

This file is a manuscript of a paper which went on to appear as:

Ajay Shah. Improving governance using large IT systems. In S. Narayan, editor, *Documenting reforms: Case studies from India*, pages 122–148. Macmillan India, New Delhi, 2006

# Improving governance using large IT systems

Ajay Shah\*

March 9, 2006

## Abstract

This paper discusses the role of IT systems in facilitating the production of national public goods. Four channels of influence are identified: removing discretion, altering information sets and thus incentives, reducing cost and offering an opportunity for fresh thinking on contracting-out. Even though the institutional structures in industrial countries often do not use IT, it is argued that improving public administration in a developing country like India often requires ‘leapfrogging’ to technology-intensive systems where overcoming agency problems is easier. The paper describes a series of case studies from India of successful nationwide IT systems which have impinged on the functioning of the State in a positive way. Some lessons can be drawn from these success stories about implementation strategies for public sector IT projects.

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\*The views in this paper are my own. The ideas of this paper evolved through discussions with C. B. Bhawe, Surendra Dave, Sameer Kochhar, P. J. Nayak, Ravi Narain, Ila Patnaik, and Susan Thomas. I am grateful to two anonymous referees for valuable comments, based on which the paper has been substantially rewritten.

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# 1 The role of IT in improving governance

Good governance is on display in numerous situations in numerous countries in the world. Yet, well functioning public administration, as seen in industrial countries, has proved to be notoriously difficult to mimic in poor countries.

The difficulty of designing processes and organisation structures in public administration is that of overcoming principal-agent problems at multiple levels. Government agencies are supposed to be agents of the people, but this relationship is fraught with difficult principal-agent problems. When we delve within a government agency, the civil servant is the agent of the agent. The puzzle of designing processes and organisations is that of finding ways to align the interests of the civil servant with the interests of the principal's principal.

Effective public administration requires building a set of information flows, and an elaborate system of checks and balances, which impel government agencies and civil servants to work for the interests of the public. In the larger picture, governments in democracies are accountable through elections. However, this "long route of accountability" is relatively imprecise and imperfect. Many countries are known to have free and fair elections but fare poorly on public goods.

This paper argues that in some important situations, nationwide IT systems can play a decisive role in improving governance. In these situations, IT systems can be used to rearrange information and incentives in ways that alter the incentives of individuals and government agencies. Our treatment falls in the context of heightened interest in the role that IT can play in improving the provision of public goods. Mainstream arguments about the field are competently summarised in Bhatnagar (2004).

## 1.1 Local public goods versus national public goods

One special aspect of the role of IT systems is the distinction between local public goods and national public goods. In the case of local public goods, the agency relationships associated with typical political structure are relatively short. The citizen, the civil servant and the elected representative are all able to see each other. This makes it easier to overcome the multi-layered principal-agent problems involved in production of public goods. There has been considerable interest in utilising IT for improving the production of local public goods, such as a land registration system in a city. However, that is not the focus of this paper.

The principal-agent problems in service delivery are greatly exacerbated when it comes to national public goods. In this case, enormous distances separate citizens, elected representatives, heads of government agencies, and civil servants. The operations of government agencies engaged in producing some national public goods are spread across the country. The challenge of producing national public goods is qualitatively harder. At the same time,

**Table 1** Policies, programs, practices

	Transaction-intensive	Non transaction-intensive
Discretionary	“Practices” E.g. police	“Policies” E.g. monetary policy
Non-discretionary	“Programs” E.g. immunisation	

many national public goods are fundamental to nation-building and for obtaining modern economic growth.

IT systems can be particularly important in improving information flows across geographically dispersed players. In some situations, IT systems can improve transparency and thus generate improved functioning from dispersed branch offices of government agencies and civil servants. Through these effects, IT can help in building organisations which produce national public goods. The prime focus of this paper is on the role of IT in improving the provision of national public goods.

## 1.2 The impact of IT upon policies, programs and practices

Pritchett & Woolcock (2004) offer a valuable classification scheme for public services, based on two aspects:

1. Whether or not they are *transaction intensive*,
2. Whether or not the frontline workers dispensing services have *discretion*.

They then differentiate between “policies”, “programs” and “practices” (Table 1) as follows :

- **Policies** are required for non-transaction-intensive, discretionary problems such as monetary policy,
- **Programs** are transaction-intensive, non-discretionary problems such as population-wide vaccination, and
- **Practices** is the term they offer for describing the production of transaction-intensive, discretionary services. Problems that fall into this category include the police, teachers in schools, etc.

The hardest problems in public administration are of the third kind – practices – where the frontline civil servant, who interfaces with citizens, has myriad interactions and has discretion in each of them. The most difficult principal-agent problems surface in these situations. In this classification scheme, the contribution that IT can make in improving governance can be identified as falling into three categories.

**Reducing room for discretion** The traditional wisdom in public administration emphasises the need to minimise discretion in the hands of frontline workers. Sometimes, using nationwide IT systems, it becomes possible to modify a problem, so as to convert it from a transaction-intensive discretionary service into a transaction-intensive non-discretionary service: to convert “practices” into “programs”. When discretion is removed in this fashion, it can often result in substantial improvements in service quality, even under traditional agency structures.

**Cost** Public administration is sometimes constrained by the high cost per transaction faced in producing transaction-intensive services – whether in practice or in program. India is an extreme case, since employees of the government are, on average, paid 62–102% more than the private-formal sector and 164–259% more than the informal-casual sector (Glinskaya & Lokshin 2005). High cost inhibits scaling up of service delivery to the population at large, and is generally likely to translate into reduced service delivery to the poor. Large nationwide IT systems can deliver a dramatic reduction in the cost per transaction, and thus address this bottleneck.

**Improving incentives** Sometimes, there is no escaping a transaction-intensive discretionary service, but nationwide IT systems can alter transparency, rearrange information sets, and thus induce superior outcomes through altered incentives.

Thus, we may suggest that IT is relatively irrelevant for ‘policies’ (non-transaction-intensive, discretionary problems). IT can help by reducing the cost per transaction for transaction-intensive problems, and thus make it easier for a fiscally constrained government to deliver universal services. IT can help convert some ‘practices’ into ‘programs’, by removing discretion in the hands of front-line civil servants. Finally, in some ‘practices’, IT can be utilised to rearrange the information sets of players, and thus help attenuate the principal-agent problem.

### 1.3 IT and contracting-out

A recurring theme in economic reforms has been a shift from the *production* of public goods by the State, using direct employees, to an arms-length contracting-out where the State is responsible for the *provision* of public goods, but the actual production is done by one or more arms-length firms which are agents of the State. Such contracting-out is often associated with many improvements, such as improved transparency about cost and service quality, more effective cost-minimisation, and superior service delivery. Firms external to government have greater operational flexibility, particularly when it comes to the labour market, and can be placed under stronger incentives to perform through financial incentives and the threat of contract termination.

Under normal circumstances, contracting-out faces considerable challenges from the status quo, both in terms of the political problems of adversely affecting the interests of incumbent civil servants, and the risk of disruption of service delivery to the public. These problems

have inhibited contracting-out in many situations, even when it is well understood that production by the State is inefficient.

In some situations, the transformation of a system using IT constitutes an opportunity for arriving at a fresh separation between the parts of the production process which are contracted-out as opposed to the parts of the production process which are done within government. In an ideal world, this need not be the case: whether IT systems are used or not, decisions about contracting-out should ideally be taken based purely on the merits of obtaining efficient production of public goods. However, given the difficulties of disturbing the status quo in many realworld situations, the induction of IT sometimes constitutes a valuable opportunity to move towards greater rationality.

## 1.4 Leapfrogging

Looking back at the history of successful countries like the UK or the US, we see hundreds of years of institution building, through which incentives were refined, which led to well functioning institutions. This involved the slow political process of building human systems, setting up adequate monitoring and transparency, and solving incentive problems. Systems for public administration in industrial countries often look archaic in terms of the lack of use of computer technology. However, the incentives operating upon individuals and agencies were adequate in order to produce adequate outcomes even without utilising computer technology.

In recent years, IT implementations in industrial country governments have been taking place, motivated primarily by the need to reduce costs both for the State and for citizens interfacing with the State.

In a developing country context, the picture is considerably different. The systems of public administration seen in industrial countries involve a rich interplay of information and incentives. The full environment of information and incentives is impossible to transplant into a developing country. Hence, direct imitation of industrial country institutional mechanisms can often fail.

In some situations, it becomes possible for a developing country like India to ‘leapfrog’ to IT-intensive public sector systems. Such leapfrogging is desirable not because IT is intrinsically desirable, but because IT may make it easier to solve principal-agent problems and thus obtain effective provision of public goods. When such leapfrogging takes place, two characteristics will obtain:

1. *Reduced time in solving puzzles of governance.*

The time taken for obtaining a high quality solution to a puzzle in governance could be shorter as compared with the historical experience of advanced countries. Instead of spending decades in improving subtle incentives in human-based procedures, a decisive solution can be obtained in a few years. This would help India obtain rapid

convergence to a high level of income, when compared with the 100 to 200 year journey of economic development of the UK or the US.

2. *Solutions that differ from those found in advanced countries.*

Countries like the UK or the US grappled with many difficult puzzles in governance at a time before IT systems were available, and found pre-IT solutions to these problems. We often see mature institutions and procedures in advanced countries, which work well without using IT. This reflects their path dependence. However, a country like India does not have to replicate the path of these countries. When India is able to leapfrog, the institutional mechanisms in India differ greatly from that found in well-respected advanced countries. In these aspects, there is much merit in departing from “international experience”.

## 1.5 The fad of E-governance

In the IT industry, there is considerable interest in E-governance, since it can lead to substantial sales of hardware and software. In the government sector also, arms of government have sprung up which claim to have a specialised capacity for building E-governance projects. There is, however, a danger that substantial public expenditures can be devoted towards hardware and software, without being rooted in fundamental new thinking about how processes can be redesigned.

As argued above, the challenge is that of designing *new* methods of delivering public services; not just an intensification of traditional processes using computers. New proposals which seek to rebuild traditional mechanisms of service delivery, exploiting IT, should be able to demonstrate, from first principles, how the proposed system solves the daunting principal-agent problems of public administration in a superior way.

Considerable investments in “computerisation” of a traditional process can sometimes yield negligible gains. While this article has emphasised success stories, the Indian government landscape is littered with many failed IT-intensive projects, which did not think deeply about how IT systems can be utilised to rearrange incentives and information, and failed to deliver gains despite substantial expenditures. Careful evaluation has shown that the mere injection of IT systems has not checked corruption in some systems, such as Property Registration in Andhra Pradesh (Caseley 2004) and the collection of fines from truckers at state border checkpoints in Gujarat.<sup>1</sup>

As an example, in India, in recent years, conversations by bond dealers on telephone were replaced by conversations between bond dealers on a computer system, in a system named the “negotiated dealing system” (NDS). The new system was designed to encode existing market practice in a computer system. This involved a considerable expense on hardware

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<sup>1</sup>The latter is analysed in an evaluation at <http://www.iimahd.ernet.in/egov/EvaluationStudies.htm>



and software, while failing to offer gains in efficiency, market access, transparency and ease of supervision.

There is a close analogy here in the tension between “business process re-engineering” (BPR), as known in the private sector, as opposed to “computerisation”. A successful BPR effort requires a full commitment of the top leadership, and it requires revolutionary thinking - not the encoding of traditional work practices into a software system. A successful BPR effort requires thinking from first principles, and not mechanically copying established practice in OECD countries. These aspects apply when thinking about leapfrogging using IT systems in the public policy context.

## 2 Case studies

In this section, a series of case studies are offered, of successful nationwide IT systems in India which are linked to problems of public administration. It must be emphasised that this is not a comprehensive inventory of all nationwide IT systems that have assisted the tasks of governance. There are hundreds of experiments taking place in India, and dozens of outstanding success stories. In particular, IT has been often been applied with considerable effectiveness in many situations, in improving the production of local public goods. The intent in this paper is merely to illustrate certain common themes about how *nationwide* IT systems have been applied to solve some puzzles of governance, and to convey a sense of the kinds of complex nationwide systems that are now known to be feasible under Indian conditions.

The choice of systems that are described here is necessarily idiosyncratic. However, one comparison is available through the work of Skoch Consultancy Services (Kochhar & Dhanjal 2004). In October 2005, they spoke with a panel of experts in the field of E-governance, and identified 20 of the most interesting E-governance projects in the country. Field visits were conducted to all 20 projects, and these were then scored. The results are showed in Table 2. Most of the projects in their list are local level projects, which have been deployed by a city or a state government in improving service delivery in the context of local public goods. The two top-rated national-level projects in this list, railway reservation (rank 4) and TIN (rank 14), figure in the case studies below.

### 2.1 Railway reservation

Perhaps the first interesting problem solved using a nationwide IT system was that of railway reservations. While this can be viewed as an ordinary problem solved repeatedly by the private sector in contexts such as airline reservation, in India, railways is presently a monopoly of the State, and the functioning of Indian Railways is hence a problem of public administration.

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**Table 2** Best e-governance projects, according to Kochhar & Dhanjal, 2004

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Rank	Project	Score
1	Aarohi (Uttaranchal)	8.9
2	KDMC (Maharashtra)	8.7
3	Kaver-e-com (Bangalore)	8.7
4	Railway reservation	8.7
5	Tamil Nilam (Tamil Nadu)	8.6
6	Rural Delivery (Tamil Nadu)	8.6
7	Sarita (Maharashtra)	8.3
8	CARD (Andhra Pradesh)	8.1
9	e-Panchayat (Andhra Pradesh)	7.9
10	LR-MIS (Andhra Pradesh)	7.9
11	Aarnar Sewa (Assam)	7.7
12	CIC (Assam)	7.6
13	Land records (Uttaranchal)	7.2
14	Tax information network	6.9
15	TIMS (Assam)	6.8
16	Kissan call centre	6.5
17	Customs automation	6.4
18	Driving licence (Delhi)	6.2
19	Agmarknet	5.6
20	Passport (Delhi)	5.1

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The complexity of railway reservation derives from the fact that passengers can alight and leave a given train at any pair of stations. Seats get freed up when a passenger leaves, and can be sold. Potential customers go up to ticket counters all over the country, and these ticket counters need to have sound information about the state of every seat. Passengers need to be given realtime information about availability of seats on all trains.

Indian Railways grappled for many decades with this problem. While fairly effective procedures were in place for coping with these informational gaps from the pre-independence period, the great increase in traffic, the gap between inadequate supply and higher demand owing to inadequate capacity increases and lack of market-clearing prices, small changes in the process design, and weaker standards of enforcement had led to a breakdown of the process. From the user perspective, obtaining reservations was difficult and involved high transactions costs. The non-transparency of the core information about the availability of seats led to a black market springing up. Indian Railways periodically tried to employ traditional enforcement strategies to “crack down” on the black market, without success.

Early development of an electronic reservation system began in 1985, and the system has been in operation from 1987 onwards.<sup>2</sup> As is well known, computerisation of railway reservation was able to decisively put an end to these problems. Using computers and communications, all reservation offices are able to access a single database, using which tickets can be booked accurately. The IT system is fully transparent about the core database,

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<sup>2</sup>See [http://www.cmcltd.com/industry\\_practices/transportation/railways\\_resrv.htm](http://www.cmcltd.com/industry_practices/transportation/railways_resrv.htm)

thus removing opportunities for malpractice. Railway reservation is now seen as effortless and corruption-free. In addition, there has been a substantial reduction in the cost per ticket issued.

At a conceptual level, railway reservation is a straightforward transaction-intensive non-discretionary service. However, in the traditional system, opportunities for discretion were created by poor information systems. The shift to a nationwide IT systems has removed these windows of discretion, and enabled the low-cost delivery of efficient public services.

There are important lessons to be drawn from the implementation strategy which was used by Indian Railways. In the first stage, each reservation office was ‘computerised’ with a local database. Such branch-level databases have often been criticised since they fail to deliver the full benefits of centralisation of nationwide data.

However, in the case of Indian Railways, this was a useful strategy to follow for three reasons:

- First, in 1987, the project implementation risk of a nationwide project were onerous, given the lack of experience with such large projects and the infirmities of Indian telecom at the time. At the time, branch level automation was a finite and implementable task. Emphasising nationwide networking in 1987 would have been a case of the best being an enemy of the good.
- Second, in the IR case, mere branch automation did generate important improvements in the behaviour of employees. Once branch level automation was in place, a customer who approached any counter was serviced using the identical information. This eliminated control of information in the hands of an individual clerk. The rental value of this information was diminished since seats could be sold by any counter in the office. Malpractice now required collusion and coordination between all clerks present in an office.
- Most importantly, success in the first stage generated benefits for customers which were manifestly visible. This helped cement support for the project, and carry it forward. It also induced confidence on the part of the managers that the use of IT was delivering results, and helped them go on to the next stage.

In the second stage, queries were redirected away from the local database to a single national database, thus ensuring that a customer who approached any counter anywhere in the country was serviced using the identical information. This eliminated the possibility of collusion within any one office.

While Indian Railways made considerable progress on the problem of the *reservation* system, other difficulties remain. Queues at counters, discretionary quotas for groups, and conductors on trains who have discretion: each of these problems is associated with persistence of corruption and malpractice.

## 2.2 Fairplay and reliability in trading

In the late 1980s and early 1990s, there was a sharp awareness of the incidence of malpractice in the bond market and the stock market. This problem is useful broken up into three aspects: trading, clearing and settlement.

In trading, the problem was of ensuring fairplay when traders talk with each other on a trading floor or on the telephone. These conversations are vulnerable to a variety of problems, including formation of cartels. In addition, there was a widespread prevalence of a practice named *gala*, where a dealer would buy a share at a certain price on the floor, but lie to the customer about the price that was paid for it. The non-transparency of the market prevented customers from knowing the true price at which the trade had taken place. Through this, dealers routinely overcharged customers for market access. These problems led to a shrinking of the market to a small set of players that were in a repeated game. This was inconsistent with the modern vision of a nationwide market, with universal participation.

In clearing, the problem was that of counterparty credit risk. If one securities firm went bankrupt, this could generate cascading effects upon other market participants. Sometimes, there could be a “domino effect” where the failure of firm *A* induced failure in firm *B* and *C*. This was known to lead to a disruption of the market called a “payments crisis”. Fears about possible default of a counterparty led to a shrinking of the market to a small set of players that were in a repeated game. This was inconsistent with the modern vision of a nationwide market, without entry barriers.

In settlement, the problem was that of theft or counterfeiting of share certificates or bonds. In addition, the growth and liberalisation of the economy meant that enormous volumes of shares were being transacted. This placed new levels of stress upon manual systems and procedures, which might have been good enough in the previous era.

Obtaining fairplay and reliability in trading thus posed a considerable challenge of financial regulation and supervision. In previous decades, the public goods of financial regulation and supervision were produced in industrial countries using human-based systems. For example, a large staff of policemen could be present on the trading floor, listening in on conversations of traders, in order to ensure fairplay. A sufficiently zealous investigative and policing effort could have identified counterfeiters and imprisoned them. However, in an Indian context, it was very difficult to solve the problems using human-based strategies, given the high level of discretion that would be wielded by employees of the government who are placed in such supervisory functions.

In the early 1990s, the Securities and Exchanges Board of India (SEBI) and National Stock Exchange (NSE) innovated by employing IT-intensive strategies in all three stages, of trading, clearing and settlement. At the time, these were relatively unproven strategies, in the sense that countries like the UK and the US were using human-based procedures in the

financial sector.<sup>3</sup> Hence, India's path down this road was a particularly remarkable event, which required fresh thinking and not mechanically imitating "international practice".

Trading was centralised at exchanges through a SEBI rule which prohibited off-market trading, and exchanges were required to do trading by anonymous order-matching using computers. When trading was organised electronically, the public service of financial supervision of the trading floor was rendered superfluous. Electronic trading, coupled with the ban on off-market trading, eliminated the cadre of supervisory staff which would have had discretion.

NSE created a new institution called the "clearing corporation", which became a realtime risk management facility, which prevented bankruptcy on the part of any one firm from affecting other firms. While the trading function requires handling information and organisations from all across the country, the clearing function is a relatively centralised function requiring intensive computation. At the same time, the clearing function is an integral part of the market design as seen by market participants who are spread nationwide.

The National Securities Depository Ltd. (NSDL) implemented "demat" settlement procedures using computer databases, thus eliminating physical share certificates and questions of theft or counterfeiting.

In all three areas, these developments removed the need for supervisory staff at SEBI which would otherwise have been called upon to produce transaction-intensive discretionary public services. These three changes added up to a quantum leap in the quality of functioning of securities markets in India (Thomas 2006). By international standards, India is now seen as a success story in the sophistication of securities exchanges, and this is the best functioning element of Indian finance.

Information technology was central to this transformation. The experiences of industrial countries proves that it *is* possible to have fairly well functioning markets without using computers. However, the challenge of obtaining effective and fair State functioning is an onerous one, and could have taken up decades of effort through the normal processes of governance. At all three levels - trading, clearing and settlement - the use of nationwide IT systems made it possible to avoid having a huge supervisory staff, and leapfrog to impersonal, uncorrupt systems.

These experiences are also a valuable source of data about the cost of building complex nationwide networked IT systems (Shah & Thomas 2003). The cost per transaction is expected to drop through time, reflecting dropping costs of IT hardware, and economies of scale. Table 3 shows the time-series of the cost per transaction at the securities depository (NSDL). This evidence suggests that over these five years, NSDL was able to grow from 23.8 million transactions to 96 million transactions while enjoying a slight decline in expenditure

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<sup>3</sup>At the time, the London Stock Exchange (LSE) and the New York Stock Exchange (NYSE) used trading floors with open outcry. The NASDAQ exchange was organised as a dealer market, which used computers but did not have anonymous trading. Clearly, the SEBI and NSE staff that travelled abroad to study *international best practice* did not mimic what they saw.

**Table 3** Cost per debit at NSDL: 2000 to 2005

Year	Number of debits (Million)	Expenditure (Million rupees)	Cost per debit (Rupees)
2000-01	23.772	546.447	22.99
2001-02	31.039	493.791	15.91
2002-03	37.375	439.944	11.77
2003-04	70.071	437.611	6.25
2004-05	96.097	480.000	4.99

in nominal terms. This led to a sharp collapse in the cost per debit, which went down from Rs.23 per transaction to Rs.5 per transaction in this period.<sup>4</sup> These facts understate the true decline in cost since inflation has been ignored.

The cost of Rs.5 per transaction for 2004-05 is a low value, and emphasises the extent to which IT-intensive transaction flows can make it possible to do small value transactions involving the poor. This is in contrast with human-intensive systems, which would inherently exclude small value transactions.

The securities markets story thus serves as an example where nationwide IT systems performed two roles. First, they converted a transaction-intensive discretionary public service (human-based financial supervision) into one where negligible inputs of supervision were required. The role of the regulator shifted to obtaining correct policies, and to a greatly reduced involvement in enforcement on episodes of market misconduct. In addition, the dramatic reduction in costs per transaction led to a huge increase in market access amongst the wider population.

## 2.3 Tracking and blocking wrongdoers

A central task of the State is that of enforcing against fraudulent activities. Traditionally, this has been done by emphasising the ordinary processes of police and judiciary. The production of these public services is difficult in that it is transaction-intensive and discretionary. It may perhaps require decades for effective and fair systems to fall into place.

However, in certain areas, nationwide IT systems can make it possible to leapfrog across these problems. We illustrate this in two areas: credit bureaus, and SEBI's Mapin database.

<sup>4</sup>NSDL's tariff structure differs from this to a certain extent, reflecting the incentive implications of any given tariff structure. For example, NSDL enforces a certain charge upon accounts, and a certain charge upon transactions. However, ultimately these costs are passed on to the end-users of NSDL as user charges.

Recent data about NSDL's tariffs, charged to depository participants, is as follows. NSDL's fee per transaction dropped from Rs.10 to Rs.8 on 1 January 2004 and further to Rs.6 on 1 October 2005.

Both these systems serve to reduce the extent of discretion in the hands of enforcement agencies, and thus improve the quality of public services delivered.

### 2.3.1 Credit bureaus

Credit bureaus are institutional arrangements to share borrower credit information amongst potential lenders. In a credit bureau, the track-record of individuals and firms, when it comes to defaulting on debt obligations, is tracked in a central database. This information is available to potential lenders and to the bond market, when they make judgments about future debt transactions. Access to credit scores reduces the discretion in the hands of employees of finance companies who make decisions on consumer credit,<sup>5</sup> and eases the development of large finance companies. Such tracking greatly changes the incentives of individuals and firms to reduce the incidence of default. It also helps identify “chronic defaulters” and block their credit market access.<sup>6</sup>

From 1999 onwards, MasterCard International has been in the process of setting up a nationwide consortium of 25 MasterCard-member banks, non-credit card issuing banks, non-banking finance companies and mobile operators to share a database on defaulters. This database, called “the negative list project”, has information about over 350,000 defaulting individuals. Other databases about delinquent cardholders have also come about.

One project aimed at creating a nationwide credit bureau, the Credit Information Bureau of India (CIBIL), is under implementation. Once the initial framework of CIBIL has been proven, the credit information industry will grow in the direction of information providers such as trade creditors and finance companies. To begin with, only black information could be shared outside the network of banks, but this could be enhanced over time.

A major problem faced in this field is the lack of a unique identifier for each individual. This would make possible the aggregation of credit information about an individual that emanates from multiple sources. It will be an important step forward when all citizens, right from birth, obtain an identification number that can serve to track credit history, pension benefits, wealth, tax liabilities, etc. This is linked to the next nationwide IT system we describe, named Mapin.

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<sup>5</sup>It may be noted that on this question, the introduction of “public infrastructure” of credit bureaus eases the principal-agent problems between finance companies and their employees and thus contributes to productivity gains in finance.

<sup>6</sup>Cross-country evidence shows that correcting for a number of other influences, the existence of information sharing arrangements increases bank lending by about 20 percent of GDP (Jappelli & Pagano 2000).

### 2.3.2 Mapin

SEBI has embarked on the creation of a nationwide database named Mapin, about individuals in the financial sector. The key innovation of Mapin is that it uses biometrics (fingerprints and photographs) to prevent a person from having more than one Mapin ID number. This implies that a Mapin number of a person is a unique one. Such a guarantee has not been available for any other identity-tracking mechanism in India till date, including drivers licenses, passports and PAN numbers.

This has implications for numerous areas, including enforcement against market manipulation, enforcement against insider trading, and blocking “serial offenders”. It could potentially be utilised in credit bureaus also.

*Market manipulation:* One of the prime tasks of governance which is performed by financial securities exchanges and the securities regulator (SEBI) is that of blocking and enforcing against market manipulation. Enforcement against market manipulation is based on detecting and defusing situations of market power, where a small set of large players are acting in concert and are disproportionately large when compared with the wide market. In order to engage in any discussion of this nature, there has to be a mechanism through which exchanges and SEBI can accurately know the full position of a person. Traditionally, this was not possible since it is easy for one individual to own multiple identities, and place orders using multiple accounts in multiple cities.

Once Mapin is in place, if one person has positions through multiple brokers in multiple cities, a central database will be able to add them up correctly and know the full position of a person.<sup>7</sup> This information would reduce the discretionary powers of employees of supervisory agencies, and improve their productivity.

*Insider trading.* The second area where tracking identity matters is that of enforcing against inside trading. Internationally, every time there is a major announcement and large price movements for a stock, it is normal for the regulator to look back at recent days and ask: *Did the stock price move before the news became public?* If price movements are visible before announcement date, then there is an attempt at locating the insiders involved.

In the US, the SEC has a full database of information about board members, accountants, auditors, top management, and their immediate family members. Through this, it is easy to locate an insider who traded prior to a news announcement. Implementing this in India requires the Mapin database: every board member of every public limited company needs to be in the Mapin database. Immediate family also need to be in the database. The

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<sup>7</sup>As an example, the central focus of the CFTC – the regulator of the commodity futures market in the US – is on a “large trader report”. They track positions of the top few clients who add up to 80% of the position on the market. They worry about smooth settlement of the futures obligations, on physically settled futures markets, of these traders. Such a system would abjectly fail in India since we do not have a way of correctly linking up individuals across multiple stock brokers. Mapin is the key institutional innovation which makes that possible.



establishment of such procedures will yield a substantial increase in the fairness of stock market trading, where independent market participants will feel more comfortable knowing that they are not trading against insiders.

*Blocking serial wrongdoers.* Finally, there is the issue of blocking wrongdoers, which is similar to that faced with credit bureaus. If SEBI finds that an individual within a regulated company has broken rules, SEBI can fine or might even be able to imprison that individuals. But within a few years, that individual could resurface under a new name in a new city, and be back in action in the securities industry. It is very important to be able to disbar an individual from working in the securities industry, after malpractice has been proven. In order to make this possible, Mapin is required.

While the technical capacity to build Mapin is in place, SEBI is in the process of making a decision on whether it should be built. However, it serves as an interesting example of a nationwide IT system, which uses innovative technology based on analysing fingerprints and photographs, to ensure uniqueness of a person's Mapin number. Once this is place, it allows a quantum leap in the ease of building effective and fair governance in several areas.

## 2.4 Standardised tests

In a well developed market economy, labour market transactions are enabled by signals produced in the educational system, such as degrees or diplomas. In India, only a tiny fraction of educational institutions produce informative signals which are respected by the labour market. Labour market transactions then take place under greater asymmetric information, which leads to higher search costs for both employees and employers, and could reduce the incentive for individuals to augment their knowledge.

In 1998, NSE setup a certification program, named NCFM, which accurately measures the knowledge of a person for many roles in the financial industry. In India, any certification examination faces the difficulty of fair implementation across the country. Examinations have been bedeviled by problems such as leakage of examination papers ahead of date, and difficulties in ensuring that individuals take the examination on their own.

NSE employed a nationwide IT systems in order to solve the problem. For each certification examination, a large centralised question bank is created in a computer system in Bombay. Each individual takes a test on the computer. At test-taking time, a randomised set of questions is extracted from the question bank. The test-taker knows his score the moment the examination ends. A digital photograph of the test-taker is taken, and is printed on the certificate, in order to sidestep the problem of establishing the identity of the person. A potential employer has an adequate incentive to compare this photograph with the face of a job-seeker.

NCFM has been a significant aspect of the human capital development in the financial sector. At present, nine different certification tests are offered. Tests take place at locations

all over the country, and roughly 55,000 tests took place in 2004. The hardware and software at NSE is capable of handling 10,000 test-takers at the same time.

In many countries, the State plays a substantial role in setting standards for knowledge, and in producing trusted measures of knowledge of individuals which are then utilised in the labour market. In industrial countries, human-based administrative procedures are well in place, and are known to be able to implement nationwide examinations without malpractice. In Indian finance, the State never embarked on these tasks, partly owing to the tremendous complexity of administering examinations across the country which are free of malpractice. The NCFM system is delivering useful public services. The implementation of NCFM, however, was vitally made possible by building a large, nationwide IT system, which has eliminated the possibility of malpractice.

## 2.5 Agricultural price measurement

Agricultural spot markets innately tend to be geographically dispersed. The sophistication of the market design employed in these markets tends to be limited. The fixed costs that went into an effort like the National Stock Exchange, and the increasing returns to scale obtained in harnessing liquidity from across the country, are unlikely to materialise when dealing with an agricultural market which serves users in one or a few districts.

The non-transparency of traditional agricultural spot markets has been associated with important difficulties for all participants in the agricultural sector. As with any other market, there are “insiders” – who have sound information – and “outsiders” who are forced to pay rents to the insiders owing to the lack of information. Further, the ex-ante asymmetric information leads to distorted incentives for farmers, the food processing industry, and other participants in the agricultural sector.

These kinds of difficulties have partly motivated major interventions by many governments, where the government takes upon itself the task of replacing the private trade in agriculture. However, if the core problem is that of non-transparency, it is possible to conceive of a more narrow intervention, which frontally addresses the problem of non-transparency, without seeking to supplant the private trade. This requires capturing sound data about prices and disseminating them. However, there are considerable challenges in implementing this given the need for speed, accuracy and unbiasedness.

In 2003, the National Commodity Derivatives Exchange (NCDEX) and Centre for Monitoring Indian Economy (CMIE) embarked on setting up a decentralised system for obtaining sound information on agricultural prices from across the country. The system works by polling multiple dealers, two to three times a day, to obtain the best bid/offer quotes for various agricultural commodities, as perceived by the dealer. Quotes from multiple dealers are put together in a robust statistical procedure called the “adaptive trimmed mean”, to arrive at a well-trusted “reference rate”, which is disseminated in realtime across the country (Cita & Lien 1997, Shah 2000).

This system presently obtains roughly a million readings of prices per year. Information is obtained from 46 cities covering 36 commodities. Typically, 11–20 dealers are polled for each commodity+city pair. All conversations involved in polling are recorded using a voice logging system so as to have an audit trail. Information from across the country is delivered to Bombay, where statistical processing is done, and delivered back to trading locations across the country within minutes. This system constituted the first time that agricultural prices from across the country were made available across the country on a same-day basis.

Information is a public good, and the private sector is generally likely to under-invest in its production. While the statistical system is traditionally viewed as being a State function, these systems have successfully come about using private sector funding.

## 2.6 Tax administration

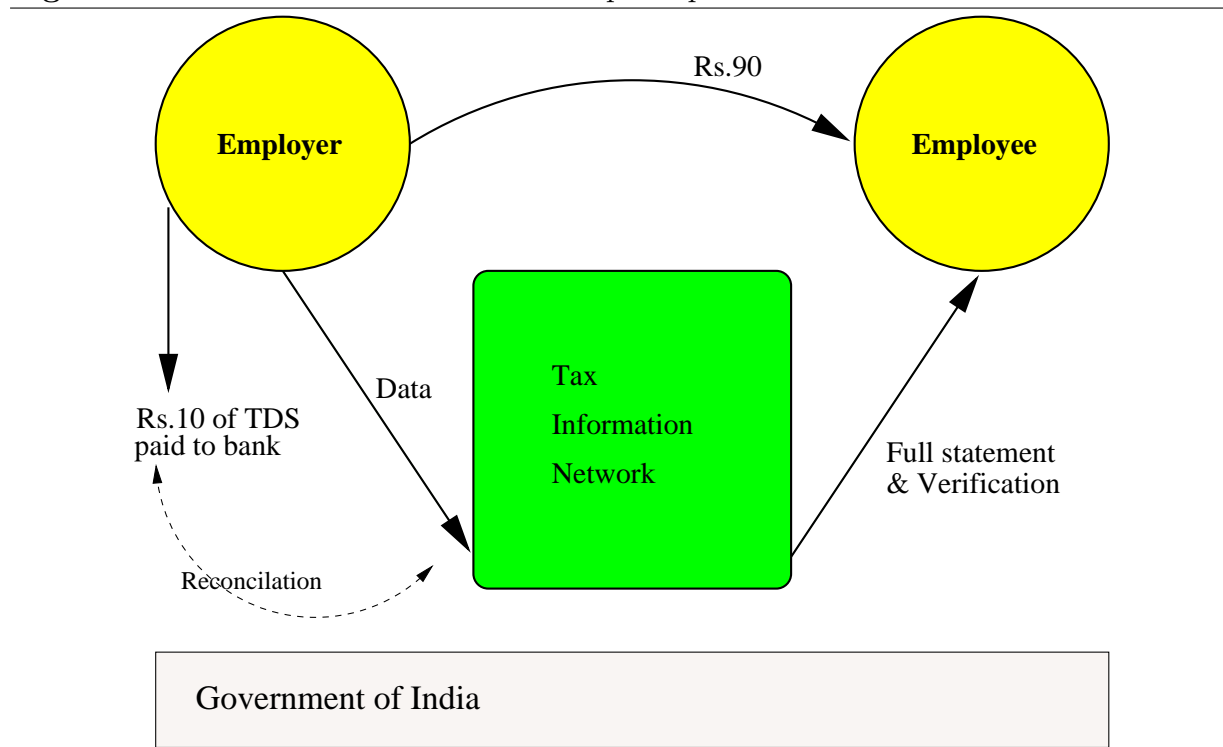
Tax administration is a crucial transaction-intensive discretionary public service, which has presented major difficulties in India. One of the most important recent success stories of large IT systems comes from the area of tax administration.

A significant part of direct taxes is collected at the source of income, by mandating that parties paying for specified services have to deduct tax at source (TDS), and deposit the same through a select list of banks branches. Currently this forms as much as 40% of the total direct tax collected. The Income Tax Department (ITD) traditionally monitored TDS by mandating deductors to file a consolidated return giving deductee wise details along with bank payment “challan” as proof of payment. The deductees claim credit for the TDS in their tax computation with TDS certificates provided by the deductor as supporting evidence.

The absence of a centralised database of these deduction and payment details led to many problems:

- Difficulty in verifying whether the deduction as per the TDS return filed has indeed been deposited to the account of the government.
- Difficulty in verifying whether the credits claimed by the deductee is based on real deduction and deposit to the account of the government.
- Harassment of genuine taxpayers.
- Unscrupulous deductees claiming credits against fake certificates.
- In case of taxes other than TDS (advance tax, self assessment tax etc) the assessing officer has to rely purely on the copies of bank payment challans to verify whether the tax has actually been deposited.

**Figure 1** Tax Information Network: Conceptual picture



- Deductees have no means to verify whether tax deducted on their behalf has been accounted in their name in the IT books.

In order to address these problems, CBDT embarked on the establishment of a system named Tax Information Network (TIN). This network was envisaged to integrate primary information of tax payments made in designated banks, tax deduction at source and information on high value transactions.

TIN thus receives on behalf of the tax administration, all TDS returns and other information for digitisation into a central database. TIN receives online information on collection of taxes from the banks through 'Online Tax Accounting System', which also flows into the central database.

TIN matches TDS returns from the deductors with the collection details from the banks and returns not matched by corresponding deposits are filtered out. Further, on the basis of this matched data a PAN wise electronic ledger account is prepared with the details tax credits posted into it.

Such a central system ensures that tax credits are allowed only against actual funds receipts to government coffers. The taxpayers also have the facility of accessing the TIN system to ascertain tax payments (made by them or deducted on their behalf). Figure 1 shows the information flows in TIN. The digitized information is downloaded to the National Computer Center of the ITD enabling faster processing of returns and refunds and data

mining tools for non-intrusive investigation.

The task of building TIN has been outsourced to National Securities Depository Limited (NSDL), and the system was implemented in 2004 and 2005.

## **3 Implementation strategies**

### **3.1 Public sector IT systems often fail**

On an international scale, there have been many project implementation failures with large IT systems in the public sector.<sup>8</sup> An annual survey by Standish, a US consulting firm, estimates that 70 percent of all large IT projects fail to achieve functionality or budget targets for money or time.

Many large projects have failed, but the failures that have garnered the most attention have been those involving systems which directly interact with citizens. As an example, in the UK, there have been a series of troubled systems, such as the ‘big bang’ in the financial sector, the problems in computerisation of the NHS, and of national insurance data. A typical project failure was the UK benefits payment card project, begun in May 1996 and abandoned within three years. Similarly, in 2005, the US FBI abandoned a \$170 million attempt to create a ‘virtual case file’ for tracking suspected terrorists. The US IRS tax modernisation project, in the mid 1990s, suffered legendary cost overruns, totally spending \$30 billion.

### **3.2 Why do public sector IT systems often fail?**

Why do public sector IT projects often fail? Scale is an issue: whether we discuss private or public projects, big projects are more likely to fail than small projects, and large nationwide systems are the biggest of projects.

There are two facets to scale. First, complex IT systems in public administration typically cut across many agencies. This increases the complexity of coordination, when compared with a project which has one customer. The second is process engineering based on weak data. In the public sector, data quality in traditional paper-based systems is often poor, through relying on undermotivated junior staff. In a paper-based process, an extensive system of checks and balances tends to solve these problems of data quality. However, when a weak system for data capture is mated to a new IT-intensive system, and the system operates across the country on a large scale, the difficulties are magnified.

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<sup>8</sup>See *Public sector IT failures* by Michael Cross, Prospect Magazine, October 2005, and Heeks (2003).

The second difficulty is the lack of professional skills, both in the public sector, and amongst IT vendors. Senior managers in the civil service often have a non-technical background, and are typically not conversant with managing large IT systems, and the ‘engineering teams’ with IT vendors are typically less professional than (say) a team that builds a highway.

The next gap is that of the public sector procurement process. Often, delays in procurement imply that a technology choice is obsolete by the time the contract is awarded. The confrontational nature of L1 procurement (picking the lowest price vendor) is inconsistent with the collegial style that is required in IT project implementation. Indeed, there is a fundamental inconsistency between L1 procurement – which works well for purchase of unambiguous commodities – and the enormous ex-ante uncertainty about the cost of building an IT system. In an IT contract, it is typical for a vendor to discover, late in the process of project execution, that a full and fair implementation of the project will result in losses. At this time, senior managers in the customer organisation require flexibility to either increase payments, or informally agree to mechanisms through which losses made on one contract will be made up in other ways. The public sector has limited flexibility in such respects.

Frequent changes of staff in the government make it difficult for IT vendors and senior managers in the government to play a repeated game where some contracts make losses and others make profits.

A particularly troublesome aspect of staff changes is swings in policy and ‘mission creep’. Every time a new senior manager arrives into the job in a public sector organisation, he is inclined to modify the goals of the system or to layer additional tasks upon a project that is presently under implementation. This raises the risks of project failure.

Finally, the most mundane source of project failure is a lack of involvement from top managers of an agency. When an ‘e-governance project’ is led by an IT vendor, or by an IT arm of government such as NIC or the Ministry of Information Technology, the failure probability goes up since this is likely to involve intensification of traditional processes using computers. This is similar to the failures of ‘BPR’ in the private sector when the BPR effort is dominated by the IT department and IT vendors, rather than by the CEO.

### **3.3 Why did many complex systems in India succeed?**

A unique feature of the Indian experience has been the use of agencies external to the government for implementing projects. Table 4 summarises some aspects of the contracting mechanisms through which these projects came about. The railway reservation problem was a ‘traditional implementation’, where the government was the customer, and after CMC built the system, it is operated by the government. In all other cases, a breed of private organisations outside the government have played a pivotal role in project implementation.

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**Table 4** Mechanisms used for the 10 case studies

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Project	Initiated by	Build	Operate
Railway reservation	Indian railways	CMC	Indian railways
Electronic trading	NSE,BSE	TCS,CMC	NSE,BSE
Clearing corporation	NSE	NSE	NSE
Depository	NSDL	TCS	NSDL
Negative list project	Mastercard		Mastercard
CIBIL	CIBIL		CIBIL
Mapin	SEBI	NSDL	NSDL
NCFM	NSE	NSE	NSE
Price measurement	NCDEX	CMIE	CMIE
TIN	Income tax department	NSDL	NSDL

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It is striking to notice that all the successful case studies discussed in this paper came about through leadership and involvement of a top management team that was steeped in the domain knowledge of the field of application, and was engaged in a quest for revolutionary gains in their respective fields. These success stories were not achieved by ‘computerisation’ of an existing process by an IT vendor or by an IT arm of government such as NIC or the Ministry of Information Technology.

## 4 Future possibilities

A few natural opportunities where nationwide IT systems can enable better governance are :

**Modernising other markets** The bond market, the currency market and the commodity futures markets are all securities markets, exactly like the equity market. Each of these is in need of reinvention, to shift from small clubs to open, nationwide markets. They could benefit from a modern IT-intensive market design in exactly the same fashion as has been done in the equity market.

**Payments system** A key weak link in India is that of the payments system. Individuals across the country are able to exchange ownership of securities but not money. While a realtime gross settlement (RTGS) system is under implementation, high quality payments services are not yet available to individuals across the country. Sound payments infrastructure is an important public good and can be achieved rapidly through appropriate policy initiatives.

Apart from the RTGS system, two additional areas where progress can be made on the payments system are a Giro system, which can be implemented by post offices, and a concept of “INR as an interest-free riskless security” at the stock depositories. In the latter case, the existing strengths of stock depositories at effecting securities

settlement can be used for effecting transfers of cash.

**Pension system** Present efforts on the New Pension System envisage a nationwide IT system with a single database at a Central Recordkeeping Agency (CRA), connected to a large number of points of presence and all pension fund managers (Dave 2000). Such an IT system would yield sound pension administration, in sharp contrast with the difficulties faced by the EPFO in delivering public services in the pensions area.

**Strengthening EPFO** Since income tax payments from all companies flow through TIN, it is easy to additionally have EPFO pension contributions flow from companies to EPFO through the identical TIN processes. This would sharply reduce the incidence of fraud associated with the mandatory pension programs run by EPFO.

**Targeted subsidies, food stamps, voucher programs** The bulk of public expenditures on subsidy programs in India, at present, fail to reach the poor. It is possible to use IT to help improve delivery. This can be done by giving each BPL household a smart card, which can be used as an “electronic purse” holding food stamps, education vouchers, and similar transfers. Resources can be delivered into individual smartcards across the country, directly from the Ministry of Finance, without requiring an intervening bureaucracy. Resources in such smartcards can be configured for use only in specified areas, such as food or education. This will require corresponding modernisation of the retailing industry. Such systems are already in use elsewhere in the world, under names such as “Electronic Benefit Transfers (EBTs)”.<sup>9</sup>

Such an approach to delivering minimum purchasing power to the poor, focused on fundamental needs such as water and education, would make it possible to remove the distortionary cross-subsidies in these sectors, and shift to rational frameworks of pricing and mechanisms for service delivery. Through this, they would enable decisive improvements in the production of public goods.

**VAT** The ideas of the Tax Information Network (TIN), outlined above, are directly relevant to the implementation of the Value Added Tax (VAT) and the Goods and Services Tax (GST) (Kelkar 2004). TIN is focused on accurate handling of tax deducted at source (TDS). It ensures that every TDS claim is backed by a true tax payment, and that TDS claims are not used more than once. VAT credits are, in effect, taxes deducted at source. A downstream merchant has to prove that the upstream merchant has indeed paid VAT as claimed. A TIN-like structure (Figure 2) can be used to implement VAT. Such an IT system would be able to do transaction-level tracking, so as to accurately compute sharing of taxes between states for implementing a domestic subnational VAT based on a destination principle.

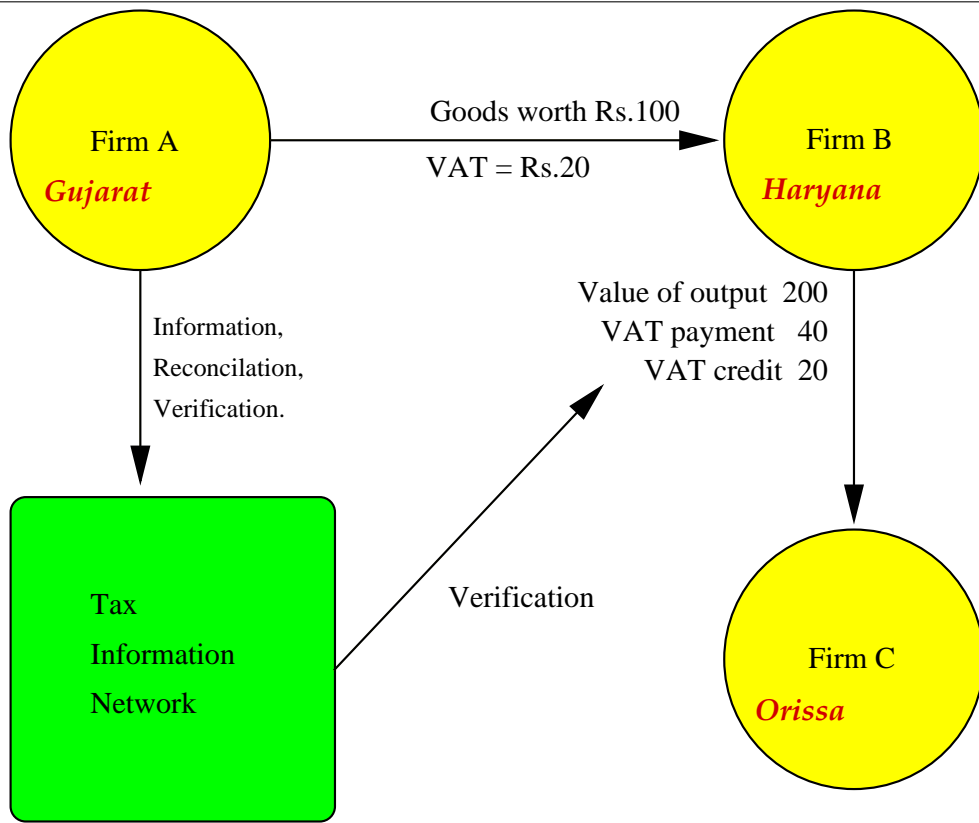
**Better governance through monitoring** The quest for improved governance will be greatly assisted by better measurement, and nationwide information dissemination

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<sup>9</sup>As an example, the United States ‘food stamps’ program covers over 20 million people. Over 95% of the benefits payout are now done using EBT.



**Figure 2** Using TIN for implementing VAT



using telecom technology. A range of questions and controversies affect the entire pipeline: from elections all the way to public goods outcomes. These questions will be answered in a more empirically founded and rational way if the entire process is instrumented properly, and sound data is captured on an ongoing basis about all aspects of the functioning of the State. This can sometimes be achieved by “instrumenting” the processes through which public services are produced, such as the release of MIS information from TIN. Alternatively, new data collection efforts can be undertaken, such as the agricultural price measurement described above.

## 5 Conclusion

The main argument of this paper is that in many situations, difficult puzzles of governance can be solved in dramatically new ways using modern IT systems. Nationwide centralised databases, coupled with ubiquitous high-speed Internet access, and pervasive computational power, has put a new set of solutions within reach in India.

*Four areas of impact can be identified: **removing discretion, rearranging incentives by modifying information sets, reducing the cost per transaction and reforming the extent to which production is contracted-out.*** The most difficult puzzles of governance are those of building human-intensive public services which are transaction-intensive and discretionary. The arguments of this paper suggest that in a certain class of situations, discretion can be reduced, and transparency can be improved, thus easing the principal-agent problems that afflict public administration. In addition, two other avenues through which IT systems are influential are reduction of per-transaction cost and as opportunities for improving the extent of contracting-out.

*For these situations, IT-intensive designs offer dramatically superior solutions to problems of governance.* Sometimes, difficult problems which require labour intensive monitoring – such as the conduct of individuals in a financial market – are simply eliminated by a computerised solution. Sometimes, a computerised solution – such as the railway reservation system – brings in new kinds of transparency which eliminates discretion.

*India now has extensive experience with these kinds of systems.* The engineering and management capacity required for conceiving, designing, building and operating these systems is now available. The underlying pre-requisites, such as ubiquitous nationwide Internet access or digital key infrastructure, are now in place. Hence, while such strategies may have been considered risky in the early 1990s, they are now much more mainstream.

*Often, the IT-intensive approach will solve a slightly different question as compared with what was originally posed.* Many times, when faced with a daunting challenge  $X$  which would require a complex human-based institutional capacity, it is possible to instead solve a somewhat different problem  $X^*$  using a complex IT system. While  $X^*$  might not be exactly the same as the problem  $X$  that was originally faced, it may be dramatically

more feasible to solve  $X^*$ . As an example, the difficult regulatory puzzle of ensuring fairplay in the private conversations of traders is not solved by an electronic exchange doing order matching. Instead, an electronic exchange with order matching makes those private conversations redundant, and shifts the market interaction to the exchange screen, where traditional kinds of malpractice just does not occur.

*The central theme of this paper is solving puzzles of governance using modern information technology; not IT for its own sake.* It is all too feasible to engage in substantial purchases of computer hardware and software, while not obtaining superior governance. The intensification of outlays on traditional management structures will often fail to transform outcomes, if the intervention does not change the principal-agent problems in a fundamental way. This paper has argued that, in many situations, it is possible to innovate on process design using IT. The success stories, and the areas for future work, that this paper has sketched do not involve “computerising” a traditional process: they involve fundamental new thinking on process engineering.

*The large IT systems described in this article are remarkably inexpensive.* The cost per transaction works out to levels much lower than those found with labour-intensive systems, even given the low price of labour in India.

*This makes it possible to reach the underserved.* IT systems with low costs per transaction make it possible to cater to small value transactions, and serve the poor, in a way that was infeasible without such low-cost transaction processing capacity. Indeed, the only way that is now available, to build systems and procedures that engage in transactions with individuals who have below-median incomes, is using IT systems.

*Often, an innovative solution will depart from “international best practice”.* In many cases, when India embarks on an IT-intensive solution, the resulting institutional mechanisms can appear very different from those found in advanced countries. This reflects the fact that the advanced countries had to confront and solve the identical questions in a pre-computer age, and have often not abandoned their old institutional mechanisms.

*Solving puzzles in governance through IT systems compresses a multi-decade process into a few years, and fuels high economic growth.* The time taken for India to go from a primitive state to the frontiers can be compressed into a few years. This contrasts sharply with the multi-decade process which was required, in the historical experience of today’s advanced countries, in creating adequate checks and balances, transparency and incentives, which have induced an adequate supply of public goods of the requisite quantity and quality.

After decades of failure, wise administrators in India have come to respect the daunting challenges of planning and implementing complex systems that operate in a consistent way across 3.3 million square kilometres. Notions of nationwide systems are sometimes seen as being naive, and disconnected from the difficulties of governance in India at the ground level. It is often argued that the process of decentralisation leads to smaller, more manageable processes for producing public goods. It is fashionable to talk about

empowerment of local communities, adaptation of public goods for local conditions, and making progress by improving public services in one village, town, city or state at a time.

But many critical tasks in public administration *require* nationwide systems. For these problems, big is beautiful. National public goods often require national systems, and retreating into one-city or one-state solutions is often meaningless when discussing national public goods. Each of the examples shown in this paper derive their power purely because of impact at the level of the nation. There is a large set of tasks in governance which require a nationwide footprint. These tasks do need to be taken head-on in addressing India's governance challenge.

This paper has sought to show a series of large, nationwide IT systems which have been successfully implemented in India in recent years, and thus argue that today, the management capacity *does* exist in India to design and build these systems.

## References

- Bhatnagar, S. (2004), Public service delivery: Does e-government help?, *in* S. Ahmed & S. Bery, eds, 'Annual Bank Conference on Development Economics 2003 (South Asia Component)', World Bank and NCAER, New Delhi, pp. 11–20. 3
- Caseley, J. (2004), 'Public sector reform and corruption: CARD facade in Andhra Pradesh', *Economic and Political Weekly* **38**(11), 1151. 7
- Cita, J. & Lien, D. (1997), 'Estimating cash settlement price: The bootstrap and other estimators', *Journal of Futures Markets* **17**(6), 617–632. 17
- Dave, S. A. (2000), Project OASIS Report, Committee report, Ministry for Social Justice, Government of India. 23
- Glinskaya, E. & Lokshin, M. (2005), Wage differentials between the public and private sectors in India, Technical Report WPS3574, The World Bank. 5
- Heeks, R. (2003), Success and failure rates of e-government in developing / transitional countries, Technical report, IDPM, University of Manchester.  
**URL:** <http://www.e-devechange.org/eGov/sfoverview.htm> 20
- Jappelli, T. & Pagano, M. (2000), Information sharing in credit markets: A survey, Technical Report 36, Universita Degli Studi Di Salerno. 14
- Kelkar, V. (2004), FRBM Implementation Task Force Report, Committee report, Ministry of Finance, Government of India. 23
- Kochhar, S. & Dhanjal, G. (2004), From governance to e-governance: An initial assessment of some of India's best projects, Technical report, Skoch Consultancy Services, New Delhi. 8
- Pritchett, L. & Woolcock, M. (2004), 'Solutions when *the* solution is the problem: Arraying the disarray in development', *World Development* **32**(2), 191–212. 4
- Shah, A. (2000), Improved methods for obtaining information from dealer markets, Technical report, IGIDR. 17
- Shah, A. & Thomas, S. (2003), Securities market efficiency, *in* J. A. Hanson, P. Honohan & G. Majnoni, eds, 'Globalization and national financial systems', The World Bank and Oxford University Press, chapter 6, pp. 145–175. 12
- Thomas, S. (2006), How the financial sector was reformed, Technical report, IGIDR. 12