Using Actor-Network Theory to Analyze E-Government Implementation in Developing Countries

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Abstract

The implementation issues leading to successful application of information and communication technologies (ICT) is a well-researched area in the information systems literature. But there is little research work of this nature that is theoretically based and undertaken in the field of development informatics/ICT4D. Within this field, an important focus for any theoretically based study could be successful application of ICT in the public sector. This focus is taken in this paper because e-government is regarded by international financing institutions as a core component of the public sector reform programs that are currently reinventing government in developing countries. It is believed that key goals of the good governance agenda—increased efficiency, improved resource management, and increased accountability—will be engendered by the application of ICT. This paper presents actor-network theory (ANT) as a framework for understanding the processes of implementing e-government in developing countries. Drawing particularly on the work of Michel Callon and John Law, it applies this theory to a longitudinal study of the public expenditure management information systems supporting the fiscal reform program in Sri Lanka. Specific findings about the global and local networks that have shaped this set of e-government applications are presented. The conclusion is drawn that the application of ICT is an inherently political process and that a successful outcome requires continuous incremental action and improvisation to address the ongoing issues as they emerge. The paper identifies operational challenges in applying ANT that can be overcome by taking a more comprehensive analytical approach. Overall, ANT is seen as having a potentially wide area of application and being a promising theoretical vehicle for development informatics research.

Actor-network theory (ANT) is introduced in this paper through the mechanism of the telling of a story. This is not a heroic episode, as in so much of ANT. Rather it tells of the unfolding of an innovation process, in fits and starts, with successes and failures, over an extended period.

The backdrop is the public sector reform program in a developing country, which is an unusual setting for an ANT history. The story is of the e-government program being implemented by a ministry of finance (MoF) with the assistance of international financing institutions, and of the many heterogeneous entities that became involved, through global and local networks, in this political and contentious process.

The first section provides the context and the research problem: good governance has become an increasingly important facet of the public sec-

tor reform agenda in developing countries, and e-government programs, such as this one, are being recognized as contributing to improvements in governance. The successful implementation of e-government projects is important and we need to understand the processes through which such projects are being implemented and succeed.

The second section introduces the theory: ANT is presented in outline through Callon's (1986) translation model of power and through the later network analysis model devised by Law and Callon (1992). The third section tells the story of public expenditure management information systems in Sri Lanka. It describes the setting of the study and how the research was conducted. The history of the information systems is presented over a ten-year period from an actor-network perspective, drawing on both of the ANT models presented in the previous section.

Finally, the findings are discussed and conclusions drawn from this application of ANT. These are presented in line with the main thrust of published critiques as the theory has progressively developed over the past thirty years—and in the recognition that there is still considerable scope available to researchers to develop the actor-network perspective further in the field of development informatics.

E-Government Investment as a Development Issue

Public Sector Reform, Good Governance, and ICT

In 1992 the World Bank convened a task force that defined governance as "the manner in which power is exercised in the management of a country's economic and social resources for development" and "good governance" in a developing country as synonymous with "sound development management" (World Bank 1992). Four areas of interest were defined: public sector management, accountability, the legal framework for development, and information and transparency. Not surprisingly, these emphasize the aspects of government affecting economic development, in line with the World Bank's own charter.

The focus on good governance has continued over the last decade with the series of strategy documents, coordinated by the OECD, that developed the international development targets negotiated and agreed at the United Nations conferences of the 1990s explicitly recognizing the importance of effective governance. In 2001, the U.K. Department for International Development argued, "The quality of governance is critical to the achievement of the Millennium Development Goals" and asserted that, where progress on achievement of the targets has been made, it reflects a parallel improvement in the quality of governance (DFID 2001).

The international financing institutions (IFIs) such as the World Bank and Asian/African/Inter-American Development Banks are currently focusing on the notion of institutional deficit as their primary area of interest under the good governance agenda. However, policy prescriptions for good governance attached to public sector reform programs supported by the IFIs need to be examined cautiously because, although they are bound to have an effect, it is difficult to predict the precise nature of this impact on the complex network of political and organizational processes within any government structure.

This is particularly true in the area of e-government: the sociotechnical arena within which information and communication technologies (ICT) are being applied to support reform of the public sector in developing countries. The IFIs are invariably focusing their attention on e-government as an integral part of a neoliberal reform agenda, which, in the 1990s, became focused on the principles for reinvention of government elicited in Osborne and Gaebler's seminal work (1992). The typical components of a public sector reform program thus chime with the IFI view of good governance: increased efficiency, improved resource management, increased accountability, decentralization, and marketization. Information systems are considered to be central to the first three components of this performance improvement effort and ICT has been identified as "the key to the reinvention and indeed to the reinvigoration of public administration" (Bellamy and Taylor 1994).

The recent literature on e-government in developing countries has identified three broad research issues that draw from this background. The first explores the broad area of the changing role of government under the reinventing government agenda, the growing importance of governance, and how these evolving government activities are being supported by ICT because "in pursuing the democratic/political processes, in managing resources, executing

functions, measuring performance and in service delivery, information is the basic ingredient" (Isaac-Henry 1997).

The second concerns the fit of ICT to the cultural environment in which the e-government initiative is being enacted. Avgerou and Walsham (2000) argue that the design and implementation of ICT projects in developing countries must be able to address the specific contextual characteristics of the organization, sector, country, and region. E-government practitioners and researchers must therefore aim to identify and support alternative identities in appropriate ways, not try to suppress cultural diversity.

The third focuses on the challenges being faced in the successful delivery of e-government projects. In general, "successful applications of ICTs in developing country contexts are admittedly still rare" (Krishna and Madon 2003), and this is particularly so in the public sector. Hence, alongside examples of successful e-government projects (e.g., Talero and Gaudette 1995) are also ones that did not fulfil their initial promise (e.g., Anonymous 2002; Jackson 2002). This paper is situated in the third area of research interest.

Failure and Success of E-Government Initiatives in Developing Countries

It is a poorly kept secret in the computer industry that information systems are more likely to fail than succeed. Surveys in industrialized countries suggest that less than one-third of projects are successfully delivered on time, on budget, and fully meeting user requirements. The evidence base is not strong in developing countries, but it all points toward at least equal problems. We can estimate that perhaps one-third of ICT initiatives in developing countries are total failures, and a further one-half are partial failures (Heeks 2002, 2003).

The failure of an e-government project in a developing country is a real and practical problem. First, because of the opportunity cost of the investment, particularly the outlay of scarce resources of capital and skilled labor. Second, because, where the IFIs are advocating an information systems project as part of a public sector reform program, failure or partial failure can undermine the whole program in part because of a negative effect on the image of the government implementing the initiative. Their credit rating with the IFIs can be adversely affected and their reputation for good governance dimin-

ished. It is therefore vitally important to examine the reasons for failure and success of e-government initiatives in developing countries.

Discussion of the obstacles to successful implementation is a theme in the information systems literature (e.g., Lyytinen and Hirschheim 1987; Sauer 1999). One strand of this analysis (e.g., Myers 1994) provides an insight into the processes of failed projects by particularly focusing on the interplay between people and technology. This emphasis seems likely to be appropriate for exploring the rather messy sociotechnical world of e-government in developing countries.

As an example, we can look at the interplay between people and technology through definitions of e-government. E-government is defined in many ways, but its definitions and the accompanying discourse provide us with insights into the limited sense in which the public sector reform goals of e-government are conceived by many of the major stakeholders. We can illustrate this by reflecting on the discussion at a national e-government conference in Sri Lanka at which the guest speaker from the World Bank, in his keynote address opening the proceedings, proposed adoption of the following definition of e-government: "E-government is a way of organizing public management in order to increase efficiency, transparency, accessibility and responsiveness to citizens through the intensive and strategic use of information and communication technologies in the inner management of the public sector (intra and inter governmental relations) as well as in its daily relations with citizens and users of public services" (Braga 2003).

Following some summary debate, though, this emphasis on public sector reform and on linking ICTs to good governance was then lost. These issues were effectively sidelined for the rest of the conference as the delegates to the conference (politicians, civil servants, consultants and computer suppliers) engaged in a lengthy examination of the technology inputs and outputs of e-government programs.

The interplay of the various actors at that e-government conference will hold no surprises for those working with ICT and e-government in developing countries. The parties enacting an e-government program—the ministers sponsoring the initiative, the government IT department, the ICT suppliers, the consultants, the public sector users—currently regard the projects primarily in terms of

technological achievement rather than application and function. Only the development planners and theorists voice their concerns that the focus should be more on the public value and returns provided by these technological investments.

This brief example supports the idea that some form of socio-technical perspective will be appropriate for analyzing e-government in development: one that helps understand how exactly the interplay of the social and the technical takes place and also what can be done in practical terms during design and implementation processes to reduce the chances of failure. We could choose a contextualized factoral model to achieve this (e.g., Heeks 2006), but here, instead, we select a rather deeper basis for understanding relations between people and technology—ANT—applied to the question of what causes e-government implementations in developing countries to succeed or fail.

ANT

Outline of ANT

To address our research question, we will turn to the field of science and technology studies that has developed conceptual constructs to deal with the processes through which technologies are developed and influence societies. This is a multidisciplinary field with a relatively short history, but, unlike the field of information systems, the writers have devoted most of their endeavors to theoretical and explanatory studies, without assuming an intellectual responsibility for guiding professional practice.

Science and technology studies writers have explored the question of integrating technology into social theory. They have variously tried to alternate between content and context to explain the influence of technology on society and vice versa through the mechanism of detailed documentation of the development of an innovation. Jenkins' story (1975) of the simultaneous invention of the Kodak camera and the mass market for amateur photography and Hughes' history (1979) of the social battles involved in the building of the U.S. electricity supply system are early classic studies.

In this paper, the framework for analysis is a well-known theory from within the science and technology field: ANT. Together with social construction of technology theory, ANT is a later variant of science and technology studies that takes an interpretive

stance. It has been selected for a number of reasons. First, it is well established and there is an important hinterland of work explaining, critiquing, developing, and applying the theory. Second, it has been comparatively stable, with later presentations building on the original theory, probably because the theory is "owned" by a relatively small group of writers. Third, it overcomes some important limitations of the technologically deterministic "ICT as an enabler" perspective taken by some management literature. ANT can thus be presented as a complementary approach to information system studies, which have also largely avoided technologically deterministic hypotheses of causality between ICT innovation and particular organizational or societal effects.

Concepts

ANT will now be summarized. In presenting such work, it would be the norm to start with a definition of key terms, but ANT has a dense language that is an integral part of the theory and must be placed in context (Latour 1988; Callon and Law 1989; Callon 1991; Akrich and Latour 1992). We will therefore present the theory and the definitions together.

The "actor-network" as a concept was developed by Michel Callon, Bruno Latour, and John Law during the course of the 1980s as a recognition that actors build networks combining technical and social elements and that the elements of these networks, including those entrepreneurs who have engineered the network, are, at the same time, both constituted and shaped within those networks.

The position of machines in ANT is unique. It is recognized that technologies do not evolve under the impetus of scientific logic as technological determinism suggests: they are not possessed of an inherent momentum that allows them, as Latour (1987) describes it, to pass through a neutral social medium. In effect, "our technologies mirror our societies" (Bijker and Law 1992) as they are continuously shaped and reshaped by the interplay of a range of heterogeneous forces within the networks. Machines are as much actors in the networks as are the humans.

Actors define the relationships between each other by intermediaries: an actor authors an intermediary and often inscribes social meaning into it. Intermediaries both describe their networks and

compose them by giving them form (Callon 1991). They are usually found in the form of texts, technical artifacts, monies, or human skills.

ANT writers typically develop their arguments in an empirical context: the stories of the hotel room key (Latour 1991) and the Portuguese sixteenth-century circumnavigators of the globe (Law 1987) are particularly memorable. Room keys aside, the tales tend to be heroic. Agency is a precarious achievement: many stories tell how it is that actors more or less, and for a period only, manage to constitute themselves and their networks. ANT treats the world as a set of related bits and pieces and there is no social order. There are only endless attempts at ordering through the formation and stabilization of networks.

The process of building and changing networks is necessarily political in nature. Actors put forward favored solutions and contest these. By enrolling allies, they are able to mobilize the resources to sustain commitment for the new network. A strongly aligned and coordinated network would be a kind of Tower of Babel: "Everyone would speak their own language, but everyone else would understand them" (Callon 1991). Convergent networks of this kind, however, develop only after long periods of intense effort and investment.

By telling stories and tracing histories rather than taking snapshots, ANT proves itself as "a pragmatic, recursive sociology of process with an interest in the uncertain processes that generate power and size" (Law 1999). Understanding power relationships in ANT means describing the way in which actors are defined, associated, and obliged to remain faithful to their alliances.

Power and Translation

The dictionary definition of "power" concentrates almost entirely on authority and its various permutations: the ability to exercise "power over." In such a diffusion model of power, a successful command moves under an impetus given to it by a central source. The ANT theorists contend that social scientists must necessarily shift away from this model to understand power as a consequence and not as a cause of collective action.

For Latour (1986), the problem of power is encapsulated in the following paradox: when you simply have power—*in potentia*—nothing happens and you are powerless; when you exert power—*in*

actu—others are performing the action and not you. Power over something is a composition that is made by many and attributed to one. The notion of "power" is a convenient way to summarize the consequence of a collective action, but it cannot explain what holds the collective action in place: "this pliable and empty term" can be used as an effect, but never as a cause.

The translation model of power (Callon 1986) presents a successful command as resulting from the actions of a chain of agents, each of whom translates or shapes it according to their own objectives. Those who are powerful are not those who hold power in principle but those who practically define or redefine what holds everyone together. This shift from principle to practice allows the vague notion of power to be treated not as a cause of people's behavior but as a consequence of an intense activity of enrolling, convincing and enlisting.

The analysis of stories in ANT leads to a better understanding of the establishment and the evolution of power relationships, because all the fluctuations that occur are preserved in these histories. In ANT, translation is the mechanism by which the networks progressively take form, resulting in a situation where certain entities control others.

The repertoire of translation is not designed to give only a symmetrical description of a complex process that constantly mixes together a variety of human and nonhuman entities. It also permits an explanation of how a few obtain the right to express and to represent the many silent actors they have mobilized. To translate is to displace, but it is also to express in one's own language what others say and want: it is to establish oneself as a spokesperson.

We will examine Callon's (1986) seminal paper on the history of the scallop fishermen of Saint Brieuc Bay in France as it presents, in a concise form, an important approach to social analysis and the study of power that emphasizes the processes of displacement, transformation and translation. In Callon's story, a scientific and economic controversy is described about the causes of the decline of scallops *(pecten maximus)* in Saint Brieuc Bay and the efforts of three marine biologists to develop a conservation strategy. The researchers sought to become indispensable by defining the problem and instituting a research program of investigation. They
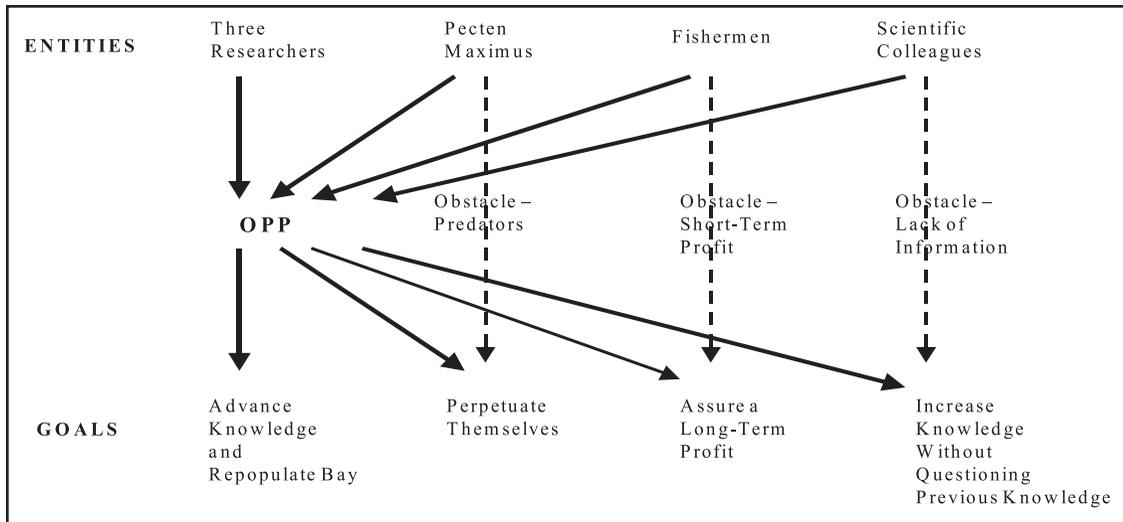
Figure 1. Translation in action (Callon 1986).

successfully locked the other actors into their strategy, enrolled them and became their spokesperson.

The four "moments of translation" in this story are

- "Problematization"—the principal actors (the researchers) make themselves indispensable to the other entities (fishermen, scientific community, scallops) by defining the nature of the problem and forcing the others to accept a way forward (the research program);

- "Interessement"—the principal actors lock the others into place by interposing themselves and defining the linkages between the others (the research program becomes the recognized obligatory point of passage between the global and the local);

- "Enrollment"—the principal actors define the roles that are to be played and the way in which the others will relate to one another within these networks; and

- "Mobilization"—the principal actors borrow the force of their passive agent allies and turn themselves into their representatives or spokespeople.

The researchers were able to construct a *global network* of relations between themselves and others—and between the others—that generated a space, a period of time and a set of resources in which innovation (the research program) took place.

Within the space provided by this global network, a *local network* of heterogeneous actors dedicated themselves to the successful production of a working device (the construction of concrete pillars) to protect the scallops and ensure their continued breeding in Saint Brieuc Bay.

The goals of the research program were to advance scientific knowledge and to conserve the scallops. The scientific community were conscious that they had little direct relevant information to contribute but were prepared to support the research once it became clear that it would build on and not question current knowledge. Likewise, the fishermen were only enrolled when they realized that they could achieve profits in the long run even though there was little gain for them in the short term as they could not collect scallops until the new breeding program, in beds protected by the concrete pillars, proved successful.

By successfully addressing the current obstacles and future goals of the various entities, the researchers managed to establish themselves as *an obligatory point of passage* (OPP) to control all transactions between the global and the local network, as illustrated in Figure 1.

Network Analysis

In their later work, Callon and Law (1989) suggest that the notions of society and technology as context and content that had been commonly used in

science and technology studies lead to oversimplified arguments over whether society affects technology or vice versa. This can be transcended if the analysis of the many heterogeneous actors in a network (human and nonhuman) is treated as a balancing act where these various elements are juxtaposed so that the complex processes of forming sociotechnical entities can be examined without a deterministic bias.

They analyzed the actions of the various heterogeneous actors that came together in global and local networks to design the TSR2 military aircraft (Law and Callon 1992) and, through this story, developed a network analysis model in an attempt to address the old context/content issues. The history of the evolution (and eventual demise) of the TSR2 was told and the stance of each of the groups of actors (the stakeholders) mapped against the evolving shape of the technical design(s). It was noted in the analysis that there was continual building and rebuilding of the two networks with seepage between the global and local networks at various stages in the project. Actors in the global network were able to interfere with the structure and shape of the local network when the obligatory point of passage was weakened, and those in the local networks were able to consult directly with actors in the global network.

The actors in the global network were heterogeneous: there were the institutional actors and a number of influential individuals, but, in addition, there were, for example, geopolitical forces (the interest of political leaders), technology diffusions, and civil society movements (antiwar protests). At the local network level, too, the actors were heterogeneous: for example, private sector contractors, public sector officers, investments in computer hardware and software, design documents, and reports.

Law and Callon contend that, if the elements that make up the networks are heterogeneous, the extent to which a project can control its two networks and the way in which they relate are problematic. It is the degree and form of mobilization of the networks and the way in which they are connected that determines the success of a project in reaching its set goals. The obligatory point of passage between the global and the local is crucial in this regard.

It is possible to plot over time the various stages in the design and implementation of any project (Figure 2) on a two-dimensional graph where the *x* axis measures the degree of mobilization of local actors (control over the local network) and the *y* axis the extent to which global actors are linked (control over the global network). The translation trajectory is thus described as the global and local networks progressively form, stabilize and reform, resulting at times in certain entities controlling others and acting as their spokesperson when an active process of enrolling and enlisting has been successful, as occurred in the scallop research program depicted in Figure 1.

Analyzing E-Government Implementation in Sri Lanka from an Actor-Network Perspective

Details of the Case Study

Having identified successful project implementation as an important analytical issue for e-government research in developing countries and ANT as a potentially relevant explanatory theory, we now move on to apply the model to one particular area of the public sector reform agenda being advocated by the international financing institutions.

There is widespread acknowledgment that reforms of the fiscal system are required to improve the low level of accountability and transparency at state level in many developing countries. Best practice guidebooks on "how to do it" are published by the IFIs. These urge the establishment of national fiscal objectives and require the ministries of finance to

Ensure *aggregate fiscal discipline.* In the face of competing demands for limited financial resources, it is essential to be able to maintain controls over aggregate expenditure in the medium term.

Facilitate *strategic prioritisation* of expenditures across programmes and projects. Within the overall resource availability, allocate resources in accordance with policy and social priorities.

Encourage *technical efficiency* in the use of budget resources. Once allocated, ensure that resources are used effectively and efficiently. (DFID 2001)

A sound financial management system allows a government to make the best use of available resources based on these three fiscal objectives, but fiscal re-
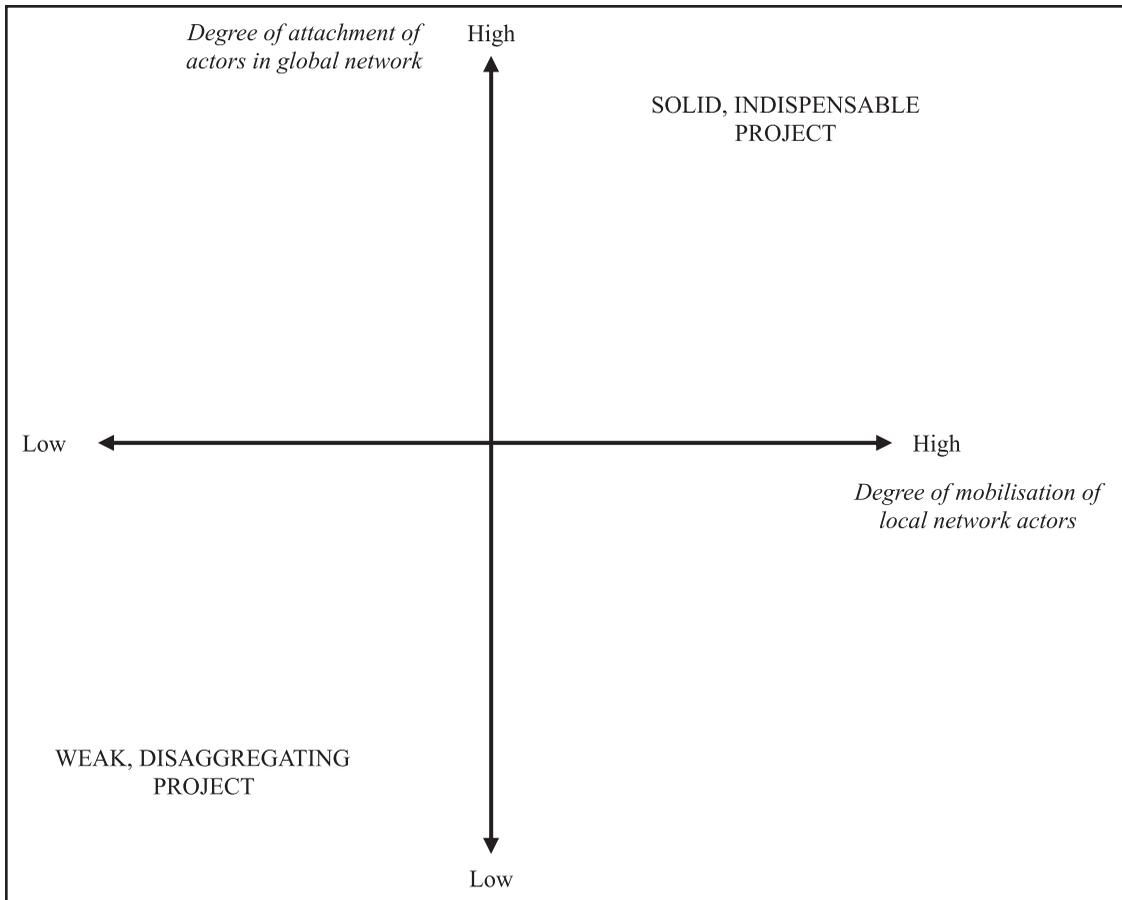
*Degree of attachment of
actors in global network*   High

SOLID, INDISPENSABLE
PROJECT

Low ←→ High

*Degree of mobilisation of
local network actors*

WEAK, DISAGGREGATING
PROJECT

Low

Figure 2. Mobilization of local and global networks (Law and Callon 1992).

form is usually approached in terms of technical measures such as a revised budget classification or computerization and the results have "often been disappointing" (DFID 2001). It has to be recognized that fiscal discipline needs political commitment: resource allocation is primarily a political process, so any reform effort needs to strengthen government commitment by fostering collective responsibility for the budget and for its implementation.

Collective decision making needs good quality information: to prepare for decision making by providing data and analysis, to accurately record the decisions taken, and to ensure that the spending agencies act upon them. The need for a governmentwide, integrated financial management information system (IFMIS) has therefore been identified as a core component of any fiscal reform program (see, e.g., the World Bank's case as put by Campos and Pradhan [1996], that of the Asian Development

Bank in Schavio-Campo and Tommasi [1999], and that of the OECD in Allen and Tommasi [2001]).

Let us now move on to examine from an actor-network perspective a case study of an IFI-assisted fiscal reform program in Sri Lanka that was targeting the implementation of an IFMIS and of the public expenditure management (PEM) information systems that resulted over a ten-year period from 1996 through to 2005.

The author's involvement in the Sri Lanka fiscal reform program was active and recent when the research for this case study was carried out. She was a visiting specialist adviser to the Government of Sri Lanka and a member of the consultant team implementing one of the projects (from 2000 to 2003). As such, she was "on the ground" and able to record developments as they took place at one particular juncture in this reform program. She has had direct access to the various stakeholder groups and

Table 1. Classification by Function of the Key Human Stakeholder Groups

Group	Organization	Department	Designer	User
Government of Sri Lanka	Ministry of Finance	Leadership	+	+
		State accounts department	+	+
		National budget department	+ (from 2001)	+
		Other departments		+
	Other ministries	Line ministries		+
		Prime minister's office		+ (from 2002)
International financing institutions	Asian Development Bank	Head office	+ (until 2001)	
		National office	+	
	World Bank	Head office	+	
	Korean Aid Agency	Head office	+	
Suppliers	British consultants	International practice	+ (from 1997)	
	Local university	IT department	+ (from 1999)	
	International accounting firm	National practice	+ (from 2001)	
		International practice	+	
	Korean consultants	International practice	+ (from 2002)	
	Korean ICT supplier	Head office	+	
		National office	+	
Civil society	Institute of public finance			+
	Media			+

to relevant documentary evidence through this practitioner role.

A case study method was used to gather and analyze relevant data. The methods employed included the study of documentation available in the various international and local organizations involved, relevant published material, interviews, and observation. The extent to which these methods were used varied according to the period of investigation in the history of the information systems. The period from 2000 to 2003, when day-to-day access was available to the author, was based on direct observational evidence of actors, institutional context, and processes. Data for other periods was gathered more through interview and documentary analysis.

A background to Sri Lanka's fiscal reform program must first be provided and the actors identified. The key groups of human stakeholders in the PEM information systems are shown in Table 1. It is to be noted that the system designers and the groups of users in the ministries were not the only interested parties in these government financial information systems—senior public officials, the media, professional societies, and the IFIs were also stakeholders.

The History of the Setting

1996–99: Implementing a Governmentwide Accounting System

The history of PEM information systems started with a financial management training project that was funded by a grant from the Asian Development Bank (ADB) and implemented by the MoF from 1996 to 1998. The project consisted of two components focused respectively on the establishment of a government financial training center and on the pre-

liminary design for an integrated government accounting system. Work on the first component did not progress as expected and project funds were reallocated to the second.

The preliminary design for the accounting system prepared by British consultants was "adapted to the [Sri Lankan public sector] environment" by the leader of a small IT group in the MoF State Accounts Department (SAD) responsible for the budget execution function. Using the reallocated project funds, the in-house team developed a decentralized, government-wide computerized integrated government accounting system (CIGAS) designed to act as the data collection system for the central Treasury Accounting System (TAS), which had been operational in the SAD since the 1980s.

A user training program was developed and the CIGAS software was implemented in more than 2,000 government offices throughout the country. Although basic in functionality, the IT group leader judged that "CIGAS has proven a useful step on the way to computerisation." The low cost of the custom development by the in-house team, the ability to maintain the systems internally and the absence of incremental license costs were important factors in the success of the CIGAS implementation.

In parallel to this improvement in the accounting systems, the MoF outsourced to the IT department of a local university the development of a stand-alone budgeting system, using funds from a World Bank loan designed to combat the effects of the millennium bug (1997–99). This centralized system was for the use of the MoF National Budget Department (NBD), which had responsibility for the budget preparation function, with advice on the specification of the system being provided by the British consultants. It is perhaps surprising that the NBD did not seek the assistance of their MoF colleagues from the in-house SAD IT team in this development rather than outsourcing it. The rational explanation given is that the funding was being allocated from the World Bank loan and the procurement procedures required the MoF to let an external contract. Informal sources within the MoF suggested that the NBD wished "to own" the system and not "to share" it with its sister department, the SAD.

The British consultants strongly recommended a locally developed systems solution for the new budget system. Their team leader commented that "despite their obvious advantages, our experience with packaged solutions has generally not been good. We have found that, with modern databases, systems can be developed relatively quickly which can meet the specific needs of individual countries. We have [specified] custom developed budget and accounting systems in Bangladesh . . . and budget systems in Sri Lanka. These have been developed in Fox Pro and Microsoft Access and the [only] major problem is security" (Parry 1997).

Despite the budget system developed by the local University of Kelanin (UOK) being of limited functionality and simple design, it was only partially implemented in the NBD and was not used for data collection from the line ministries. This situation was attributed to a lack of technical computing knowledge within the NBD.

2000–01: Designing an Integrated Financial Management Information System

Once first-generation computerization had been achieved, based on the simple stand-alone cash accounting systems (CIGAS/TAS) deployed through all government agencies and supported by the MoF's IT unit, the ADB in the late 1990s urged the government to build upon this structure to implement a modern integrated financial management information system covering all aspects of budgeting, accounting, treasury, and debt management.

A consultancy report on the institutional modernization of the MoF in 1999 identified five departments with 700 staff responsible for the key elements of public expenditure management, and the ADB designed a cluster technical assistance project with each of the five interlinked components targeted at one of the implementing departments. To link these departments, it was intended that "a new computerised system will integrate all key financial management functions into a cohesive system on a common database" (ADB 1999).

The expectations of organizational transformation to be achieved through the IFMIS were extraordinarily high. The ADB's task manager reported (Wescott 2001, 11):

The Ministry has a vision of rebuilding itself into a high-performing organization. The vision is in part determined by the Permanent Secretary's previous job in the Central Bank, which is about to implement a re-organisation which will include a 50% cut-back on staff. A new implementation unit run according to private business practice will work with each department to help them re-organise

around the new systems being designed, thus avoiding the risks and expense of customising software. In the vision, the unit will grow larger and the ministry smaller over the long term. Such a model has been followed successfully in other finance ministries that have moved to integrated financial management systems, as a way to offer competitive compensation and an attractive working environment.

As a first step, the finance ministry, with the assistance of consultants from an international accounting firm, undertook a "public expenditure management systems" project from 2000 to 2003 under ADB grant funding. This was intended as the design and preparation phase of the IFMIS that would be implemented with the financial assistance of a follow-on loan from the ADB.

The ADB technical staff that designed the reform program based it on the theory that technology-led change is an efficient implementation mechanism. However, a number of harsh realities emerged when the strategy for the IFMIS development was mapped out by the international consultants and reported to the MoF at the end of year 1. The recommended IS strategy was to move quickly over a three-year period to international best practice in public expenditure management, based on state-of-the-art ICT and a packaged software solution. An overall investment of US$40 million was envisaged for the exercise with the recurrent cost for the maintenance of the IFMIS hardware and software estimated at over US$2 million per annum.

The MoF departments that would implement the IFMIS, however, were unsure of their role and of the incentives for them to adopt the procedural changes that would have to be made to accommodate these technology-led developments. Then, the MoF leadership, advised by the in-house IT unit, judged the cost of the envisaged system to be prohibitive and requested an urgent review of the project.

A crisis ensued and a senior ADB delegation was dispatched to Sri Lanka. The project was extensively redesigned during their two-week mission. The remaining grant resources were retargeted for the final two years of the project on introducing policy changes in the budgeting and accounting framework and the piloting of new and improved processes supported by less ambitious information systems. A strategy of improving the "functioning basics" rather than of implementing a "big bang"

technology rollout was adopted. Leadership of the project also changed: the ministry appointed a full-time project director, the ADB task manager was replaced, and the technical lead switched to the national office of the accounting firm.

2002–05: Improving Expenditure Management Policy, Procedures, and Systems

During 2002 and 2003, as planned under the redesign, the MoF progressively introduced a series of new budgeting and accounting policies and procedures. These were based on international best practice adapted to the Sri Lankan environment by three international advisers working with the national office of the accounting firm. They were supported by information systems developed by the IT practice of that accounting firm that built on rather than replaced the ministry's custom-developed systems. At the close of the public expenditure management systems project, a medium-term change program (the financial management reform program) was agreed to continue this reform effort that would progressively lead to the full adoption of international accounting standards. This was widely publicized by the ministry and the Institute of Public Finance and endorsed by the international financing institutions. One of the elements of the improvement program was to be an IFMIS.

So how did this reinstatement of the IFMIS as a key enabler of the overall objectives of the government's fiscal reform program take place? A simple answer would be that the ministry officials were now more familiar with and at ease with the technology. During the latter phase of the project, as a direct result of advice by the national consultants during the redesign of the inputs, a local area network was implemented in the MoF and Internet access provided to 300 staff. A Web-enabled integrated budget system (IBS) was built to support the new budget preparation and monitoring procedures and a governmentwide training program carried out. User-friendly evolutionary prototyping development techniques were employed by the national consultants to win the support of the potential users and open source software was used, so creating "a low-cost but leading edge solution" (Senanayake 2003). The NBD invested heavily in training its staff as the computerized support to the budget preparation procedures moved gradually

from the centralized UOK system to the decentralized IBS system.

The IBS was designed to interface with the CIGAS/TAS accounting systems and hence budget preparation and execution information was available to the MoF and line ministry users from one single source. A firm technology base for an IFMIS was thus put in place through the public expenditure management systems project.

A more complex answer to the question lies in the political environment in which the latter phase of the project was situated. A change of government in late 2001 brought to power a party with a neoliberal economic reform agenda and a prime minister who saw that "the future of Sri Lanka lay essentially in the service sector—in banking, finance, tourism, IT, call centres and so on" (Weerakoon 2004). Eight steering committees were formed to guide the economic reforms, of which one had a direct mandate covering the development of ICT in the country. Membership of these committees was mixed: top civil servants, senior managers from the private sector, and civil society representatives.

The MoF leadership was reconstituted with the change of government: a new ministerial team and a new permanent secretary. The latter shared his predecessor's view of the organizational transformation to be effected through the widespread use of ICT in the ministry. More crucially, he was a close colleague of the prime minister and shared his vision of replicating in Sri Lanka "the path-breaking achievements in Andhra Pradesh where . . . a most efficient and people-oriented government [is] heavily assisted by information and communication technology" (Weerakoon 2004). He had a seat on the steering committee with ICT development responsibilities, together with the leader of the national team of consultants working on the IBS, and strongly upheld the committee's objective of using the emerging e-government program to support growth in the national software industry.

The launch of the web-enabled IBS was engineered to coincide with both the first National E-Government Conference in Sri Lanka and a conference on international accounting standards organized by the Institute of Public Finance. When the minister of finance officially launched the web site at a ceremony in May 2003, he referred to the near revolutionary changes that were occurring in financial management administration in the public

sector through the use of ICT (*Sri Lanka Financial Times* 2003) and, shortly afterward, when the permanent secretary gave the opening address to the e-government conference, he boasted that the IBS was the first and only example to date of an interactive e-government application in Sri Lanka.

In 2002, the ADB commenced the design stage of a loan to continue the implementation of the streamlined budgeting and expenditure control procedures being piloted under the public expenditure management systems project, as well as substantive measures to improve the performance of the revenue administration. The design of this loan package, the fiscal management reform program that became effective in early 2005, included elements of the government's medium-term change program for expenditure control improvement. Crucially, the expenditure-management modules of an IFMIS were not to be covered by the ADB loan, only the revenue-management component.

In a parallel move to the ADB loan negotiation, the MoF had been discussing with the Korean bilateral aid program their offer to assist in the financing of the development and implementation of an IFMIS. In late 2003, after the close of the ADB grant-funded project, a team of consultants from Korea moved into the MoF to undertake a PEM information systems design study under bilateral grant funding. The resulting recommendation was to tailor the IFMIS that had recently been built by a national software supplier for the Korean government to the requirements of the Sri Lankan government, taking into account and building on as much as possible the IBS/CIGAS/TAS systems that were already in place. A bilateral credit line would be used to fund the necessary technical infrastructure, the tailoring of the software and a widespread training program.

The MoF leadership, drawing on technical advice from the World Bank, requested that the Korean consultants and software supplier pilot the system in the MoF and three line ministries prior to a decision being made on whether to adopt the recommended strategy. Up to the end of 2005, though, no decision on this had been taken and there was unease within the IFIs about the appropriateness of this approach to IS-enabled reform.

Application of Network Analysis
Law and Callon's (1992) network analysis model is a relevant framework for analyzing how the imple-

Figure 3. PEMS program network analysis (based on Law and Callon 1992).

mentation of a program or a project is managed to reach its goals. It has enabled a longitudinal mapping of the ten-year history of the PEM information systems, with the fluctuations of support from the global and local networks graphically illustrated. It shows clearly that withdrawal of sponsorship by both networks results in a crisis and a disaggregating, failed project whereas it is only through the active and mobilized support of both networks that project goals can be successfully met.

The translation trajectory of the reform program is mapped in Figure 3 using Law and Callon's network analysis model. This is followed by a description of the analysis and mapping process and then by an analysis of the technological trajectory of the PEM information systems (Table 2).

The program started in the center of the diagram

and climbed up the vertical axis as the MoF leadership and the IFIs agreed a mutually acceptable objective of improved public sector financial management based on international best practice (*A*) (see Figure 3). This was broadly translated, in information system terms, into the need for an IFMIS to improve fiscal accountability and transparency (*B*) and a global network was formed to move this objective forward.

The formation of the local network that led to the development of CIGAS within the financial management training project (*C*) effectively sidelined the global network. This movement down the vertical axis was strengthened when the MoF, supported by others in the local network, decided to go its own way with custom development of the budget system by the University of Kelanin (*D*).

Table 2. The Shaping of the PEM Information Systems (adapted from Law and Callon 1992)

Technological Trajectory	Stages in the network analysis		
	Interested Actors	Hostile Actors	Neutral Actors

1. CIGAS/TAS 1 Budget System
Decentralized data collection
Monthly centralized processing
	Stages A to D
	SAD
	  Central control
	  Ownership
	Line ministries
	  Incentives
			NBD
			Lack of technical staff

2. Package IFMIS
Standard solution
Real-time processing
High-speed communication network
Integrated systems
	Stages E to H
	MoF leadership
	  Organizational
	  transformation
	ADB
	  E-government
	  Good governance
	International suppliers
	  Best practice solution
		SAD [blocked]
		  Loss of control
		  High recurrent costs
		CIGAS
		  Superseded
		Other MoF departments [blocked]
		  Imposed from outside
		  Unknown procedural changes	

3. IBS/CIGAS/TAS
Web-enabled data collection
Centralized back-end processing
System interfaces
	Stages I and J
	NBD
	  Ownership
	  Support to policy and procedural
	  changes
	Line ministries
	  Incentives
	ICT steering committee
	  High-visibility system "made here"
		ADB
		  Internal perceptions
		  Reconfiguration of loan portfolio
			SAD
			Lack of direct influence
			CIGAS
			  Interface

Table 2. Continued

Technological Trajectory	Stages in the network analysis		
	Interested Actors	Hostile Actors	Neutral Actors
		Stage K	
4. Tailored IFMIS			
Real-time processing	MoF leadership	ADB and WB	
High-speed communication network	Full system integration	Fit to policy and procedural	
Tailored to Sri Lankan requirements	IBS and CIGAS	changes	
	Build on what is there		
	Korean aid agency		
	E-government export International		
	suppliers		
	Sole source project		

The global network was reconstructed when the decision was taken by visionaries in the MoF leadership and the ADB to transform the ministry through technology-led change (E). A project was delineated and a team of international consultants versed in international best practice appointed (F).

Attempts to construct a local network were ineffective, however. Local differences led the recommended IS strategy to be rejected (G). The removal of sponsorship of the project by the MoF leadership and the ADB led to a crisis (H) and a redefinition of the information system objectives that began the process of rebuilding the networks around somewhat different actors, goals, and interests.

As part of this rebuilding, a local network was formed (I) that developed the integrated budget system. This symbol of success contributed to the formal adoption of a financial management reform program by the MoF that included an IFMIS. The international financing institutions promised support (J). It was proposed that the expenditure management component of the IFMIS would be a tailored version based on the Korean model and the period under study ended with some skepticism in the global network that this would be an appropriate solution (K).

The translation trajectory of the reform program is plotted graphically in Figure 3 and, following Law and Callon's methodology, it is useful to compare this to the technological trajectory of the various PEM information systems (accounting, budgeting, and integrated systems) and map the changing position of each of the groups of actors against the evolving shape of the information systems (Table 2). The categorization of the actors as interested/hostile/neutral at each stage of the technical development of the systems, together with the identification of the drivers behind their behavior, is based on the qualitative data collected by the author as part of her research.

It can be seen that the technological trajectory of the reform program evolved in a contingent manner as a direct result of the interplay of the various actors within the networks that were formed. The behavior of the human actors was influenced by the other entities within the networks, including the technology itself.

For example, the CIGAS system was a low-cost, governmentwide application, owned by its developers in the MoF and its users in 2,000 offices across the country. Funded by an international financing in-

stitution and recognized as an important step on the road to computerization, the expectation inscribed within the software design was that it would be built upon by future system improvements rather than superseded. When the package IFMIS was proposed, it became clear that its design intentions were that the current data collection processes and the supporting system would have to change. CIGAS represented a decentralized approach to financial control that the MoF and the line ministries wanted to retain. The human actors in the local network therefore ensured—supported by the technology itself—that the technology was not displaced.

The IBS, likewise, became a symbol of success for the local network that developed it but also for the emerging Sri Lankan e-government program and the national software industry. Without the IBS, which was a local improvisation measure and an unintended consequence for the global network, the Korean IFMIS might well have been adopted without any piloting program and tailoring of the software to the specific needs of the government of Sri Lanka.

More Advanced Application of ANT
A more advanced level of analysis will now be undertaken that provides detail on how the lack of an obligatory point of passage between the global and local networks at certain junctures caused the success of the reform program to be questioned. This is based on the translation model of power, implicit within the network analysis of Law and Callon's work.

The network analysis model suggests that the success of each project in reaching the targets set for it (time, budget, output/innovation) crucially depends on the creation of an effective local network that operates independently of the global network. In the cases of the financial management training project and the public expenditure management systems project, the local networks that formed produced outputs that differed from those in the original project design agreed by the champions in the global network. These outputs (namely, the CIGAS and IBS systems) met the technical requirements of the developers and users in the local networks and the ministry officials judged each project as "successful," but the original project target outputs agreed by the MoF leadership with the ADB were not met.

So what power did the ADB have to ensure that

the public funds it was investing in the Sri Lankan fiscal reform program were being used for the development of appropriate PEM information systems? As described above, location within the formal organizational hierarchy (particularly the bureaucracy of national and international government) can provide certain stakeholder groups with their bases of power. For others, it can be their familiarity with the relevant technology and their ability to access—or to block the access of others to—needed information. A rating for each group of the human stakeholders of their "power over" the development of the PEM information systems is given in Table 3, on the basis of their position in the bureaucracy and their knowledge of technology, as drawn from the author's research findings. Note that some groups were analyzed as having no "power over."

In this case study, the translation process at the global level was effective in that the network successively generated periods of time and sets of resources—the projects—in which innovation took place. The local networks produced outputs within the overall timescale and budget of these projects, but the global network was unable to directly influence the shape of those PEM information systems: it had no "power over" the output. The implementation of an IFMIS, "the problematization" first agreed by the global network in 1996, still had not materialized ten years later.

As the translation model of power so clearly shows, power is always in relation to something or someone else. Those who are powerful are not those who hold power in principle (either bureaucratically or technically based) but those who practically define or redefine what holds the networks together. The "power to" enact through others is a social power experienced in relationship with others and is based on an intense activity of enrolling, convincing and enlisting.

On the public expenditure management systems project, for example, there were problems in forming a cohesive local network during year 1. The international consultants were attempting to lead the translation process and found opposition to "the problematization" set by the global network and inscripted in the intermediary of their terms of reference. They were relying on their technology-based knowledge to convince others to support the development process but their "power to" actively enlist the potential users and the PEMS systems into the

network was weak. Had a well-respected and senior program director been appointed from within the ranks of government to lead the formation of the local network and to act as the spokesperson for the project, "it might have been otherwise" (Star 1991).

There was no recognized single point of control for transactions between the global network and the local network identified in the project design, so, without a strong obligatory point of passage, the global network operated separately from the emerging local network in year 1. Figure 4 illustrates this problem graphically. Eventually, the two networks did come together in an unplanned and unexpected way when the information systems strategy was delivered, resulting in the redesign of the project and its information system goals having to be changed at short notice.

There are other interesting areas for consideration in this application of the translation model of power. For example, civil society groups, such as the Institute of Public Finance and the media, were identified as having no "power over" the shape of the PEM information systems in Table 3; However, once they were enrolled into the local network as potential users during the implementation phase (in the second and third years) of the public expenditure management systems project, they certainly had "power to" influence and to assure the success of the IBS.

Findings: the Contribution of Actor-Network Theory

What contribution, then, has analysis of this longitudinal study of e-government implementation from an actor-network perspective made to the question of the processes to be followed in a successful application of ICT for development? It has shown clearly that systems implementation is an inherently political process. Actors with diverse interests and power bases sometimes succeed in translating their interests into the development and use of ICT applications. Information system innovation is a contingent outcome that is determined not by the properties of the technology but by the result of contested interests of actors linked together in complex networks.

Application of this theory has helped identify that e-government implementation in developing countries involves networks at both the global (the sponsorship) and the local (the implementation) levels. It
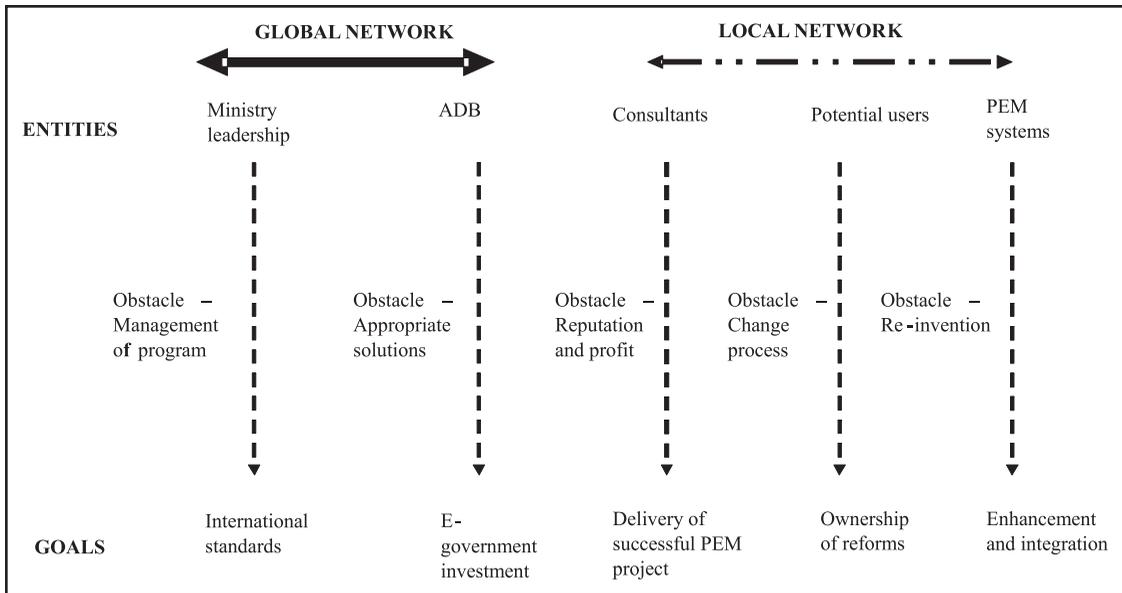
Figure 4. Problems with translation in action on PEM IS project (adapted from Callon 1986).

has shown clearly that a withdrawal of support by both networks can only result in crisis and a disaggregating, failed project, whereas it is through the active and mobilized support of both networks that project goals can be successfully met.

Adopting an actor-network perspective has helped to address the issue of what actions to take to ensure e-government project goals are met. Linking the two networks is important: a point of passage should be identified. Planned control of the networks is unrealistic but a means to address project issues as they arise during implementation, to take incremental action, and to improvise as necessary is required. Project management that steers "a creative drifting process" (Ciborra 1999) rather than imposes control is suggested. This implies that the point of passage must be through a culturally embedded and committed individual: for example, a senior civil servant appointed full-time as program director.

An actor-network perspective would recommend to the designers of e-government projects that they carefully consider how the translation process might occur. If they themselves are not to be the heterogeneous engineers that build the networks that will lead to technical innovation and systems implementation, they must consider what other entities need to be enrolled. A flexible but pragmatic approach is

advocated to tackle this issue: one that considers all elements of the envisioned organizational change necessary to reach the project goals. Recognizing that "efficiency, truth, profitability and interest are simply properties of networks" (Latour 1999), the construction of sustainable networks becomes vitally important in the implementation of e-government projects that are targeted at improved governance.

ANT permits an explanation of how a few can obtain the right to express and to represent the many. The Sri Lankan case study material provides industry and policy practitioners with a clearer sense of the forces at play in e-government implementation in developing countries and, by explicitly recognizing the inclusion or exclusion of various groups, it facilitates discussion on how the networks can be re-engineered to include potential users able to demand wider governance targets for e-government projects, such as increased public information and debate. In overall terms then, analysis of the case study from an actor-network perspective does seem to score relatively well on the obvious research tests.

First, one can ask whether it says anything new. It certainly puts into a new shape previous ideas on the organizational change that must take place in order to move from the current to the future system. The translation trajectory is mapped, together with the technological trajectory, thus indicating the

Table 3. Classification of the key stakeholder groups by their "power over" the development of the PEM information systems

Group	Organization	Department	Bureaucracy Power Base	Technology Power Base
Government of Sri Lanka	Ministry of Finance	Leadership	+	
		State accounts department		+
		National budget department		+ (from 2001)
		Other departments		
	Other ministries	Line ministries		
		Prime minister's office	+ (from 2001)	
International financing institutions	Asian Development Bank	Head office	+	+ (until 2001)
		National office	+	
	World Bank	Head office	+	+
	Korean Aid Agency	Head office	(from 2002)	
Suppliers	British consultants	International practice		+ (from 1997)
	Local university	IT department		+ (from 1999)
	International accounting firm	National practice		+ (from 2001)
		International practice		+ (until 2001)
	Korean consultants and software supplier	International practice		+ (from 2002)
Civil society	Institute of public finance			
	Media			

sociotechnical priorities that need to be addressed in a successful project. Second, one may ask whether it says anything credible. Some questions about ANT will be raised in the next section, but one advantage of using a well-known method and the accompanying vocabulary is that it does make complex results more convincing than the simple listing of factors found in other analyses. It also provides the basis for further argument and debate framed around the model rather than simple assertion versus counter-assertion.

Finally, does application of this model say anything useful? Although presented only briefly in this case study, it does seem to. ANT is an appropriate perspective through which to analyze the dynamics of the power relationships that characterize IFI-funded reform programs in developing countries that employ ICT as "an enabler" of change. Neither the technology nor the social characteristic determines the outcome: the success of a project is dependent on the process of someone or something managing and controlling the various forces at play, both technical and social.

Reflection and Review of ANT

Tractable Critiques of ANT
This section reflects on the ANT application just undertaken, plus evidence from other applications of the theory. The information systems literature on ANT is almost solely confined to case studies of the Sri Lankan type, which is not atypical of the ANT

discourse where the theory is developed in relation to specific histories.

Semiotics and Methods

Critics of ANT (e.g., Habers 1995) have suggested that the approach has developed into a complex social theory with a dense vocabulary and that many case studies make rather an eclectic use of the conceptual vocabulary and, to a lesser extent, its methodology.

The ANT theorists recognize the need to keep their vocabulary in motion (Latour 1999), but researchers using the theory in interpretive case studies certainly need to be wary of the dense academic definitions of ANT replacing the rich vocabulary of the actor's own practice. Being mindful of Latour's caution (1999, 18) that "a great deal of our [ANT] vocabulary has contaminated our ability to let the actors build their own space," the present author has drawn on the language used by the actors *in situ* wherever possible in the Sri Lankan case study.

Law (1999) shows that ANT was intentionally developed as a way of being faithful to the insights of ethnomethodology where actors know what they do and researchers have to learn from them not only what they do, but how and why they do it. "The explanation emerges once the description is saturated. There is no need to go searching for mysterious or global causes outside networks. If something is missing it is because the description is not complete" (Latour 1991).

The problem identified by the critics is that researchers tend to use elements of ANT selectively (see, e.g., recent development informatics studies by Madon et al. [2004] and Macadar and Reinhard [2005]), and few studies have taken a comprehensive approach that works through all elements of the theory. Walsham (1997) criticizes many information system studies using ANT as not being true to the theory. He cites various case studies as concentrating on the detailed description of a particular network without paying attention to the broader social structures and processes within which the network is formed, which is in itself a larger sociotechnical network that should be described: "linking the inside and the outside" according to Callon (1987).

This frequently repeated accusation of relativism and "the paralysing anything goes attitude" (Avgerou 2002, 65) often found in the networked social settings that ANT-based studies describe can certainly be leveled at the Sri Lankan case study as it is presented in this paper. Full explanation for the development of the Sri Lankan PEM networks cannot be deduced from the sparse description provided here. A richer and fuller description forms the basis of the author's doctoral thesis, which is a painstaking attempt to situate the PEM networks within such broader sociotechnical networks as the institution of the Sri Lankan civil service and the e-government "best practice" globalization process. Such an approach will often be required in studying information systems in development, given the influence of broader global institutions and discourse that are tied to the "ICTs for development project" (Wade 2002).

Human and Nonhuman Actors

An often-mentioned shortcoming of ANT is the inadequacy of the analysis it offers in respect to the actor (Lee and Brown 1994). The theory assumes the radical indeterminacy of the actor and thus opens up the social sciences to nonhumans. ANT makes no analytical distinction between the social and the technical and this symmetry between humans and artifacts enables a sociology that accommodates both on the same terms. This indeterminacy provides ANT with a unique theoretical position, but it entails a number of difficulties, including significant challenges in operationalizing ANT for research purposes (Fujimura 1991).

The ANT theorists (Latour 1991; Law 1999) have robustly met this critique of indeterminacy. They contend that the technological entities in the network are actors and intermediaries, embodying social intentions and the scripts of particular behaviors that are influenced by the sociotechnical circumstances of the societies that created them. The process by which these properties are ascribed in practice can be potentially described—but often it is not.

It is true that the network analysis applied in the Sri Lankan PEM case study did not provide particularly useful guidance on how to trace the forces that resulted in the supremacy of one actor's translation over another's. The results as presented were of a local and transient nature, even though this was a longitudinal study. But the PEM networks described were divergent and reversible: there was no ongoing translation process that might have stabilized them.

With more convergent and less reversible networks, "the more the descriptions delivered by the intermediaries turn into explanations or predictions" (Callon 1991, 154).

Akrich's (1992) study of the photoelectric lighting kit, which was designed in France but put to use in the Ivory Coast, is an often-cited example of a case study where the nonhuman actors (the elements of the lighting kit) stabilize a network while being changed themselves in the process. Ascribing social values to the Sri Lanka PEMS information system innovations (i.e., CIGAS and IBS) as intermediaries in the network was an initial step by the author along the theoretical path trodden by Akrich. However, operationalization of this element of ANT is proving one of the major challenges of applying the theory in the author's doctoral thesis.

Emphasis on Power

The translation model of power was the central framework for the application of ANT in the Sri Lankan case study. The story unfolded as events occurred where there was a crisis or drama involved, such as the redesign of the PEMS project, but there was no principal actor driving this process: no one management figure engineering the networks as in many of the ANT case studies.

ANT is often criticized for presenting actors guided by the quest for power (Fujimura 1991) and solely interested in spreading their influence through the manipulation of networks. In reply, Callon (1999) explains that heroic stories tend to involve actors with Machiavellian tendencies but that, in ANT, there are no model actors and a variety of possible configurations of action so, depending on the configuration, the principal actor can be both generous and altruistic (see, e.g., Hennion 1993).

Latour (1999) points out that the theory was meant to concentrate attention on a fluid movement, a circulating entity with actor and network designating two faces of the same phenomenon, like waves and particles. This is indeed the case in the Sri Lanka PEM case study, where a creative drifting process was responsible for the information systems innovation rather than controlled management measures.

More Challenging Critiques of ANT

This discussion ends with two further issues related to ANT that are less tractable and that, it is argued, require continuing modifications to the theory.

Social Theory

It has been contended by various critics (Collins and Yearley 1992; Descola and Palsson 1996; Bloor 1999) that ANT has slowly drifted, during the past twenty years, in a directionless fashion from being a sociology of science and technology into a social theory and onward into yet another inquiry into modernity.

The ideas of postmodernism, as embodied in the work of philosophers such as Lyotard (1984), have undoubtedly influenced the development of ANT. The central belief of modernity that science and technology are founded on objective reasoning has been continuously questioned by the ANT theorists from the late 1970s onward. The arguments of Lyotard on the delegitimization of scientific discourse resonate strongly with, for example, Latour's (1987) and Law's (1994) detailed investigations of the day-to-day work of scientists.

It is no surprise therefore that ANT has been criticized by social scientists with a radically different viewpoint on the nature of society from the ANT theorists. Within ANT, the necessary continuous definition and redefinition of what collective action is about in the network, as power is only obtained from those who are doing the action, means that society is being constructed in the present: it is being built by every actor and is in principle unknowable. This is the performative model and the ANT writers argue that society is not what holds us together: it is what is held together (Strum and Latour 1985). This is in direct contrast to the view of those social scientists that see society as existing and in principle knowable (the ostensive model). They are unable to subscribe to the postmodernist view that the grounds of objective knowledge are contestable and that knowledge can only claim localized validity.

Relating these competing worldviews to the issue of e-government and development and, more specifically, to the Sri Lanka PEM case study, we note that the modernist premise that ICT contributes directly to gains in economy and efficiency is effectively challenged when an ANT perspective is adopted. The champions in the global network, supported by the myth of technology-driven organizational change, viewed an imported IFMIS, with its inscripted values of international standards and economic rationality, as the most appropriate way of organizing and accounting for the government's finances. The local networks, at various times and

with varying outcomes, disputed this managerialist viewpoint. Theirs was a different rationality, one embedded in the local sociotechnical environment, and the information systems innovation that resulted was a translation of their particular interests. This is a pattern that may well be typical of information systems in developing countries (Heeks 2002).

In 1986, Latour argued that, as different actors define society in their own way, nonsocial resources must be mobilized to enforce standard definitions if a stable society is to result. He saw this, in effect, as the same result as that obtained by Foucault (1977) when he dissolved the notion of a power held by the center in favor of micropowers diffused through the many technologies to discipline and keep in line. Latour expanded Foucault's notion to the many techniques employed in machines and the hard sciences that influence and control society.

The current pitch of the e-government discourse, as explored in this paper's first section, has a universalist appeal. But there are unsettling undertones of ICT being mobilized as a disciplining social force, and perhaps it is only through the study of the "failure" of certain of these e-government initiatives that researchers can hope to trace how information systems are being used to this effect. Latour (1999, 158) contends "social ties are not strong enough to link us all together, all the forces that are mobilised to link humans together and ensure that some orders are obeyed, and others are not, must be considered." E-government (and other ICT) programs in developing countries funded by the IFIs, operating at the intersection of multiple national and international institutions, must surely be worthy of examination in this light; however, we must recognize that ANT does bring a particular postmodern perspective that is not necessarily commensurable with all views on ICTs and development.

After ANT
ANT as a sociology of science and technology may well have developed into a social theory. But this is to its advantage rather than its detriment, because the current theoretical stance is grounded in the original concepts. The question is what happens next, and, in this, the ANT theorists are their own most vocal critics:

- For Latour, "there are four things that do not work with actor-network theory; the word actor, the word network, the word theory and the hyphen! Four nails in the coffin" (1999, 23).

- For Law, "the desire for quick moves and quick solutions, the desire to know clearly what we are talking about, the desire to point and name, to turn what we now call ANT into "a theory, all of these have done harm as well as good." "Have theory, will travel." Easy use of the term "actor-network" has tended to defuse the tension originally and oxymoronically built into the expression. We have lost the capacity to comprehend complexity" (1999, 1–14).

- For Callon, "we never claimed to create a theory. In ANT the T is too much. It is a gift from our colleagues. I fear our colleagues and their fascination for theory" (1999, 193).

Perhaps Avgerou (2002) is right in contending that it is important not to see ANT as complete in itself and as a well-developed social theory with all its limits and delimitations, but as a theoretical position within the broader debate of the studies of the sociology of technology. By applying ANT concepts, embedded within the situated contextual analysis of the multiple institutions implicated in information systems innovation, one can extend the framework to one of direct relevance to the study of e-government—indeed, all ICTs—and development.

However, Latour's clarion call (1999) not to limit ANT by considering tackling the complexity and locality of the sociotechnical situation "seriously and modestly" is to be heeded. "We are somewhat terrified by the monster that we have begot. But once launched in this unplanned and uncharted experiment in collective philosophy, there is no way to retract and once again be modest. The only solution is to do what Victor Frankenstein did not do, that is, not to abandon the creature to its fate but continue all the way in developing its strange potential" (1999).

Overall Conclusions About ANT and Development Informatics
This paper has argued that the successful implementation of e-government projects can make a contribution to development, particularly where the wider governance goals of public sector reform programs, such as improvements in transparency and accountability, are being supported.
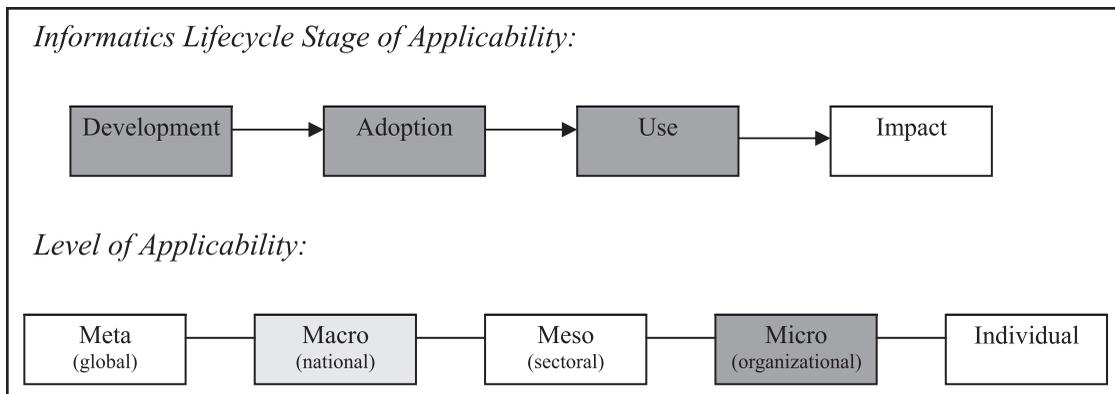
Figure 5. Applying ANT in development informatics research.

When questions arise about the success or failure of development informatics projects then frameworks drawn from the literature on science and technology studies, such as ANT, can have a role to play. Specifically, this paper has made use of Law and Callon's theory of network analysis of technical change, based on the translation model of power, and has shown that it has a contribution to make in answering both analytical questions (for example, about the interplay of the social and the technical) and more practical questions (for example, about how to build networks around implementation of e-government projects in developing countries).

Technology is just one of a number of heterogeneous sociotechnical elements that must be considered and managed in the design and implementation of a successful information systems project. Information systems projects in developing countries funded by the IFIs pose a particular challenge in this regard because of the issues they raise in both global and local networks, and in the linkages between those networks. It was shown here that specific, culturally sensitive solutions need to be identified at the design stage that will facilitate the formation of sustainable global and local networks of actors that will deliver a successful e-government project.

The contribution of the theory was demonstrated in relation to the story of the public finance reform program in Sri Lanka and the resulting public expenditure management information systems, an area that does have some particular features in its focus on transparency and accountability and its cultural setting. However, these features do not make any major difference to the applicability of the translation model of power, which has been used for the analysis of, for example, noncomputer-based information systems in other developing countries (Madon et al. 2004). We can also see the relevance of ANT to other forms of "global" and "local"—for example, the external drivers and networks, which we can cast as central/state government-led or urban-led, seen when ICTs are introduced into rural areas in developing countries.

This paper has focused on the application of network analysis in information system design and implementation. This is only one element of ANT, and the actor-network perspective has been applied in various other ways to bring value to development informatics research: it has been used, for example, to analyze technology transfer between countries (e.g., Akrich 1992). We can sum up aspects of its applicability in development informatics research by using Figure 5. It can be used to research the interaction of groups and technologies at various stages in the informatics lifecycle, from researching questions about how particular ICTs come to be invented and developed, through questions about the diffusion and adoption of ICTs in developing countries, to questions about how and why ICTs are (or are not) implemented and used in development. It seems particularly to have been used for organizational-level research (as here with the main focus on the MoF) but could equally be used for broader analyses; for example to research the way in which technologies diffuse or are used in an economic sector.

In summary, then, we can echo Walsham's ac-

knowledgment of actor-network theory as "a promising theoretical vehicle for IS research" (1997, ___). ANT offers researchers the next step after basic identification of ICT4D stakeholder groups (a process that itself is not so simple—see Bailur's [2007] paper in this issue), to understand the interplay between those groups and between people and technology in a way that helps explain the trajectory of ICT4D initiatives. It is not necessarily an easy theory to apply but ANT has a unique potential in ICT4D research because of the way in which it identifies the technology itself as an actor that sits in coalition or conflict with different human groups. It can, therefore, find use in addressing a wide variety of ICT4D research questions. ∎

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