet all the needs of its consumers. Innovators and Early Adopters are willing to accept a new technology in spite of these shortfalls because of their approach and attitude towards the technology and even they are ready to pay high purchase cost. As the technology matures, it offers better reliability, more technical support, and a lower price point because of which new types of consumers get attracted and continue to enter the market. Thus, the TALC describes the overall progression or diffusion of technology adoption through the entire consumer base. The above bell shaped curve indicates that in the first area, consumers want performance and tries to satisfy the basic needs and the second area is more to do with solutions and convenience.

- **Technology S Curve**

The innovation theory deals with the innovation process. The innovation process shows S-pattern. The innovation life cycle shows a base for technological forecasting. According to the study of the by Fisher and Pry [1971], when a new innovation reaches about 5% penetration of the market, one can predict the speed and when the ultimate penetration will be possible. The process of innovation adoption is generally considered as an evolutionary model of technological change. That is to say, the theories of evolutionary economy explain how new technologies are diffused and used in the market and its impacts on society.

- **Schumpeter's Model of Economic Development**

According to the Schumpeter model, it is the introduction of new product and the continuous improvements in the existing ones lead to development. Schumpeter's long-wave theory explains the economic development by indicating it with the waves and showing the shift from an existing business cycle to a new business cycle. This shift is nothing but how the industrialization and its growth takes place. The techno economic paradigm is a group of technical and organizational innovations that will affect the economy at large. According to Freeman and Perez (1988), the three trajectories which shows a shift in technical and economic grounds are:

- The fall in cost: As and when the technology becomes older, its use increases and hence its cost also decreases because of the availability and high demand. So the fall in cost of any technology shows that it is now accepted by the users and used widely.
- Unlimited availability of supply over long-time periods: When the technology becomes acceptable its supply also multiplies, then only the innovation can reach to all the users.
- Prevailing use in a large number of products or processes: When the technology is accepted by the users, demand from the user's side increases and hence the use of such technology is widespread and seen in variety of products and processes. All the above three factors shows a sign of paradigm shift in any technology.

### Literature Review

(Abemathy, 1975) In their research paper titled, "A Dynamic model of process and product innovation" the authors have explained the life cycle in a technological development of a product. They have tried to establish a relationship between the pattern of innovation within a firm and its characteristics. The conclusion of the research is that there is a strong relationship between firm's capacity to innovate, its strategy and the model of production process. The research suggests a consistent pattern of variables that will change systematically with changes in firm's product and process development.

(Pry, A Simple substitution Model of Technological Change, 1971): In their research paper titled, "A Simple substitution Model of Technological Change" has made the attempts to show how the old technologies are substituted with the new and latest technologies. According to the research paper, the technology substitution growth flows at a specific rate and forming S curve. The paper depicts the forecasts of products like natural fiber and synthetic material, plastic and leather, synthetic and natural rubber and many other products based on the consumption pattern in US. It was concluded from this research paper that the new process, product or service has to compete strongly with the old technologies in order to be at an acceptable stage to the users. There are many economical and market forces which has its own impact on the substitution process.

(Rogers E., 1995) According to the Rogers theory of diffusion, it is the process by which an innovation is well communicated through channels among the members. The decision to use a new technology is a five step process – knowledge, persuasion, decision, implementation and confirmation. Their decision to use is also at times based on what the society is doing, whether others have accepted or not? For innovation the users do follow S shaped curve and accordingly the users are categorized as innovators, early adopters, early majority, late majority and laggards.

(Wonglimpiyarat, S Curve trajectories of e money innovations, 2016): The author has very well explained the S curve applications to the global financial payment system. The paper focuses on whether Bitcoin can bring a paradigm shift toward cashless society and the analysis was conducted relying on Schumpeter's model of economic development and S curve theory. It was concluded from the research that there is a move towards cash based economy but at the same time the shift of S curve is not enough to cause a paradigm shift. The research also compared Bitcoin with PayPal in order to understand the new challenges towards cashless society.

(Wonglimpiyarat, The New Darwinism of the payment system: Will bitcoin replace our cash based society?, January 2016) This paper is concerned with the new Darwinism of the payment system. The researcher focuses on the payment system and makes an attempt to understand whether Bitcoin can replace the cash based society. It can be concluded from the study that there is a move from cash based to cashless society. Currently there are issues towards accepting Bitcoin as a payment system due to its disadvantages like insecurity, legality, risks of money laundering and risk on stability and effectiveness of monetary policies.

(Perez, 1988) The author in his paper titled "Structural crises of adjustment, business cycles and investment behavior". The author has discussed here the impact of technical change. He argued that technological changes have widespread consequences for all the sectors of economy. Technology diffusion is accompanied by major structural changes which in turn also lead to social and institutional changes. This paper discussed certain long waves and its effect in sectors like early mechanization, steam power and electricity and information and communication.

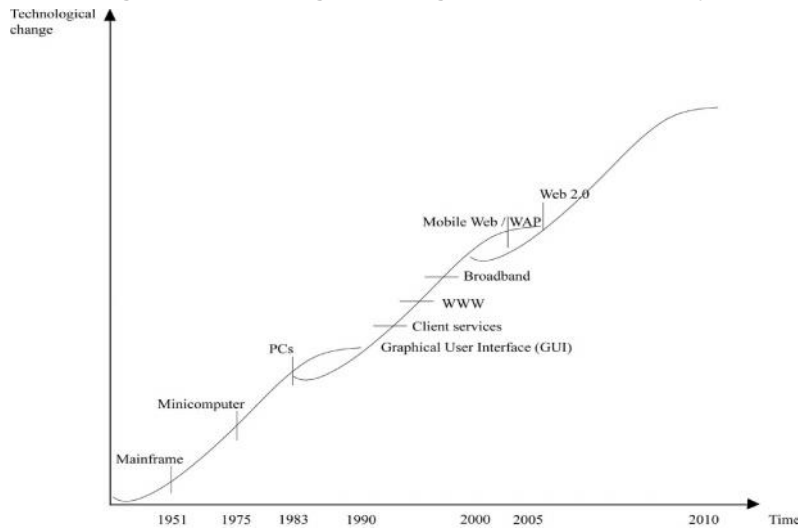
**Research Design and Methodology**

Descriptive research design is the method used. The main goal of this type of research is to describe the data and characteristics about what is being studied. The goal of this research is to study S curve trajectories of electronic money innovations in India. So here secondary data is used for the research.

**Development in Indian Payment System**

For knowing how technology S curve affects the payment system, the researcher first implements the same on computers. Figure 4 show the process of technological change in the computer industry. The technological change based on the theory of innovation life cycle represents such shifts of S-curves. The technological improvement follows the S-curve to reflect technology progression from mainframe to minicomputer to PC to client services to broadband and lastly mobile web/WAP technology. The envelope of S-curves underlying the innovation process also shows technology substitutes to extend the life cycle of the operating system.

**Figure 4: Technological Change in Computer Industry**



Mobile and Computer technology are growing fastest and for financial payment transactions also, these technologies are growing and used tremendously fast. Majority of the people would like to use the modern banking technologies for payment purpose rather than traditional ways. Following table shows the increasing usage of various modern technologies like retail electronic clearing, credit card usages, M wallet and mobile banking from the financial year 2012-13 to financial year 2017-18.

**Figure 5: Growth in Modern Banking Facilities in India**

Year	2012-13		2013-14		2014-15		2015-16		2016-17		2017-18	
	Volume(Million)	Value(Billion)	Volume(Million)	Value(Billion)	Volume(Million)	Value(Billion)	Volume(Million)	Value(Billion)	Volume(Million)	Value(Billion)	Volume(Million)	Value(Billion)
Retail Electronic Clearing	694.07	31,881.14	1,108.32	47,856.29	1,687.44	65,365.51	3,141.53	91,408.14	4204.96	132250	5467.29	192017.98
Credit Cards	399.13	1,243.93	512.03	1,556.72	619.41	1,922.63	791.67	2,437.02	1093.51	3312.21	1412.97	4626.33
Usage at ATMs	2.52	14.42	2.96	16.87	4.29	23.47	6.00	30.41	6.37	28.39	7.81	36.68
Usage at POS	396.61	1,229.51	509.08	1,539.85	615.12	1,899.16	785.67	2,406.62	1087.13	3283.82	1405.16	4589.65
Debit Cards	5,999.21	17,393.44	6,707.10	20,602.86	7,804.57	23,492.65	9,247.00	26,960.63	10962.36	26901.79	11945.65	33588.31
Usage at ATMs	5,530.16	16,650.08	6,088.02	19,648.35	6,996.48	22,279.16	8,073.39	25,371.36	8563.06	28.39	8602.26	28987.61
Usage at POS	469.05	743.36	619.08	954.51	808.09	1,213.49	1,173.61	1,589.27	2399.3	3283.82	3343.39	4600.7
M-Wallet	32.70	10.01	107.51	29.05	255.00	81.84	603.98	205.84	1629.98	532.42	3025.98	1086.75
Mobile Banking	53.30	59.90	94.71	224.18	171.92	1,035.30	389.49	4,040.91	976.85	13104.76	1872.26	14738.54

Source: RBI Website

Even after demonetization government is supporting digital India for financial transactions which is very clearly evident from the below three graphical representation showing the increasing use of mobile technology, NEFT and how the digital transactions have increased. Immediately post demonetization.

### S Curve Trajectories of E Money Innovations

Taking into account the process of technological change of these industries, it can be seen that the S-curves represent generations of new or improved technology (for product/process innovation). The analysis of technology S-curves at industry level provides a basis to understand the potential adoption of Bitcoin. The present banking system is now evolving towards mobile payment systems due to widespread smartphone usage and the growing number of mobile broadband subscriptions. Bitcoin is currently seen as the latest electronic money or digital money that might revolutionize the payment system. As per the literature review there are three trajectories that affects the technology diffusion. Those trajectories how affects Bitcoin acceptance is discussed below:

- **The Fall in Cost**

The transaction cost is 1% and IGST will be 18% The net banking and Pay U money mode of payment will incur additional 1.9% . The Bitcoin mining fee is as low as 0.0002 BTC per 1 transaction compared to other financial transactions (compared to credit card transaction fee of 3%–5% per transaction value) which would help achieve widespread usage.

- **Unlimited Availability of Supply Over Long-Time Periods**

Bitcoin is a virtual currency created by software for exchanging value without banks acting as an intermediary. Because of software based payment technology, it provides unlimited supply as the software developers can use the open-source code to develop Bitcoin applications.

- **Prevailing Use in a Large Number of Products or Processes**

In India RBI and Government has not declared Bitcoin to be a legal mode of payment. Hence its usage is not seen. Earlier Bitcoin was used as an investment tool but after the RBI's statement and the world wide fall in its price, currently people are not even investing in Bitcoin.

### Conclusion

This paper attempts to study the innovations in Indian financial payment system. The focus is how technology changes the way payments are done. The researcher can conclude here that there is definitely a move towards cashless society. Even Indian Governments are now a days supporting the digital payments and digital India. Various applications and wallets are found in India for the payment system and people are using these services to a large extent. About the virtual currency Bitcoin, the researcher concludes that it will take some time in India for it being a legal payment option. Many countries are reluctant to accept Bitcoin. The biggest issue is lack of secure infrastructure which has affected Bitcoin innovation to achieve widespread use. Based on the technology S-curve and Schumpeter's model of economic development, it can be seen that the technological evolution progresses from physical cash and cheques to electronic cash of ATM/cash card, credit card, EFTPOS/debit card, mobile money (or electronic money transfer through cellular networks) and the latest digital money innovation of Bitcoin. Taking into account the trend of a cashless society, Bitcoin innovation has not yet been a successful innovation due to many implementation problems. The major problems are that the Bitcoin innovation is that it is not supported by any government and there are problems of insecure payment infrastructure and so users feel risk in even investing in it. There is a significant move from a cash-based economy towards a less cash society. The global payment system is progressing towards a less cash economy. But there is still time to accept Bitcoin as a legal tender in India.

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