Chapter III
E-Governance

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ABSTRACT

E-governance uses Internet and communication technologies to automate governance in innovative ways, so that it becomes more efficient, more cost-effective, and empowers the human race even more. E-governance exercises are being attempted for more than a decade now, but have so far achieved only mixed success. The long-term prognosis for e-governance, however, remains extremely positive. The emergence of Web-services technologies, the continually proliferating computer networks, and the irreversible migration towards digital information strongly confirm the view that e-governance is here to stay. The eventual success of any e-governance project is intimately linked to the methodology used, and to that complex mesh between men, machines, and mindsets. We explain the "what," "why," and "how" of e-governance. We also talk of e-governance concerns, and discuss a few illustrative case studies.

WHAT IS E-GOVERNANCE?

Definitions

The biggest problem in developing countries is good governance, not poverty. It is, for example, well known that only a miniscule fraction of the money earmarked for development, relief, or rehabilitation eventually filters down to fulfill its mandated objective. There are also numerous instances where the concern is not how to *find* the money, but how to go through the maze of complicated procedures to *spend* the available money before the financial year ends.

Until a decade ago, the sheer logistics of accounting, bookkeeping, correspondence, and approvals was an onerous overhead. But the World Wide Web completely changed things. With e-mail, correspondence across the globe became almost instantaneous, and richer, because mail attachments were possible. The technologies to make Web pages interactive, and connect them to databases, worked wonders on the approval

processes: approvals became faster, were based on more intelligent inputs, and could be securely archived. It was now possible, and indeed highly desirable, to use the Web for real governance.

Electronic governance (or e-governance) could therefore be defined as the use of Internet and communication technologies to automate governance in innovative ways, so that it becomes more efficient, more cost-effective, and empowers the human race even more.

Since "governance" is normally associated with a "government," may authors choose to explicitly mention the government while defining e-governance. Backus (2001), for example, defines e-governance as the "application of electronic means in the interaction between government and citizens and government and businesses, as well as in internal government operations to simplify and improve democratic, government and business aspects of governance." The strategic objective of e-governance, as Backus explains, is simply to use electronic means to support and stimulate good governance.

Governance vs. E-Governance

Both governance and e-governance are based on the same principles, and aim to achieve the same end objective. But the means used are widely different. Consider, for example, the requirement of a publicly funded national R&D lab to recruit scientists. A decade ago, the following procedure was probably adopted: (a) advertise widely in national newspapers indicating the job requirement and eligibility, (b) identify the format in which applications must be submitted, (c) receive, sort, and classify the applications sent, (d) shortlist the applicants and invite them for a test or interview, and (e) select the candidates and issue them appointment letters.

This entire process usually took almost a year—so long that the applicants often got tired of waiting and flew away to some other opportunity. The excuse offered for the delay was that prescribed government procedures were too complex and tedious. It was ironical that these classical governance procedures were actually sending away the best talent instead of bringing it in.

The e-governance approach would dramatically change things: the job requirement and eligibility would appear as hyperlinked Web pages on the lab's Web site. The application format would be a Web page template, with thoughtful validations to improve data quality. Upon submission, the applicant's data would instantaneously flow into database tables on the lab's server. The shortlisting process would merely involve making lists based on a wide variety of database queries and, finally, the selected candidates would be issued appointment letters via an e-mail attachment.

The advantages offered by this e-governance procedure are abundantly clear, but let us list them for the record. First, the "time-to-recruit" is dramatically reduced: 12 months could be reduced to 1-2 months. Second, the quality of the selected candidates is significantly better because of timely selection and improved data quality and search procedures. Third, the procedure is much less expensive; there are no advertisement or data tabulation costs. Fourth, the e-recruitment procedure reaches a much larger number of applicants right across the globe because of the growing ubiquity of the Web, and because the application window is open 24×7. And, finally, the e-governance procedure automatically guarantees data or content in digital form, making them more amenable for future knowledge management or data mining exercises.

On the down side, e-governance procedures frequently raise security concerns, for example, could someone access or modify information? Electronic procedures also require widespread, efficient, and reliable computer networks. But the biggest concern relates to mindsets: officials involved in governance fiercely resist change.

Table 1 summarizes the arguments for and against e-governance. It can be seen that the advantages significantly outweigh the concerns.

Table 1. Advantages and concerns of e-governance

Advantages	Concerns
Significant time saving ("there are no delays")	Mindsets of governance teams
Improved information quality	Security concerns ("can information be tampered or delayed?")
Less expensive (especially after e-governance infrastructure is set up)	Requirement of widespread, efficient and reliable computer networks and software
Wider reach ("can reach the whole world")	
Digital content (data capture is digital)	

Evolution of E-Governance

E-governance became possible only after the appearance of the World Wide Web and the widespread use of browsers like Netscape and Internet Explorer. In the early years (until about 1997), browsers simply displayed "static" Web pages. These pages were attractive, available on different computer platforms, allowed you to "mix" text with multimedia content, and could be hyperlinked.

From an e-governance viewpoint, this still was not good enough. Imagine that the task is to secure admission in a school or college. With Web pages, you could display all kinds of information about the college: its history, its courses, names of teachers on its faculty, pictures of the college buildings and swimming pools, college maps, and so forth. You could also post formats of application forms that must be submitted. But you could not *actually fill up such forms online*. With static Web pages, you could only "inform," but you could not "interact."

The chief reason was that Web pages use the Hypertext Markup Language (HTML), and HTML simply was not meant to be interactive. It was a one-way street: the college could reach its information to you, but you could not get back to the college using the same browser.

One could, of course, still print the application form off the Web page, fill it up off-line, and then mail or fax it to the college. The college could then, if it wished, reenter the details on an electronic database. But this did not seem right. If you could "connect" to the college, why could you not "reach" its database as well?

HTML's inability to directly connect to a database had to be corrected; one had to get HTML to talk to SQL (the structured query language that all databases use). The early efforts (1997-99) to achieve this involved the use of a common gateway interface (CGI) and a programming language like PERL. It worked rather well, although the programming overhead was a little severe. Later, especially after the widespread use of a platform-independent language like Java (by 2001), the database connectivity problem was solved much more elegantly.

From an e-governance perspective, this meant that we had moved from the "inform" to the "interact" phase. Our college applicant was now only required to fill up an online form and "submit." The data would seamlessly flow into the college's backend database. Better still, the student could also obtain an online or e-mail response, for example, to say that the application has been received or accepted.

A typical governance transaction, however, involves much more than filling or submitting a form. The conventional procedure is to put this application form on a file or dossier. The file then travels from one "governance desk" to the next. At each desk, the concerned individual is required to carry out a process involving either

"scrutiny and verification" or "decision-making and judgment." Each process therefore involves information addition or manipulation. In the college application example, the process might involve seeking referee reports, administering a test, determining qualification criteria, and eventually reaching a decision.

How would one achieve an electronic adaptation of this governance transaction? We would first of all store the applicant's information and documents into carefully structured databases ("files") or similar digital repositories. Every participant in the governance transaction ("desk") would then access the databases in the prescribed sequence, and either add or manipulate data. As the transaction proceeds, information is continually updated digitally. The eventual verdict is based on the same information inputs, albeit in the digital format.

A transaction therefore involves multiple, and usually richer, interactions. We are therefore moving higher in the e-governance hierarchy: after "inform" and "interact," it is now "transact." In terms of technology, a transaction is considerably more complicated. Basically, transactions involve workflows (a supply chain is an example of a workflow). There are now more participants, and issues relating to security now require greater attention. Even workflow management can get sufficiently complicated, because workflows may not be straightforward. For example, after traveling through desks A -> B -> C -> D, D might suddenly decide to revert the file back to B for a clarification; or, in certain situations, one may be directly required to jump from desk B to desk D.

Technologies relating to such electronic transactions matured by about 2003. In most cases, these were Web-enabled implementations of the enterprise resource planning (ERP) solutions that had been around for many years.

But even as e-governance solutions became more sophisticated technologically, a very different sort of problem was becoming increasingly evident. The technology was "ready," but the people required to use the technology were "not ready"; in fact, often "not willing" to change. This mindset problem was apparent even earlier, when full-blown ERP solutions started being implemented, because such solutions required considerable process reengineering, and established organizations with aging managers simply refused to change.

While developing technologies for e-governance transactions constitutes a very big forward step, it is not the end of the story. These transactions must eventually go on to "transform" businesses; they must change business paradigms. There are still serious problems in migrating from the "transact" stage to the "transform" stage.

Consider again the case of an applicant to College A. If College A rejects the applicant, he would like to be considered for College B, College C … and so on until he eventually gains admission somewhere. Unfortunately, it is still unlikely that College A and College B can seamlessly exchange the applicant's information. Their information systems would be engineered at least a little differently, making such information exchanges difficult and expensive. Consider another example where Enterprise A takes over Enterprises B. Sadly, the billing procedures in Enterprises A and B are significantly different, although each procedure is, by itself, efficient and streamlined. Exchanging information between Enterprises A and B will therefore become a major handicap. So severe, in fact, that many information managers might find it more convenient (Hagel III, 2002) to adopt a "no tech" solution—backroom boys (perhaps outsourced from India!) would manually "convert" formats and then throw the data back into the system.

This difficulty arises because we do not have standardized information formats and processes. One recalls the electronic data interchange (EDI) initiative of the 1990's that fell through because it was not sufficiently versatile, and because it allowed the business "big brother" to become the "big bully" by "controlling" data formats.

The way out seems to be to evolve universal (and "open") frameworks, and then build supporting frameworks for interoperability so that every enterprise's formats are "reduced" to this universal format. This approach should hopefully usher in true e-governance.

G2B, G2C, G2G

The three principal participants in e-governance are the government, the citizen, and the business entities. So e-governance is essentially about interactions between these participants in which the government plays the pivotal role.

It is customary to classify these interactions. G2C, for instance, refers to interactions between the government (G) and the citizen (C). Obtaining a driving license is an example of such an interaction. The citizen approaches the government for a license with the relevant supporting documentation. The government eventually grants him the license and ensures that the citizen's details enter the government's information repositories. These details can then be used in governance, for example, to fine the citizen after a traffic violation.

G2B refers to the interactions between the government (often as a regulatory authority) and business enterprises. The procedures involved in receipt and payments of taxes are an example of G2B e-governance. There could be very complex underlying processes such as date management, discounts, payment policies, and so forth, in G2B e-governance.

Finally, G2G refers to interactions between two government departments, for example, between a state and federal government or between government agencies respectively involved in development and funding projects. The real G2G e-governance challenge is to create a monolithic government entity in which the citizen or the business interacts with an apparently single entity (a "single window") for all governance transactions. This is a very formidable task given the wide disparity in governance procedures between two government departments.

An E-Governed Future

E-governance is a very attractive and compelling concept. But the path towards this ideal is exceedingly difficult and complicated.

First of all, we need the *infrastructure*: every enterprise, every government department, and every home must hold electronic devices such as computers, mobile handsets, or wireless sensors that must be "connected" with robust, fast, and reliable networks. The networking technologies could be different (wired, wireless, terrestrial,

Table 2. Different phases in the evolution of e-governance

E-Governance phase	Attributes
'Inform' (<1997)	Web pages containing 'static' information (featuring text, pictures, or even multimedia clips) posted on a Web site. Pages are hyperlinked.
'Interact' (1997-2001)	Web pages with database connectivity. Now possible to submit queries and receive responses.
'Transact' (>2001)	Improved interactivity. Transactions across workflows. Security features. ERP-like formulations
'Transform' (?)	Universal frameworks. Enterprises can seamlessly exchange information over distributed networks.

satellite-based), but this variety need not be a concern.

Second, we need *enabling software* that is compatible across these diverse hardware platforms: ideally, software with open architectures. Software solutions must seamlessly support (a) browsers or other communication devices at the "front-end," (b) the information repositories and databases at the "back-end," and (c) the business logic and intelligence in the "middle-tier."

Third, we need *digitization*. All data or information in the archives, in administrative ledgers, in books, in court proceedings, and so forth, must eventually get digitized. This is an onerous task, but, thankfully, not an urgent prerequisite. A pragmatic approach would be to choose a cutoff date and make sure that at least all future records are digital. We also need supporting instruments such as scanners, document management systems, and so forth, for digitization.

Fourth, we need *security*, operating at different levels: (a) user identification and authentication using smart cards and digital signatures, (b) data protection using encryption and fault-tolerant software, and (c) protection from other external threats such as hackers, viruses, spam mails, and service denial programs.

Finally, we need *universal standards and frameworks* to facilitate data exchange. The eventual success of e-governance would depend on how good these standards are, and how faithful and widespread is the compliance with these standards. Such standards would grow into frameworks, and the emergence of robust Internet technologies like XML, or more generally, Web services, would eventually package these standards and frameworks into successful e-governance implementations.

Thus, in tomorrow's e-governed future, anyone, any time, from anywhere, using any connection device, can ask for any service. This looks like a pipe dream right now … but there is no reason to believe that it cannot happen tomorrow, or the day after, if there is a shared collective will.

WHY E-GOVERNANCE?

Empowerment

In historical narratives, a king was considered virtuous and benign if each of his subjects had the freedom to approach the king's court with a request or a grievance. In many ways, this continues to be the ideal of democratic societies even today. But the governance agencies are getting more "distant" because of growing populations, growing procedures and, sadly, growing indifference.

One of the chief merits of e-governance is that it can again empower the citizen. To take a trivial example, most governance procedures are initiated with an application form. It is common, especially in developing countries, to deny a citizen even access to this form! One has to know an influential contact, or pay a modest bribe, to obtain this form. In an e-governed world, this form would be available almost instantaneously … in fact it could be filled out and submitted almost as easily.

The citizen is also often completely ignorant of procedures, and of his rights. He needs counseling or advice before he can choose his preferred option. Such advice, however, is often denied or only made available at a price. In e-governed societies, the citizen could have access to video films or interactive help routines to permit him to make a better-informed decision. He could also join discussion groups where individuals share their personal experiences in working around procedures.

E-governance offers a 24 × 7 service desk, and this too is a major instrument for empowerment. Government offices worldwide are known to have an abnormally large number of holidays, and, even on working days, service counters are often not manned all the time ("Mr. X still isn't back from lunch").

E-governance will also empower businesses. Every businessman knows how difficult it is to

Table 3. The prerequisites for e-governance

Prerequisite	Attributes
Infrastructure	Participants must have electronic interfaces such as computers or mobile handsets. There must be a robust, reliable, and fast network to connect these participants
Enabling software	Software with open architectures to seamlessly connect the front-end, back-end and middle tiers
Digitization	Data must become digital: new data must be entered in digital formats, legacy data must be digitized using scanners and document management systems
Security	User authentication, data protection, and protection from external threats
Universal standards and frameworks	Development and compliance of universal standards to exchange data and applications.

bid for, and perhaps eventually obtain, a lucrative government contract. The associated paperwork requires him to interact with a large number of different government offices and officials who have no worthwhile information exchange processes between their establishments. This significantly delays the award of the contract and proves to be an unnecessary and expensive overhead.

Finally, e-governance will empower because of its wider reach. It is, for example, well known that a cartel of big vendors often gobbles up most of the big government contracts. Likewise, citizens residing in a country's capital often run away with most of the lucrative international opportunities. When such tenders or announcements are put on easily accessible Web sites, they will reach practically every entrepreneur or citizen.

Profitability

E-governance will make businesses and enterprises more profitable. One route to greater profits will emerge because of reduced lead times. Every business process can be streamlined to a greater degree, parallel activities can be initiated and the project can be completed faster. It is always more profitable if projects are completed on time.

E-governance will offer significant gains because businesses can deploy a reduced, but more skilful, manpower component. All project teams have a team of core technical experts and a second team of "facilitators." These facilitators are not really productive in a business sense; they are needed to cover up the deficiencies in the governance processes. As e-governance implementations improve, we will need fewer facilitators.

E-governance has also opened up the extremely profitable opportunity of outsourcing. Project tasks can be transferred, for example, from Boston in the U.S. to Bangalore in India, because businesses are electronically wired up, and a country like India offers manpower of matching quality at a fraction of the international costs. Starting from about 2003, the outsourcing business is booming; it even easily survived a campaign debate in the 2004 U.S. presidential elections.

Efficiency

Anyone visiting Asia after a gap of about 5 years would be struck by two very visible phenomena: the ubiquity of bank ATM counters and the pervasive use of mobile telephones. This is a strongest possible signal that e-governance is coming.

The example of mobile telephones is most interesting. Starting off as a status symbol that every rich man was supposed to flaunt, it has now

made deep inroads into the middle-class income groups and the small business or service segments. Plumbers, electricians, car and scooter mechanics, and even cooks and priests are now just a phone call away! Mobile phones have provided decent livelihood to a significant fraction of the population and made businesses much more efficient.

ATM counters too have dramatically improved efficiency. ATM services have often served as "robots" to reduce the burden on banking clerks, and ensure that fewer citizens crowd bank offices. Best of all, the ATM experiment has made signatures less sacrosanct. Two of the most dreadful requirements of classical governance are (a) to ask that every request be written out on paper, and (b) to insist that every governance agent affixes his signature after even the most trivial transaction. The acceptance of an ATM card with its secret pin code, instead of a printed signature, to disburse money is a step forward.

Flexibility

One often encounters administrative procedures that are extremely tedious, and for no apparent reason. Both the administrators and the customers are aware of this, but seem incapable of changing things. This is largely because the established governance procedures are inflexible. You realize, for example, that A -> D -> C -> E is a better way of going about things than A -> B -> C -> D -> E, but you are told that this cannot be done because it would disturb the existing administrative set-up, and require reprinting of all the stationery and the bound ledgers. An e-governance set-up that would easily permit modification of workflows would solve the problem.

We need flexibility in a wide variety of other situations as well, for example, while changing from summer times to winter times, if we decide to shift a particular business operation from Location A to Location B, or if we wish to transfer a responsibility from Mr. A to Ms. B.

Anticorruption

Corruption is arguably the biggest obstacle to good governance, at least in the poorer states and countries. E-governance can counter corruption in at least two ways: first by introducing *transparency* in all governance processes, and, second, by being a very effective *deterrent.* For example, consider all governance procedures associated with land or property records. These procedures are so seeped in corruption that even a legal owner of land or property can never feel secure. Ownership is normally established based on an appropriate entry in an official governance record—but what if this record is modified for a bribe? Farmers in poorer countries are often the biggest victims; their land can be "grabbed," and their land records "destroyed" by the evil nexus of politicians, lawyers, and the land mafia. Digitizing all land records securely, and educating the local farmer to use electronic procedures to protect his ownership rights, could defeat such corruption. Another example of the transparency of e-governance is the management of examinations by universities: all worries about exam paper leaks, faulty evaluation, and manipulation of results can be banished once the entire process becomes publicly visible, and thus accountable. Even corrupt practices in elections, arguably the greatest scourge of democratic societies, can be countered by e-governance.

The role of e-governance as a corruption deterrent is more subtle, but equally effective. Information about every high value government transaction can be posted on a public Web site for citizens, public interest groups, and the media to peruse. This will ensure that every transaction is publicly watched, and every decision fiercely debated. This simple e-broadcasting ploy can keep every official on his toes, and make him think twice before making a wrong move! Aggressive e-advocacy can also help reverse decisions where corruption has been spotted.

Digital Repositories

In an e-governed world, all records will be entered or sensed into electronic repositories, and will therefore be automatically digital. This "forced digitization" is extremely useful because digital content is easiest to manipulate, and also potentially the most durable (although the rapid obsolescence of the data capture and storage devices is a matter of concern). The ability to easily manipulate or play with data will enable more efficient "knowledge" extraction, or discovery, for example, using data mining or using algorithms based on artificial intelligence (AI) methodologies.

The digital medium also embraces multimedia content. We already see many instances of multimedia in governance: "in-camera" court depositions from geographically distant locations, animated weather forecasts and hurricane alerts on TV, tracking a criminal's movement using GPS/GIS devices, and so forth. Digital multimedia is therefore poised to become a powerful and versatile force in e-governance.

Once Again, Why E-Governance?

It is interesting that while practically everyone advocates e-governance, the reasons cited are widely different, although each is thought provoking. The following one-liners (W'O Okot-Uma, 2001) are in response to the question: "Why good governance?". If we assume that e-governance is the most likely vehicle to deliver good

Table 4. The benefits of e-governance

Benefit	Reasons
Empowerment	Empowers the citizen or business because of unfettered access to governance, education on governance procedures, 24 x 7 service, and wider reach
Profitability	Reduced lead times, better manpower deployment, possibility of outsourcing
Efficiency	Opportunities for mobile connectivity, sophisticated devices to automate mechanical and repetitive tasks, faster transfer of money, encourages digital signatures
Flexibility	Reengineering or reconfiguring business processes, easy transfer of business locations or individual responsibilities
Anticorruption	Introduces transparency in the governance process, acts as a deterrent
Creates digital repositories	Forces data digitization, this allows easier data manipulation and more efficient knowledge retrieval. Supports multimedia content.

Table 5. One-line responses to "Why good governance?"

Respondent	Response
Amartya Sen	Development of freedom
John Paul II	Freedom of a person to live out his/her creative potential
John Rawls	Social justice as fairness
Mahathir Mohamed	Global civilized society
George Soros	Global open society
UNDP	Human development
Atlantic Charter	World free from fear and want

governance, then these are also answers to "why e-governance?"

We therefore see that e-governance is much more than just an implementation of information and communication technologies. It is also intimately linked to a wide variety of social, economic, and political factors such as "freedom," "social justice," "openness," "globalization," "economic liberalization," and "human development." E-governance could, one day, redefine human civilization itself.

HOW E-GOVERNANCE?

Climb the Mountain

How does one actually begin the business of ushering in e-governance? There is really only one way: start climbing the mountain that takes you from the "inform" phase to the "interact" phase, and thereafter, to the "transact" and "transform" phases.

It is also still not completely clear how we will scale the ultimate peak; but if we keep climbing, and equip ourselves with the essential "tools" to trudge upwards, we will surely get there. Better still, the benefits start coming in almost as soon as we harness this resolve to climb; and they grow incrementally as we conquer each intermediate peak.

For the "inform" phase, we need rather modest tools: at the "governance end" we will need a Web server to host the Web site, and at the "citizen end" we will need no more than a networked desktop computer with browser software. As we move to the "interact" phase, the governance end will have to be bolstered: faster servers, and a database server to complement the Web server. At the citizen end, the same desktop computer would still do the job, but it would help if the network connect speed improves, and if the connectivity can be sustained over longer time periods.

The climb up to the "transact" phase is significantly more difficult, and we need more powerful and versatile technology tools. More importantly, we have to steel our human resolve. The inform phase is great fun; no one protests … in fact, everyone says: "hey, I didn't know this was so easy, and so cool!" The honeymoon endures as we enter the "interact" phase … we are now gushing: "I didn't have to wait in long queues to get this done, I applied right from my home, and in the middle of the night!". The "transact" phase brings in the big worries; at the governance end there are concerns about the performance of the servers and fidelity of the processes. Officials are also alarmed by a perceived loss of power, since they no longer physically hold official records and the office hierarchy gets disturbed. At the citizen end, there are widespread concerns especially about security, and confusion about the process workflows. By the time we reach the "transform" phase, the big action has shifted to the backend: the concerns are about how to exchange and manage data seamlessly and share the same processes. At the citizen end, things have now become rather simple: a single, completely configured, and customized desktop provides that ultimate "window to the whole world."

We will now introduce the many underlying e-governance building blocks. It must be mentioned that the real technological challenge is significantly greater than what this narrative might suggest.

Hypertext Markup Language

The Hypertext Markup Language (HTML) is used to create Web pages. The general procedure is to first key in the text, and then add "tags" to (a) embellish the page appearance, (b) insert multimedia content, and (c) hyperlink the Web page to other related Web pages. Internally, HTML identifies the IP address of the server holding the referred Web page, and requests the server to send the page across the Internet.

Table 6. The major steps in e-governance implementation

Phase	"Governance end"	"Citizen or client end"	Technology prerequisites
Inform	Host an attractive and informative Web site on a Web server with hyperlinked Web pages and multimedia content	A desktop computer with browser software; at least a rudimentary network connection	HTML, browsers, devices for content digitization (scanners, optical character recognition software, conversion to pdf) TCP/IP network connectivity
Interact	Database server to complement the Web server. Ability to connect to databases. Design front-end forms with suitable validations. Routines to populate and query back-end databases	A desktop computer with browser software, and an improved network connection. Logins and passwords to identify and authenticate user	HTML, browsers, digitization, improved network connectivity, database design and development, programming for database connectivity (e.g., using Java)
Transact	Cluster of servers for specialized functions such as database management Web hosting, Web application management, security and fault tolerance. Design and coding of process workflows, and of user-friendly and secure front-end interface. Data encryption.	A desktop computer with browser software, and a fast and reliable network connection. Logins, passwords, and digital signatures or security tokens to identify and authenticate user	HTML, browsers, digitization, reliable and secure network connectivity, database design and development, programming for database connectivity (e.g., using Java), software to support workflows, process integration, rights and privileges. Hardware devices and software tools for information security
Transform	Cluster of servers for specialized functions like database management, Web hosting, Web application management, security, and fault tolerance. Design and coding of process workflows, and of user-friendly and secure front-end interface. Data encryption. Standards and frameworks to connect diverse data and application implementations.	A desktop computer with browser software and a fully user-specific configured desktop. Fast, reliable, and persistent network connection. Wide slew of features to authenticate and protect the user.	HTML, browsers, digitization, reliable and secure network connectivity, database design and development, programming for database connectivity (e.g., using Java), software to support workflows, process integration, rights and privileges. Hardware devices and software tools for information security. XML and Web services. Data format standardization. Frameworks for interoperability.

From an e-governance perspective, HTML provides the richest possible machinery to inform. In spite of its apparent simplicity, designing a Web page is still a considerable challenge. The Web pages must be appealing, must contain compelling links to other information sources, and must have an intelligent underlying structure. Web pages must also be frequently updated, with old pages being promptly weeded out.

Internet

There would be no e-governance without the Internet. The Internet is a worldwide computer

network created by interconnecting computers. The most popular connecting "topology" uses a switch (earlier, a hub) with multiple ports. Every computer in the local neighborhood connects into this switch. Then the switch itself connects into another switch, and so the network telescopes out. Computers are identified by a unique IP address (that is, quite like a phone number; IP addresses currently are "dotted quads," 202.12.13.14, for example), and there are searching and connecting mechanisms on the Internet to quickly identify computers and then exchange data packets. When a user types in http://www.google.com on his browser, the domain name server on the network (that is like a telephone book) quickly identifies the IP address of the server hosting the Google site, and then attempts to establish the connection. Things happen very fast, and the data packets are delivered at great speed and with uncanny precision.

Networks are now turning "wireless"; instead of cables, networks use radio as the primary carrier. Wireless networks, using associated technologies like WiMAX (Vaughan-Nichols, 2004), will provide a major fillip to e-governance because they allow use of *mobile* devices. So if you want to book an airline ticket, you could use the handset of your mobile telephone instead of a "wired" computer. If you are a soldier patrolling a border area, you could use a palmtop computer to update the army's database on enemy positions. If you are a fisherman on the high seas, you could connect to a database indicating the supply requirement at different points on the coastline to plan and optimize your catch.

Indeed it appears increasingly likely that "full-blown" e-governance will eventually be achieved using wireless networks, and wireless data collection technologies, such as RFID (Want, 2004), that use electronic tags to store data. RFID tags can make any object "visible" to a network—anywhere and at any time. RFID tags are still rather expensive, and so used rather sparingly (to track expensive goods in transit, for example). But their use will proliferate once they become more affordable. Every book in a library or bookstore, every commodity in a supermarket, every inventory in an engineering or medical establishment, every car on an auto route, and even every child's schoolbag could then be tagged. Indeed, these tags could go on to redefine the very art of governance.

Databases

A lot of governance involves the collection, storage, and retrieval of data. Databases store data intelligently so that it can be retrieved easily and quickly using powerful querying options.

As data gets more complex and interlinked, database design becomes important in e-governance. For example, if a database field seeks a respondent's *age*, instead of his *date of birth*, things will become very awkward a few years down the line.

One of the challenges in database design is to ensure that the data locked in different database tables always remain consistent; this is usually achieved by the normalization technique (Gilfillan, 2000), where the designer works his way through the first, second, and third normal forms.

Another e-governance challenge was to connect "front-end" HTML-based user interfaces to "back-end" SQL-based databases. Such database connectivity initially tended to be specific to the database software product used, and that was obviously not very comfortable. Now the connectivity issue has been resolved more elegantly with the appearance of platform-independent "middle-tier" *Web servers*, for example, using Java.

A related problem arises when the number of "hits" becomes very large. Simple Web servers can no longer cope up with the traffic of users wishing to connect to databases at practically the same instant. One way out is to use the more powerful *Web application servers*. A second option is to move the data out of the database and store it between customized Extensible Markup Language (XML) tags. Since XML pages show

up almost instantaneously on browsers, the user receives a much quicker response to his query. In fact, XML is now emerging as the preferred choice for data exchange across disparate networks.

Workflows

Most transactions in e-governance depend on workflows. After an applicant initiates a process, the application normally travels from one official desk to the next, until the process is eventually terminated. For example, an application for a loan will involve a careful scrutiny of the applicant's credit-worthiness before a decision on the loan request is made.

Most of the "bad" governance, especially in developing countries, can be attributed to faulty workflows. To start with, the workflow could be clumsy and tedious, and spread across geographically distant locations. This involves multiple queues and much grief. Then, bad workflows tend to introduce unacceptable lead times in the governance procedures. Finally, and rather sadly, flawed workflows promote corrupt practices. A file containing valuable documents and endorsements might, for example, simply vanish into thin air, and reappear only after a hefty bribe is paid.

"Good" workflows, on the other hand, provide the surest route to good governance. Like all evolutionary processes, good workflows evolve over time. Paths or chains in workflows must be trimmed, elongated, diverted, or concatenated until the optimal procedure evolves. The recent appearance of powerful workflow engines greatly simplifies such business process reengineering exercises.

ERP

Enterprise resource planning (ERP) is about tightly integrating all the business processes, usually *within* the enterprise. Most enterprises have very similar sort of functions: inventory management, manufacture, sales, marketing, human resource development, payrolls, budgeting, and so forth, and they usually operate in the "project mode," It would obviously be a great advantage if all these functions, and their interdependencies, are continually watched and monitored by a single information system. Successful ERP solutions, therefore, allow the enterprise to be much more alert and responsive, and make more intelligent business decisions.

On the down side, ERP solutions have proved to be expensive and rather difficult to implement. The difficulty in implementation is directly proportional to the extent of process reengineering ("customization") that the ERP solutions demand. But ERP solutions still provide a very valuable platform and facilitate the eventual migration to full-blown e-governance.

Security

As e-governance implementations grow, so too will security concerns. Most enterprises work around a security policy that outlines rules for network access. Security threats can be internal or external, could involve men or machines, be either willful or accidental … or be a combination of some or all of these factors.

To counter internal security threats, users are required to use passwords, or passwords in combination with other devices (smart cards, synchronized tokens, biometric matching) if the perceived threat is greater. All data and information are encrypted, and multiple back ups are maintained on diverse media. Software routines also archive detailed transaction logs so that security breaches can be investigated.

External threats are controlled by firewalls. These threats are largely from hackers or malicious software such as viruses, spasm, worms, or Trojan horses that seek to disrupt or deny service. Firewalls typically try to cut off most of the network access "ports." Because of the ubiquity of the Web, the "80 port," which brings in all the HTTP traffic, has necessarily to be kept

open. The effort therefore is to funnel *all* network traffic through this single (well-guarded) port. This partly explains the growing popularity of the Web services framework.

Finally, security threats can be significantly reduced by good user practices. An ongoing training program on correct user behavior is often the first, and vital, step in the wider social engineering that enterprises must undertake.

XML and Web Services

HTML's greatest merit is that it is based on *open* standards. That is why Web pages can show up on any browser sitting on any operating system. But HTML can only *display* data; it cannot *describe* data, or facilitate the *exchange* of data. XML corrects this weakness. XML too is based on open standards, but it can also encode data or information.

XML therefore provides a wonderful opportunity to exchange data across disparate information systems. Suppose Enterprise A, having all its data on the Oracle database, wishes to exchange information with Enterprise B using the SQL Server database. Both Enterprises A and B could encode their data using XML, and the platform-independent XML could then easily facilitate the information exchange via the Web route (Hagel III, 2002).

Indeed, as the Web and Web protocols become ubiquitous, it is now even possible for two different Web-based applications to interact dynamically! A connection can be set up, for example, between an application using Java and another using .Net. Such connection technologies (Web services) will allow e-governance to move up from the "transact" phase to the "transform" phase.

Implementation Strategies

E-governance is not just about technology; the social, political, and economic challenges in its implementation are just as daunting. The citizens and officials must be willing to accept change; the political leadership must have a roadmap and aggressively push it; and the project funding must be committed and available. It also helps if

Table 7. The e-governance building blocks

Technology	Role
HTML	Open standard for displaying Web pages. The first step in e-governance is to build a Web site that is visible to all users
Internet	The information carrier. All users participate in e-governance by using a computer or mobile device connected to the Internet. Networks are built using cable or radio
Databases	All information used in e-governance is usually stored on databases. Databases allow easy and secure storage, and quick and smart data retrieval.
Workflows	Workflows describe the paths of the e-governance processes. Most transactions are modeled using workflow engines
ERP	A tool to tightly couple business processes in an enterprise. Enterprises with ERP solutions are significantly better equipped to implement full-blown e-governance
Security	Software and hardware solutions to protect e-governance implementations from internal and external threats
XML and Web services	Open standards to exchange disparate data and applications across the Web. The recommended model to implement e-governance, especially in the "transform" phase.

good (but not electronic) governance practices are already in place.

To get e-governance off the ground, Andersen Consulting (Backus, 2001) recommends a strategy of "think big, start small and scale fast." At the top end of the e-governance implementation spectrum, John Hagel et al (Hagel, Brown, & Layton-Rodin, 2004) suggest that the secret to creating value from Web services is to "keep it simple, keep it incremental, and learn, learn, learn."

E-GOVERNANCE CONCERNS

The Three Big Worries

To make e-governance a reality, "soft" leadership and management skills must complement "hard" technology skills. There are many instances where the technology development and infrastructure creation has been impeccable, but e-governance implementations have failed because the "soft" concerns were not addressed.

Three worries will be apparent as we take the long road to e-governance, and at different stages in the implementation life cycle. The first barrier, which we face soon after an e-governance project starts, relates to *human mindsets*. We often do not appreciate how radically e-governance will change human interactions and affect the "power" that people feel by physically "holding" information repositories.

Midway through a successful e-governance implementation, we worry about the *digital divide*. E-governance apparently favors "digitally well-connected" governments and enterprises. Imagine a scenario where e-governance causes the trusted postman to disappear, but the e-mail connection, which is supposed to replace the postman, has not been installed, or is unreliable. The fear, therefore, is that, for the less privileged, the old order will change, but a new order will not replace it.

Finally, in full-blown or near full-blown e-governance implementations, there is a real concern that the citizen will lose all his *privacy*: the citizen's bank balance, medical condition, voting preference, physical movements, and even his love life will be visible as e-governance radars relentlessly scan every moment of his life. We already hear protests about mobile phones being unacceptably intrusive. Tomorrow's e-governance processes could blow the privacy lid wide open.

Human Mindsets

Human reaction to an e-governance initiative can be widely different. While many enthusiastically embrace Web connectivity, others strongly resist change. It is important to understand why they respond this way, and see how we can correct that response.

Often, there is a *fear of technology*, or of interacting with "alien" machines instead of familiar humans. The attitude is: "I will submit my form to the office clerk, not a dumb computer." This is also why many callers are not comfortable leaving a message on a voice recorder, or of typing in a credit card number on a Web interface.

In most cases, however, there is the *fear of losing power or authority*. E-governance brings in sweeping process changes that make officials very uncomfortable. Most officials enjoy the power of receiving files, making remarks on files, signing on them with a flourish, and entertaining visitors soliciting favors. E-governance initiatives dilute this power and make their hallowed role rather redundant. And, if indeed this is a corrupt official receiving bribes for a favorable verdict, the pinch is felt even more.

In the early days of e-governance, there was also the very genuine *fear of losing your job* and livelihood. That is why labor unions stoutly resisted electronic initiatives. Now that fear is fading, but this is still no guarantee that an employee or official will change his mental makeup.

These mindsets must be corrected gradually. A continuous and intensive training program will be very useful. Enterprises could also start with e-governance projects of the "win-win' type; for example, showing a clerk how a click of the mouse will generate a report that took him 5 hours to write. Incentive and rewards for the best participants in e-governance projects also help in swinging things.

Digital Divide

A frequently articulated concern is that e-governance will create a digital divide between the technology "haves" and "have not's." One reason cited is the wide divergence in Internet access: while practically every citizen of a developed country would soon have Internet access, the access percentage in an under-developed country could be abysmally low. According to a recent estimate, only 7% of the human race has Internet access.

It is feared (Norris, 2001) that this wide gap between the information rich and poor will actually exacerbate social tensions, not reduce them. It is also feared that this divide, caused by e-governance, will actually weaken democracy, not strengthen it. The counterview is that "the simple binary notion of technology haves and have not's doesn't quite compute" (Warschauer, 2003) and that the "divide is not caused by just physical hardware availability, but also by the ability to engage technologies" (Warschauer, 2004).

It does indeed seem that the early concerns on the digital divide are now receding. Computer hardware and networking costs continue to decline rapidly, and the growing usage of open standards in e-governance is also diminishing software costs. The availability of cheap mobile interfaces, and the growing geographical reach through wireless networking are also encouraging developments. So although the digital divide will not disappear, it does appear that this divide will be no deeper than the other divides that have always plagued human civilizations.

Loss of Privacy

At a recent seminar of Indian CIOs in Bangkok, one of the technology solution vendors surprised the audience by openly declaring that he was not a nice man to know because he did a lot of nasty things: for example, buy up the old laptop computer that the CIO had recently sold after formatting its hard disk. "I can recover every byte on that computer using special software tools … and then threaten to publish all your valuable data," he said only half in jest.

E-governance indeed poses a very serious threat to a citizen's privacy. For example, software for tracking a voter's preference would give a political party the sort of inputs it needs to win the next election. The e-governance tool that uses a sophisticated GIS-based software to track down criminals could just as easily be used to blackmail an innocent citizen—and things would become even easier when RFIDs start flooding the marketplace! The infrastructure created for e-governance implementations can also facilitate serious sexual misconduct on the Web.

We already see minor privacy invasions: mobile phone operators, for instance, cheerfully sell customer databases to banks and market research agencies without the customer's permission! While the menace can be partly countered by better security implementations, and by legislating more punitive legal measures to counter cyber crimes (Sinha & Condon, 2005), it does look as though, with e-governance, citizens are doomed to suffer at least a certain loss of privacy forever.

How to Address E-Governance Concerns

In a very detailed appraisal of e-governance implementations worldwide ("eGovernment for development," 2004), the "eGovernment for

Development Information Exchange" project, coordinated by the University of Manchester's Institute for Development Policy and Management, has identified the "enablers" and "constraints" for every individual case study. In Tables 8 and 9, we summarize the major e-governance enablers and constraints. In Table 10, we run through the major recommendations retrieved from this study.

E-GOVERNANCE CASE STUDIES

We will look at e-governance case studies drawn from different parts of the world. The case studies highlight the many phases in an e-governance implementation. A very large number of case studies are available on the WWW; see, for example, UN Public Administration compilations ("UNPAN: Virtual Library ..", 2006) or the collection put together by the University of Manchester's Institute for Development Policy and Management ("eGovernment for development," 2004).

Citizen's Web Portal in Estonia

Every citizen in Estonia, as indeed in many other parts of Europe, has the right to know the information stored about him on the government's official databases. Typical queries could be: "give me my data from the population register," or "show me my entries in the motor vehicles register." This service had to be offered to each of Estonia's 1.4 million citizens.

Estonia, therefore, created its special citizens' Web portal (Kalja & Ott, 2004) with standard database services, at a cost of about a million euros. This service, which became fully operational by 2002, offered access to about a hundred government databases. Interactions with some of these databases could be intense and frequent; each of the 10 most popular databases recorded a few thousand hits daily. This portal could be accessed both by the citizens and the authorized civil servants.

Table 8. Enablers of e-governance

Enabler	Remarks
Champion	Someone in the enterprise, preferably the CEO himself or one of his trusted advisers, must aggressively support e-governance and facilitate its implementation
Political will	Things become a lot simpler if the political leadership shows its willingness and keenness to usher in e-governance
Funding	The timely availability of the requisite funds is a big advantage
Frequent awareness and promotion campaigns	Many of the human mindset problems can be overcome this way
Continuous training	Even after the e-governance solution is put in place, training must continue on a regular basis
User acceptance	Start with e-governance applications offering win-win option for both the employee and the enterprise
User pressure	Once a user feels empowered by e-governance, he will ask for more
Correct location	A location with the right mix of resources is a better enabler; for example, Bangalore in India is better than Dhaka in Bangladesh
Government-citizen partnership	If both the government and the citizen perceive a shared stake in e-governance, both cooperate to make it happen. If the government fails to involve the citizen, it is less likely to work.

Table 9. E-governance constraints

Constraint	Remarks
Lack of leadership	An e-governance project without a champion, and without strong government support may not succeed
Scale	A big vision is desirable, but scales must be manageable and grow incrementally. Goals should not be overambitious
Technology availability	Projects launched without sufficient infrastructure, or using the wrong technology, tend to fail
Legislation	Even the best e-governance solution cannot be successful without supporting legislative action, for example, to permit business process reengineering
Political interference	A feud between rival political parties may hurt e-governance plans
Official disinterest	Officials will scuttle e-governance if they fear a loss of power or opportunity; a video conferencing initiative in Africa failed because officials thought it would deny them opportunities for foreign jaunts
Hostile work conditions	Implementations are not likely to succeed if work conditions are inimical
Apathy or resistance	If the participants are not excited by e-governance, or are illiterate, it will not work
Poor research	If the e-governance solution is poorly designed, it will fail far too often.

Table 10. E-governance recommendations

• Get the technology right	• Provide intensive training
• Start small	• Use a phased approach
• Match e-governance to organizational reality	• Look for 'win-win' situations
• Encourage transparency	• Undertake risk management

The challenge in this relatively simple e-governance project was to ensure that the data was *secure* and *comprehensive*. To authenticate users, the portal required citizens to either log in using their ID-card, or ride on the authentication service of the country's commercial banks (this ensured access to about 75% of the citizens). Another highlight of this project was the use of open architectures to create the portal.

The project has been quite successful and triggered off other similar citizen friendly services. This project is likely to be replicated in neighboring Latvia and Lithuania.

E-Procurement in Brazil

Brazil's federal government set up an e-procurement system called COMPRASNET around 2000. Two years later, more than 1,000 federal government purchase units used this Web-based system for online quoting and reverse auction commodity purchases.

The procedure was rather simple. Every department of the federal government was required to post the specifications of its required purchase online. If the value of the commodity was relatively low, the federal procurement officer opted

for online quoting; for higher value purchases he recommended the reverse auction procedure.

In a review of this system, Marcos Ozorio de Almeida (2002) notes: "COMPRASNET was introduced to automate the procurement process. The aim of the automation was to make the procurement process uniform without centralizing the buying process of the federal organizations. It was also intended to reduce procurement costs and give more transparency to the process. Other aims were to increase the number of government suppliers, reduce participation cost for these suppliers, and increase competition among suppliers to reduce costs and improve the quality of goods or services acquired."

The COMPRASNET system was rated to be "largely successful." In its first 2 years it recovered about 30% of its investment cost, chiefly because it achieved an average reduction of about 20% in the cost of goods or services. Procurement times were substantially reduced; in typical cases, the time came down from 2 months to 15 days. The project was a success because it was backed by "political will inside the government" and the "external pressures" from the suppliers for a fair playing ground. The project also benefited because "it got the technology right," "provided intense training," and "adopted a phased approach." The idea of using the Web for a reverse auction, to

Table 11. Citizen's portal in Estonia

Attribute	Details
Why?	To guarantee the right to information to every Estonian citizen.
Who gains?	The citizen and the civil servant in Estonia, because both can quickly and securely access official records. The State, because its records get digitized.
Technology inputs	Open standards with internationally accepted protocols. The alpha version used XML RPC. The final version uses SOAP.
Lesson	Web technology could be used to offer citizens an information service that was practically free. The quality of data could be improved because citizens e-mailed corrections. There were some problems because suitable legislation did not precede the project implementation.
E-governance phase	"Inform"

Table 12. E-procurement by Brazil's federal government

Attribute	Details
Why?	Automate procurement process, make it more transparent and uniform, reduce procurement costs, speed up procurement, increase pool of suppliers.
Who gains?	The Brazilian federal government because of reduced costs, improved quality, and faster procurement. The suppliers because of better opportunity and a more level playing field.
Technology inputs	Classical client-server architecture with Windows-based servers and clients, Web application services, and application software from Vesta Business Services Suite
Lesson	Even a relatively simple e-governance implementation improves efficiency, increases profits, empowers suppliers, and builds goodwill for the federal government.
E-governance phase	"Inform" and "interact"

whittle down prices, was also sufficiently innovative (Joia & Zamot, 2002).

eChoupal to Empower Indian Farmers

In Indian agriculture, the farmer often benefits the least although he does the most work and takes the biggest risks. The farmer is obliged to sell his produce at the village marketplace for ridiculously low prices to "middlemen"; these middlemen, who have better storage, transport, and marketing resources, often go on to make big profits.

The eChoupal software (Annamalai & Rao, 2003), from ITC, electronically recreates the village meeting place—where farmers meet to discuss crop prospects and selling rates—by positioning computers in the village with Internet connectivity. At these kiosks, often located in the house of the educated village head, farmers can order seeds, fertilizer, and other products at prices lower than those available with the village trader. They also obtain information about new farming techniques.

This e-governance project, which started gathering steam by 2003, has reached thousands of villages and helped millions of farmers. Although it started off as a project to "inform" the farmer, and help him in his trade "interactions," eChoupal is now acquiring a community center character by also advising farmers on health and creating e-learning portals for farmer education. The project should receive a significant fillip when wireless connectivity becomes more widespread.

Beijing's Business E-Park

The Zhongguancun Science Park was established in Beijing in 1988 following China's decision to open its economy to the outside world. By 2000, there were 6,000 business houses operating out of the Science Park, including international giants such as IBM, Microsoft, and Motorola.

Managing all these business establishments was proving to be very difficult because of diverse administrative procedures and workflows, a large number of approving and monitoring government departments, and long operational lead times. These business establishments contributed $12 billion in revenue and $200 million in foreign investment, so it was essential not to lose goodwill.

In 2000, therefore, the Chinese government set up the Zhongguancun E-Park as a pilot project to improve the efficiency and responsiveness of the Government (Lin, Zhu, & Hachigian, 2006).

Table 13. The eChoupal project for the Indian farmer

Attribute	Details
Why?	Empower the Indian farmer by educating him about good agricultural practices and enabling him to sell his produce at more attractive prices.
Who gains?	The Indian farmer and ITC who run eChoupal. ITC's investments allowed it to replace the old "middlemen" and profit from commercial transactions. It is a win-win for both.
Technology inputs	Computers with Internet connectivity; the best results were achieved using the VSAT technology.
Lesson	E-governance can be successful even in the sparsely networked Indian countryside. The project succeeded because it was visionary and ITC had the financial muscle to push it through. The project illustrates how human mindsets can indeed be changed.
E-governance phase	"Inform" and "interact"

Table 14. Beijing's Zhongguancun E-Park

Attribute	Details
Why?	It was becoming very difficult to manage the operations of the 6,000 business establishments in the Zhongguancun Science Park. These businesses brought in valuable revenue and investments.
Who gains?	The business establishments because of efficient and streamlined governance. The Chinese government because of better trade and positive goodwill.
Technology inputs	A conventional Web-faced solution by Beijing Beauty Beard Ltd. with enhanced security and workflow management systems. Major investments in hardware, fiber, and application software.
Lesson	E-governance brings about a dramatic increase in efficiency, revenue, and goodwill, but it is important to manage mindsets and legal bottlenecks. Legislation must be in step with implementation.
E-governance phase	"Inform," "interact," and "transact."

Over 30 G2B and G2C functions such as "apply for license," "submit tax reports," or "file monthly statements" were introduced in a comprehensive software solution that had modules for e-application, e-registration, e-reporting, e-administration, and e-consulting. The solution also contained "reminder routines" and options to monitor the workflow progress online.

The Zhongguancun E-Park initiative has been very successful. Ninety percent of the application and approval procedures are now performed online, with as many as 4,400 companies actively interacting with the e-governance system. Application filing can now be completed in 3 days, instead of 15 days. The number of visits to complete the application filing is down from a dozen or more to just one. In fact, the Mayor of Beijing has gone on record to say that *all* administrative procedures in Beijing will be converted to this E-Park model by 2010.

The chief difficulty involved in this $1.5 million implementation was the unwillingness of officials to accept this e-governance solution because of a decrease in their power and autonomy. There were also several legal hurdles encountered during the process. Continuous and intensive training was very useful. An attractive spin-off is that there are now no traffic jams around Beijing's government establishments since most of the activity happens online!

Electronic Reservation in Indian Railways

The Indian Railways use 7,000 passenger trains to carry 5 billion train passengers every year across a network spanning 63,000 km and 7,000 railway stations. Because of overcrowding and long journey times, the recommended procedure is to board an Indian train only after prior reservation.

While software solutions to manage train reservations were implemented over a decade ago, the procedure still required the passenger *to physically visit* a reservation booth to make his booking and payment. From 2003 or so, however, a comprehensive online booking system is now operational.

The new procedure seeks the passenger's travel details, offers an interactive session to verify seat availability online, and eventually prepares a travel bill with the option to connect to the passenger's preferred bank. An electronic

Table 15. Summary of e-governance initiative for Indian Railway ticket reservation

Attribute	Details
Why?	Indian Railways only have about 3,000 automated reservation counters. These counters are always crowded and expensive to manage.
Who gains?	(a) Every passenger using Indian Railways. (b) Indian Railways, because it can manage its business processes much more efficiently, offer its customers a 24x7 service, and eventually downsize its expensive reservation counters to smaller kiosks.
Technology inputs	Conventional interactive Web architecture with the provision to link the disparate railway and bank databases.
Lesson	Political pressure required the Indian Railways to innovate almost 15 years ago. Now user pressure and user acceptance ensures that there is no going back.
E-governance phase	"Inform," "interact," "transact," and fledgling elements of "transform"

payment is made using a secure connection and the passenger either has the option of printing an e-ticket or receiving the ticket by courier.

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