

Recent Technological Developments in Indian Banking*

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It gives me great pleasure to be here in Sri Lanka with all of you today. The ties which bind the two peoples of our countries are strong and owe their foundations to a shared culture, social and economic ties and to history going long back in time - be it the bridge, which Rama built in mythological times and which still binds the two nations or the great emperor Asoka, who sent his son and daughter to this fabled land for spreading the message of peace and harmony, which continues to foster the friendship between the two nations. It is, therefore, a privilege for me to be here and to share some of my experiences on some of the challenges we as a Central Banking community, face.

Central banking is a relatively new phenomenon. Central banks have essentially evolved in the 20th century. In 1900, there were 18 central banks, and at the next turn of the century, there were 172 central banks. The evolution of central banks has gone through many ups and downs as the real and financial world around metamorphosed at an increasingly stupendous pace. The Great Depression of the 1930s, the collapse of the Gold Standard and then of the Bretton Woods agreements, the free float of currencies, the onset of the global village and the collapse of national boundaries in the financial world, all have contributed in sculpting the ownership, and scope, the nature of functioning and the importance of central banks. Central bankers have taken every challenge as an opportunity and today, are considered the world over, as bastions of professionalism and centre of stability in macro economic policy. Central Banks in South Asian countries evolved by design and have matured to be efficient institutions by reverence and governance.

In our part of the world as well, central banks have evolved after much debate and discussion. Central banking in India, for example, was a result of prolonged deliberations in which senior dignitaries including persona of the standing of no less than Lord Keynes, were involved. The Reserve Bank of India itself took a long time to fructify and its history boasts of perhaps the longest incubation period in history. The period since inception has also not been all smooth sailing but today India is no exception in recognising the importance of central banks for the smooth and efficient functioning of the real as well as the financial economy.

In the closing years of the 20th century and the first few years of the 21st century, several new challenges have emerged for the fraternity of central banks. And these challenges, *inter alia*, have been posed by the onset of the technological revolution. Technology, and in particular, information technology, has transformed the manner in which organisations and production processes in the economies are conducted. It has introduced a myriad range of significant structural changes in all economies and in all sectors of economies, though in varying degrees and has rendered non-competitive and archaic, many traditional time-tested processes and practices.

So why are central banks interested ? The simple answer is that central banks do not exist in a vacuum and cannot and do not remain insulated from developments taking place in the world around them and particularly in the financial world. The banking and financial sector is arguably the sector which was in a position to benefit most by leveraging technology and not surprisingly

is also the sector which has absorbed technology to the hilt. The quintessence nature of banking operations – astronomical items processing, voluminous transaction processing, complex credit evaluations and risk management calculations – correspond closely to operations, technology specialises in automating and rendering more efficient. To say that banks, and Central Banks, cannot survive without the support of Information Technology in the times to come is to state the obvious.

A more focused investigation into why central banks are interested in technology would encompass the fact that the technological changes taking place around the world have altered the production processes and the deliverables arising out of the every core functions of every central banks viz. monetary and financial stability, regulation and supervision, and currency management. The answer would also factor in the fact that the central banks, as organisations themselves cannot insulate themselves from the opportunity of tremendous benefits that technology offers to their internal functions and processes. Let me elaborate a bit on the issues and also share with you some of the initiatives we, at the Reserve Bank of India, have taken to exploit the opportunities created by technology and the efforts taken by us to minimise the threats it poses.

Impact of Technology on Regulation and Supervision

With the banking industry marching ahead, no holds barred, in embracing technology, central banks face a tough challenge in donning suitable regulatory and supervisory armory to the constantly changing complex banking environment. With rapid growth in technology and the increasing complexities of technology driven developments in the financial markets of a shrinking universe, the regulated are, as a general norm, more pro-active than the regulators on innovation of products and services and in finding opportunities for regulatory arbitrage, especially in countries like ours where there are multiple regulators and central banks face an uphill task in drawing abreast and equipping themselves with an array of tools to deal with the regulatory implications of a technology induced fast changing financial world. These developments warrant a qualitative change and fine tuning in the relationship between the regulator and the regulated, as on-going process and in the light of the phenomenal impact technology has warrants alterations to decades old mindset and practices.

Technology has opened up new markets, new products and services and new and efficient delivery channels for the banking industry. On line electronic banking, mobile banking and internet banking are just a few examples. As banks venture into new and hitherto, un-chartered territories and enter new markets, the diversity and complexity of risks faced by them multiply. Rapid developments in the financial market also have an impact on the banking industry and are not without implications for the financial health of banks and for the stability of the financial system. A case in point is the technology driven market for risk *i.e.* derivatives, which has found a regulatory response in the form of increased attention to off balance sheet items. Another area of emerging challenges and risks are the implications arising from the imperatives of financing tech firms and information technology initiatives - an altogether different ball game from financing of traditional businesses by the financial sector.

Paradoxically enough, information technology has also provided central banks with the

wherewithal to deal with the challenges the new economy poses. Information technology has been the cornerstone of recent financial sector reforms aimed at increasing the speed and reliability of financial operations and of initiatives to strengthen the banking sector. Technological facilities are being used globally to supervise banks more effectively and with greater intensity than ever before. Increasing emphasis is being given to technology-aided, non-intrusive and focused supervision with a view to prevent frauds and to nip in bud the origin of disturbances and instabilities.

The Reserve Bank of India also has been no exception in making efforts to harness technology in its quest for more effective supervision. An Off-Site Monitoring and Supervision System has been in place for some time now to accept and analyse returns from banks. The system is used in monitoring trends in a broad set of key variables to track the financial health of the supervised entities at frequent intervals and to throw up exception and early warning signals. A similar system for monitoring and supervising non banking financial institutions is also in place. To address the specific needs for the supervision of the co-operative banks in the country, a wide area network based system called UBD Soft is in an advanced stage of development.

As part of another initiative to strengthen the banking sector in the country, the Reserve Bank has been actively promoting the establishment of a Credit Information Bureau as a joint venture in private sector. This is another attempt to exploit technology to monitor assets and to provide instantaneous information on defaulters to the participants without getting into legal hassles and thereby facilitating improvement of the non-performing asset position of banks and financial institutions.

Impact of Technology on Currency Management

Let me deliberate on the impact of technology on the Issuances of Bank Notes and Currency Management by central banks. Technology offers us immense opportunities to drastically improve our performance of this core function. Given the high value and volume of currency in circulation, the vast geographic spread of currency operations, the largest distribution channel for the supply of currency, prevalent marked preference for cash and currency handling practices, currency management in India is a challenging and arduous task. In 1999, the Reserve Bank of India announced a “Clean Note Policy” to bring about improvements of the quality of notes in circulation and technology has played a stellar role in enabling the Bank to provide better quality notes to the general public.

With an eye towards meeting the goals enshrined in the Clean Note Policy, the Reserve Bank embarked upon an ambitious project of mechanisation of the currency processing system – an initiative which has left its mark on almost every aspect of currency management from note design, note printing, withdrawal of soiled notes from circulation and their examination and destruction to taking anti counterfeit measures. This was supported by setting up two new note printing presses to pump in an adequate supply of fresh notes in the economy on the one hand. On the other, 48 state-of-the-art currency verification and processing systems (CVPS) have been set up in different parts of the country to enable quicker disposal of soiled notes. CVPS are high speed fully automatic machines which are designed to segregate notes which are fit for re-circulation from those which are not and to band them in packets of 100 pieces each after

examination for genuineness, pre-set soilage levels, limpness, *etc.*. The notes, unfit for circulation, are then passed to on line shredding units where they are shredded into very small pieces; and all this at a capacity of 50,000-60,000 banknotes per hour. 21 Shredding and Briquetting machines have also been installed and operationalised for the disposal of soiled notes in an eco friendly manner.

Technology is also being harnessed for more effective anti counterfeit measures. We are in the process of introducing bank notes with enhanced security features including magnetic character in all denominations, electrotpe watermark, polyester metallised, magnetic and machine readable security thread and dual coloured fluorescent fibres in the paper.

Impact of Technology on Monetary and Financial Stability

Central banks the world over share a common brief of accelerating economic growth and ensuring price stability. A common agenda for the achievement of this goal is the maintenance of monetary and financial stability in the system. In implementing monetary policy, central banks across the globe use a toolkit of economic indicators. The proliferation of IT has, however, redefined and rendered more complex, this toolset. In the first place, it has increased the weight of intangible goods and services (such as “data”, “knowledge”, information, *etc.*) in overall economic activity, which has made more challenging, the task of compiling and grasping the statistical information. It has also become a challenge to capture the rapid developments in, and induced by, advances in technology. The impact of technology on prices has also become rather tricky to assess. To take an example, it is difficult, if not impossible, to segregate the impact of increasing price level between an actual price rise and the impact of advanced features or improvements in the PC. As a result, it is becoming more and more difficult for central banks to select economic indicators and interpret them to serve as guideposts on which, their monetary policy can rely. This has not only increased uncertainty, it has also made the conduct of monetary policy more complex and prone to implementation and operational risks.

The digital money offshoot of Information Technology may also make central banking more complex in the years to come and may raise questions related to money laundering and intellectual property rights. The rapid expansion of e-money would also pose challenges in the area of compilation of monetary statistics. More importantly, the onset of the new economy can impact the leverage of central banks *i.e.* the supply of base money. It is a threat which has not become real as yet but all central banks are keeping a very vigilant eye on technological developments on this count.

The critical role of central banks in the payment and settlement systems is well recognised. One of the critical activities undertaken by central banks to ensure monetary and financial stability is to provide the banking sector with finality of settlement, which is essential for the smooth and stable functioning of the payment and settlement systems in the country and for the stability of the financial sector in general. Additionally, the payment and settlement systems are the conduits through which monetary policy measures are transmitted to the financial and then the real economy. The management and minimisation of risks in payment systems has not been a traditional central banking activity but is one which has assumed significant importance in recent years. Recent history has re-iterated time and again that disruptions in payment and settlement

systems can ripple across the rest of the financial system and create havoc with any semblance of stability. Systemic risk is the nightmare of central banks and the specters of the collapse of Bankhaus Herstatt, the Russian Coup de etat, the Barrings collapse, the East Asian Payment Crisis, and other such incidents have done little to mitigate the nightmare.

Simultaneously, the IT revolution has set the stage for unprecedented increase in financial activity across the globe. The progress of technology and the development of world wide networks have significantly reduced the cost of global funds transfer. Deregulation of international capital flows, including the relaxation of exchange controls, which has been implemented by many countries around the world since the 1980s has also contributed to increased volumes and values of cross border flow of funds.

Consequent upon this, the financial markets are becoming increasingly more integrated and globalised. These backward and forward linkages with the international economy and with foreign payment systems have made domestic payment systems, which have continued to remain basically national, far more vulnerable than ever to “shocks” and to systemic risk. The gap between “international” financial activity and “national” payment systems has made the oversight of payment systems a complex and challenging assignment for central bankers.

Central bankers, however, realised early on, the role which technology can play in improving and managing risks in payment and settlement systems. Technology has, in fact, placed at the disposal of central banks an enviable array of instruments to manage, in some cases to eliminate, risks in payment and settlement systems. Electronic trading platforms have reduced the gap between trade finalisation and trade reporting and settlement and in the process have significantly reduced risks arising from the trading and settlement process. Real Time Gross Settlement Systems (RTGS Systems) have been the preferred mode of settlement for large value funds transfers by central banks globally to minimise settlement and systemic risk. The RTGS systems would not have been possible without the network externalities and information system capabilities to transmit payment messages to the settlement agency and process funds transfer instructions in real time. Delivery versus payment systems to reduce credit risks in securities settlement systems also owe their origin to the technological capability to harmonise positions in settlement banks and depositories in real time. The emergence of secured netting systems with enhanced liquidity saving elements *i.e.* the Central Counterparty arrangements, to reduce credit and settlement risks in payment and settlement system, require superior analytic and processing capability for tracking member positions, marking positions to the market, calculating and recovering margins, *etc.* Such guaranteed settlements would not also have seen the light of day without the omnipresent computers to provide the processing support. The triumph of Information Technology has perhaps been the introduction of Continuous Linked Settlement which ensures payment versus payment settlement of very large value foreign exchange transactions thus completely eliminating the Herstatt risk in cross border transactions.

Globally, central banks have been at the hub of reforms and refinements in payment and settlement systems both individually and collectively. Individually, central banks have been the catalyst in making payment and settlement systems more secure and efficient through the use of technology, both a provider of payment system services and as overseer of payment and settlement systems operated and managed by private enterprise. Collectively, central banks

through fora such as the Committee of Payment and Settlement Systems of the Bank for International Settlements, have striven towards the establishment of best practices and global standards for payment and settlement systems, which can be used as yardsticks for evaluation of existing payment and settlement systems and guideposts for development of new payment and settlement systems. The Lamfalussy Standards, the Core Principles for Systemically Important Payment Systems and the Recommendations for Securities Settlement Systems are the results of such collective efforts.

The Reserve Bank of India has also been at the forefront of improvements in payment and settlement systems in India with technology a very faithful friend and companion in the Bank's quest towards the establishment of a secure, modern and efficient payment and settlement system in the country. The approach adopted by the Reserve Bank of India to this end has been one of consolidation (of existing payment systems), development (of infrastructure and new payment systems) and integration of the existing and new payment systems.

Network externalities and accessory infrastructural arrangements are sine que non for any technology driven initiatives in payment and settlement systems. In recognition of this, *inter alia*, the Reserve Bank of India established the Institute for Development and Research in Banking Technology, at Hyderabad, in the mid-nineties. It is a dedicated Institute that caters to the technology requirements of the Indian banks and also acts as a one of its kind institute in India that focuses on conducting research in banking technology products and services. It goes to the credit of the Institute that the three critical pillars which constitute the building blocks of a technologically advanced payment systems – communications backbone, standard messaging formats and mechanism and security of financial messages travelling over a wide area network – have been constructed.

We have set up a country wide leased line, satellite and ISDN based Wide Area Network called the Indian Financial Network, in short, the INFINET. It is a Closed User Group Network and is intended to work as a safe and reliable communication backbone for the various intra and Interbank applications including the various payments related applications, I will be shortly talking about. The sheer necessity of such a communication backbone to overcome the tyranny of geography in a country of the length and breadth of India cannot be exaggerated.

Standardisation of message formats and communications protocols to enable Straight Through Processing has been engaging the attention of the banking and IT industries for sometime now. Taking cognisance of this, we, in the Reserve Bank of India, with the help of IDRBT, have put in place a standardised messaging solution –the Structured Financial Messaging System - for inter and intra bank applications including all payment systems applications. SFMS is a SWIFT-like messaging solution which aims at providing a common communication standard to enable banks to integrate their host systems with payment system applications and sets the stage for Straight Through Processing.

The provision of foolproof security for electronic messages resulting in financial transactions to prevent data tampering during transmission and to ensure non-repudiation of messages is a pre-requisite for any electronic payment and settlement systems. Globally, encryption and digital signatures using the asymmetric key algorithm has been the preferred mode for securing

financial messages moving over local and wide area networks. In India too, we have adhered to the international best practices and have developed our own Public Key Infrastructure (PK) based security solution. IDRBT is the Certifying Authority for the entire banking and financial sector and this role assumes an increased significance in the light of the numbers of banking transactions that are expected to move over networks in the foreseeable future.

The other area that is engaging our attention presently is a total revamp of the manner in which Inter-Bank transactions are conducted. Presently, these are based on paper cheques and despite the very high value of each of these transactions, our present technological capabilities do not allow us to debit or credit the accounts of these banks in real time. Also, the settlement of these transactions takes place on a deferred net basis, and in this forum of central bankers, I do not need to emphasise the huge potential for systemic risk that such deferred net settlement systems entail. In a time scale of less than six months, this is all going to be history in the Indian banking industry. Over the last couple of years, we have been striving to put in place a Real Time Gross Settlement

System, which will allow the account balances of the banks to be debited and credited in real time and on per transaction basis. I understand that a similar initiative has been undertaken in Sri Lanka as well. I wish you all success in your endeavor.

The most critical pre-requisite for successful operation of an RTGS System is the management of liquidity, particularly, intra day liquidity, by the participants of the system. To facilitate effective liquidity management, we have put in place a Centralised Funds Management System which allows our financial system customers to view and monitor the account balances and funds movements in their accounts in various RBI offices across the length and breadth of the country from a centralised location. Equally important, it equips funds managers to move funds between these accounts from their desktops at the click of a button.

The payment and settlement arrangement for the primary and secondary markets of gilt edged securities is systemically very important in our country, as in most countries around the world. For this segment, we have deployed a modern electronic trading platform called the Negotiated Dealing System. The system is seamlessly integrated with the backend Securities Settlement System which provides the depository and settlement services and is, in turn, integrated with the settlement bank (another wing of the Reserve Bank of India) to ensure Delivery versus Payment in securities transactions. The benefits of the Negotiated Dealing System encompass elimination of cumbersome paperwork and enabling of Straight Through Processing of securities transactions and beyond. The system captures trade particulars as soon as a deal is struck and thereby enables more effective price discovery and sets the stage for a more transparent market. It also places at the disposal of regulators the wherewithal to watch the gilt market and monitor movements on an intra day, rather than on an end of the day, basis – a tool which considerably reduces the lag between market developments and the cognisance of the same by the regulators thereby enabling more timely and effective regulatory measures, and if required, intervention mechanisms where necessary.

With the active encouragement, support and oversight of the Reserve Bank of India, the Clearing Corporation of India has been set up by a group of banks and financial institutions. This

institution has come to play a critical role in the payment and settlement system arrangements of the country. CCIL provides the facility of secured netting under central counterparty arrangement for secondary market transactions in government securities. In the forex segment, a pioneering effort has been made for facilitating the settlement of rupee-dollar trades through a secure netting system by CCIL. These clearing and settlement systems offer important services in terms of mitigation of settlement risks. Liquidity saving elements *vis-à-vis* a gross settlement system offers additional benefits. The risk management framework designed and implemented by CCIL are comparable with international standards and along with the RTGS System, will go a long way in making the payment and settlement system in India secure, efficient and compliant with the Core Principles for Systemically Important Payment Systems,

RBI as user of technology

Let me now share how we have made attempts to integrate IT within the Reserve Bank of India to improve our processes, work flow and customer service. As a central bank, as highlighted earlier, the Reserve Bank of India has a special interest in the transforming the economic landscape wrought by technology. But as a corporate organisation, the Reserve Bank recognises the tremendous potential to re-engineer and make more efficient the entire gamut of activities within the organisation, from banking operations, administration, establishment, housekeeping, human resource development, management information systems and decision support systems to service the customers. Initiatives and measures to harness technology in all these areas by the Reserve Bank of India are being made for quite some time now.

The IT vision that the Reserve Bank has for itself is to empower every single employee with state of the art on line transactional, analytical and decision making capability on his/her desktop in a secured manner.

The route we have taken is to equip each functional area in the bank with an Integrated Solution. For the traditional “banker to banks” role, the nerve centre of the operational activity of the Central Banks, an advanced message based solution, an Integrated Accounting System is being developed and will be rolled out completely by the middle of next year. The system also provides on line transaction processing capabilities for the maintenance of the Reserve Bank of India’s internal accounts. An Integrated Government Accounting Solution will impart technical capability to the central bank’s “banker-to-government” function while a Computerised Currency Operations and Management Solution will provide a technological base for the currency management function of the Reserve Bank of India and will enable better management of movement of currency and related reconciliation across the network of currency chests spread across the length and breadth of the country. For the debt management function of the Reserve Bank of India, a Securities Settlement System has been implemented to provide a country wide integrated solution for the management and servicing of public debt. An integrated Establishment System will enable the bank’s administrative and staff compensation related functionality to be conducted efficiently.

On line analytical capabilities are being provided through integrated solutions for our supervisory departments in particular. I have already spoken of the offsite monitoring and supervision systems which have been developed or are in an advanced stage of implementation.

For the foreign exchange management function of the central bank, an Integrated Forex Management System is being put in place which provides the technology to monitor patterns in data in foreign exchange transactions, monitoring trends and throwing up exceptions and early warning signals. Analytical capabilities for our monetary policy functionaries are being put in place through another integrated solution. We have not ignored our functionaries concerned with personnel policy and human resource development either. For them, a Human Resource Information System has been developed and implemented.

Bridging these functional area specific applications are two enterprise wide applications – the Centralised Database Management System (CDBMS) and the Enterprise Knowledge Management System which provide the requisite decision making capabilities at the desktop of officials. CDBMS is a data warehousing solution which has already been operationalised. The solution provides a central storehouse of data from every other application in the bank and has data mining tools to support decision making. The blue print for Enterprise Knowledge Management System is in the process of being finalised. The solution aims at providing the wherewithal to every field functionary to discharge his/her duties– from books of instructions, manuals, guidelines, procedures, *etc.* including tacit knowledge of various functionaries.

Dissemination of information to stakeholders is critical for every organisation. And when the organisation is a central bank, the dissemination of the appropriate information to the appropriate stakeholders in a timely fashion assumes critical importance. The Reserve Bank of India has also made attempts to harness technology to enable more effective dissemination of information to its customers and to the general public. The RBI website is a storehouse of information on the state of the economy, the money markets, the functioning of the bank itself and a spectrum of other information including the RBI press releases, notifications, speeches by senior central bankers, central bank publications and statistics about money and debt market trades, foreign exchange rates, *etc.*

An area in which the banking industry has excelled is in the arena of customer service. The banking industry has outdone itself in providing service to its customers at the time, location and in the form most convenient to the customers. Delivery channels have multiplied in the last decade with machine banking, tele banking, PC banking, internet banking, mobile banking, *etc.* The Reserve Bank of India is also not far behind in providing customer service to its customers whose profiles vary from large government departments to the banking industry, from tech savvy financial institutions to the common man on the street. Coin dispensing and note exchanging machines have been set up in various parts of the country for the general public. Interactive voice response systems have been set up for the customers of the banking and financial sector while a web server caters to the needs of our government customers. With the full implementation of the various integrated systems, I spoke about a little earlier, customer service of the Reserve Bank of India will receive a facelift. Banking and government customers will be able to send and receive the account and other service requests and details from and at their desktops as e-mails or as structured messages using SFMS which can then be directly integrated with the customers' host applications to enable Straight Through Processing. A secure web server is at an advanced stage on the drawing board which, on implementation, will provide a common platform for customers of the Reserve Bank of India to interact with the Bank, access necessary information and file returns in a most secured way. The Integrated Forex Management System also provides for

online collection and dissemination of data/ information from/to its constituents in a secured environment.

In the area of payment and settlement services as well, it has been the attempt of the Reserve Bank of India to take efficient payment services to the general public. The introduction of MICR clearing has enabled faster clearing of paper cheques in many parts of the country. We are presently in the process of finalising the modalities for introducing cheque truncation to enable speedier clearing of cheques, particularly of intercity cheques – a formidable task presently in view of the geographic size of India. The possibility of introducing electronic cheques is also under active consideration in the country. Electronic Clearing Services (ECS) and Electronic Funds Transfer facilities have been introduced in the country to enable movement of funds based on electronic instructions instead of paper cheques. Very soon, a National Electronic Funds transfer system will be put in place to ensure same day (T+0) movement of funds from any corner to any other corner of the country. In short, a no holds barred effort to make geography into history for our customers!

Concluding Remarks

Friends, we are living in a defining moment in history, an era in which the pace of change has been unparalleled to any other era. There can be no doubt the immense potential and unbound opportunities offered by advances in technology. However, there are pre-requisites and preparations which have to be made before the full benefits of the tech economy can be harvested. Some of these preparations pose greater challenges to organisations than the ones I have spoken of so far. I will briefly touch upon three such areas where preparations are necessary here.

First and foremost is the need for planning for disaster. The use of technology in manifold areas of operations by central banks and other institutions have made processes and functions increasingly reliant on technology. This opens up vistas of operational risks which need to be addressed and disasters planned for if the use of information technology is to be prevented from backfiring. To take an example, payment failures and consequent financial disruption could be ignited by technical failures thereby adding a new dimension of “operational risk” to the existing array and credit, liquidity, settlement and price risks which operators, overseers and participants of payment and settlement systems have to deal with. All of this places greater onus on central bankers to take appropriate measures against such system failures, including injecting additional liquidity to troubled institutions and/or systems to avoid a technical failure from disrupting the entire system. Greater responsibility, in terms of making suitable disaster recovery arrangements and business continuity planning, devolves on central banks. This dimension of technology risk has assumed critical importance post September 11. In the Reserve Bank of India, we have taken Business Continuity Planning very seriously. For each of the systems, two sets of standby arrangements have been implemented or are in the process of being implemented. The first standby site is co-located with the primary system in the same city as the primary site and, for all time critical applications, is equipped with on line data replication facilities. This ensures that operations can be re-started at the standby site, in the event of a disaster, at the primary site in a time frame of two hours. The second backup system is a fully equipped disaster recovery site located in a geographically distant centre.

Secondly, in many countries and in many organisations, computerisation of processes has mimicked manual processes. This recycling has prevented the full benefits of computerisation from being realised and have, in some cases, bred other kinds of inefficiencies. Mechanism of processes needs to be accompanied by business process re-engineering and a re-look at business processes and work flow patterns if inefficiencies in manual systems are to be eliminated and the potential of computerisation fully realised.

Last but far from the least, constant technological change poses a great challenge for human resource development. Advances in information and communications technology has implications, in some cases radical implications, for human resource functioning, attitudes and skill sets. There is a need for considerable and continuous upgradation of human resource skills and fine tuning of human resource management strategies with a view to enhancing the level of knowledge, sharpening skills and also to instill the necessary attitudes and work culture. We, at the Reserve Bank of India, are devoting considerable attention to these areas.

The benefits to be derived from the use and adoption of technology cannot be exaggerated. Central Banks the world over have been providing their unstinted support to development of technological infrastructure and to IT innovations in the banking sector. There is no doubt in my mind that technology usage is a core component of all future efforts of central banks to improve their deliverables and to play their defined role more effectively. No system or institution can hope to benchmark itself against international standards without making optimal use of technology.

Let me end on a slightly different note. Central Banks in our part of the world have an additional charter – some additional social responsibilities. We live in an era of a knowledge revolution – an era where knowledge is or can be made to be available, accessible and affordable; an era where knowledge will drive progress. And it is this era which, I hope, will migrate our world to a path of equity and sustainable development.

*** Address delivered by Shri Vepa Kamesam, Deputy Governor, Reserve Bank of India at Central Bank of Sri Lanka, Colombo on August 20, 2003.**