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RESEARCH Newsletter
of the Research & Publications Committee, IIMA

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Chairperson's Message

Dear Readers

This issue of the Research Newsletter contains summaries of two research papers published by our faculty. It also contains a succinct overview of a book *(The India Infrastructure Report 2002: Governance Issues for Commercialization)* to which our faculty members have made major contributions. As usual, we seek your feedback for continued improvement of the Newsletter.

Jayanth Varma

Peer Reviewed Journal Article

Mathematical Programming Applications in Steel Plants

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An integrated steel plant is a complex industrial system in which numerous products are routed through different production units. Sales, cost, and net profit of each product are functions of many variables. If the operating manager makes decisions that result in sub-optimal operations, a significant savings or income opportunity can be lost. Professor Goutam Dutta of the Production and Quantitative Methods (P&QM) area and Professor Robert Fourer, his colleague at Northwestern University surveyed mathematical programming applications and report about seventy applications in fifteen different countries since 1958. Based on their study, Professors Dutta and Fourer have written a paper that is addressed to two types of audiences. The first is the management science practitioner in industry who is looking for possible areas of applications of optimization techniques in an integrated steel plant. The second is the academic researcher who is looking for potential research areas in integrated steel plants.

Although steel is a basic industry, very few applications of mathematical programming have been reported in the literature in comparison with other industries such as oil, airlines, and semiconductors. Also, very little work has been done in the area of inventory control and manufacturing control in steel plants. However, it is noteworthy that four applications (two in Bethlehem Steel, USA, one in LTV Steel, USA, and one in Tata Steel, India) were selected as finalists for the Management Science Achievement Award. The work by Bethlehem Steel is about optimal selection of ingot size and reported a benefit of US$ 8 million. Optimal distribution of

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How can Agroindustries Succeed

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Agroindustries are given high priority in India and their role in development is recognized world wide. The stress on village-based agroindustries by Mahatma Gandhi during the independence movement is well known. Today agroindustries are looked upon for their significant potential in bringing value-addition to agriculture's output, and creating rural incomes and employment, on which most of the poor depend. What can we learn from experiences in India which can be useful for future and for other developing countries? What kind of policy, institutional and organizational arrangements / models can help overcome the managerial challenges of agro-industries and maximize their contribution to rural and small farmer development?

Professor Vasant Gandhi of the Centre for Management in Agriculture (CMA) and co-authors Gauri Kumar and Robin Marsh find that the agro-industrial sector in India contributes a large share to overall employment in industry, as well as to value addition and income generation in agriculture and industry. However, the sector faces numerous managerial challenges. The current trend towards large private agro-industrial units, though often good for technology and marketing, has a strong risk that small farmers and the rural poor will be ignored and will not benefit. This greatly weakens the development linkage for which agro-industries have been given priority. The linkage depends substantially on the nature of the organization and the commitment of the agroindustry to the involvement of small farmers and the poor as partners. It also depends on the bargaining power of small farmers within the models and structures that are created.

Cooperatives have done better in bringing benefits to the rural poor, sometimes with the assistance of NGOs. Supply contracts with small farmers are rarely enforceable in India, as elsewhere in developing countries, and remain moral in nature. Therefore, to make contract farming successful, much depends on the development of long term relationships between agroindustry and farmers through transparent contract terms, fair pricing, effective extension, and good marketing. This is possible even for private agroindustry firms as shown by the PepsiCo model. The authors show that the major challenges lie in organizing sustained production and procurement from a large number of small farmers. A partnering approach appears to be most promising in overcoming multiple constraints. It can be implemented either through building cooperative organizations, or by building confidence and trust through a mutually beneficial business relationship involving private enterprise and famers. In both cases, and with other successful models, the government can play a facilitating role through enabling policies, regulations, financing options, research, and extension.

The authors are of the view that there is a need for new indigenous models to emerge for the organization of the agroindustry. Government models often do not show a good record of performance. The Amul cooperative model is a promising one that brings benefits to small farmers and gives them ownership of the enterprise. However, it needs to overcome political, legal, and managerial limitations. The PepsiCo model that involves cogent backward integration offers another alternative. However, it requires long-term commitment and financial strength, and perhaps has limited scope for affecting large numbers of the rural poor. It is critical that alternative agro-industrial models are encouraged to emerge and receive government backing, especially those models that contribute positively to rural employment and income generation for small farmers and the poor.

Gandhi, V.; Kumar, G.; and Marsh, R. (2001). "Agroindustry for Rural and Small Farmer Development: Issues and Lessons from India," *International Food and Agribusiness Management Review*, Vol. 2(3 / 4).

India Infrastructure Report 2002

In the recent past, a substantive project on Indian infrastructural issues was taken up at the initiative of Indian Institute of Management, Ahmedabad (IIMA), Indian Institute of Technology, Kanpur (IIT-K), and Infrastructure Development Finance Company (IDFC). While IIMA, IIT-K, and IDFC were the principal collaborators, scholars from many other institutions also contributed to this project. The second of its reports, the *India Infrastructure Report 2002, (IIR2002),* focuses on the issue of governance in the sector, and more generally failures in governance as a constraint. The report, edited by Professor Sebastian Morris of IIM-A and Rajiv Shekhar of IIT-K, contains forty-five articles with over ten from faculty at IIMA. The exact reference of the publication is as follows:

Morris, S. and Shekhar R., eds. (2002*), India Infrastructure Report 2002: Governance Issues for Commercialization,* 3iNetwork, New Delhi: Oxford University Press.

Here are the excerpts from IIR2002 having substantive contribution from IIMA faculty:

Governance Issues for Commercialization of Infrastructure

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Many of us would accept the statement that India's is a problem of "good policy having been badly implemented." Similarly, today the multilateral agencies not excluding the World Bank are prone to point fingers at "poor governance" as the reason for the failure of many economies to ensure consistent growth and development. But the category of governance is problematic since it is really a 'catch-all term' or a truism. One can and should follow up the same with the question: "What causes poor governance?" Nothing in India is more constrained by poor governance as infrastructure is today. Governance failure in India is more the result of prior policy failures and poor design of the law and rules rather than arising out of any intrinsic property of the Indian or the Indian bureaucrat to be corrupt. The perverse incentives that result from poor design bring about failure. Thus, the mode of subsidization has in most instances been badly chosen, allowing vast "arbitrage opportunities" and leakages, and resulting in enormous waste.

The leverage points for change lie in better policy and modes of subsidization that do not create these perverse incentives in the first place. Only then can the call for greater commitment in implementation make sense. Thus, massive adulteration of petrol and diesel is possible because of the price arbitrage that exists between diesel and petrol on the one hand, and solvent, naphtha, and kerosene on the other. In electricity, price based subsides do not allow the subsidy to be capped. Given information asymmetry demand, consumer mix and costs can then be misreported to enable the arbitrage of different prices for different groups of consumer, by the utilities. And over a period of such rents and corruption, governance failure becomes a pathological condition.

Today's vested interests are merely the creation of past design and policy failures. And that includes the politician. Too long the politician has been used as a mask to cover the poor and absurd designs of programmes and policy. The waste due to price-based subsidy in the agriculture sector is difficult to imagine. Even if account is taken for the non-budgetary aspect of these subsidies (food, fertilizer, irrigation, electricity, and other inputs) the total fiscal costs though very large are still only a part of the total costs imposed on society. The total social costs ought to include the cost of in-optimal regional specialization of crops and wrong use of technology including the distinctly higher environmental costs that result from such inappropriate usage.

Norms and standards that are over-ambitious, in a large measure bring about governance failures. Thus environmental standards in India are often better than those in the rich West. This is plainly hypocritical. Similarly, layout and road to built-up area restrictions in cities as per master plans and norms are very lavish. Unaffordability implies that violation is inevitable. But there is nothing like a controlled violation. Some violation leads to complete violation and even those norms that could have been adhered to (which could have mitigated much of the negative externalities)

Professors J.R. Varma, Sebastian Morris, G. Raghuram, Biju Varkkey, Ajay Pandey. Inset: S. K. Barua

would not be realized. The common property aspects of adherence leads violations, when not punished, to its quick spread to encompass nearly all.

India is not intrinsically a lawless society as many lawyers and judges would like to believe. In the design of law and in standards in society there is so much that is over-ambitious and against the simple economics of law. Thus many laws ignore the aspect that the probability of detection (itself a function of cost of monitoring) times value of the punitive measure has to be substantial enough to create deterrence against non-adherence. When the above is small (and they are laughably insignificant in such important aspects of our everyday life as environment, adherence to building standards, and public safety) the pathological condition of non-adherence is guaranteed. Clearly punitive measures must have some recognition of the costs of monitoring. The right to information enabling users of public services and concerned citizens to monitor the activities of the service provider making every senior level position within the bureaucracy open to people outside the cadres would be seminal in changes from within the system. The specialized skills and knowledge necessary today make the latter an imperative. Details of the above discussion are available in the following chapters:

Morris, S. (2002). "Overview", Ch.1, and "The Challenges to Governance in India," Ch. 2 , *IIR2002*.

Historical Insights in Bringing in Private Entrepreneurship into Infrastructure

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Professor Jayanth Varma discusses the history of infrastructure and the evolution of regulation therein to lead to insights into the Indian problem. After a few years of struggling with somewhat half-hearted efforts to attract private finance into infrastructure, the time has now come to move forward more aggressively. The government must now prepare to relinquish its exclusive role in decision-making in infrastructure and allow much of these decisions to be made by the free play of market forces. This would open the way for private entrepreneurship in infrastructure.

The private sector would then bear the risks and reap the rewards of infrastructure projects. The design and location of these projects would follow economic logic rather than the dictates of political considerations. The private sector would come forward to build most of the infrastructure that India needs without the government having to bear the risks. Only a small number of strategic infrastructure projects that the state considers important but the private sector does not consider attractive may remain. It is only for these few projects that the state needs to step in either by undertaking the project with public funds or by providing subsidies or credit enhancement. The details of Professor Varma's arguments can be read in the following chapter:

Varma, J. (2002). "From Private Finance to Private Entrepreneurship," Ch.6.1, *IIR2002*.

Problems with the (Reform) Draft Electricity Bill 2001

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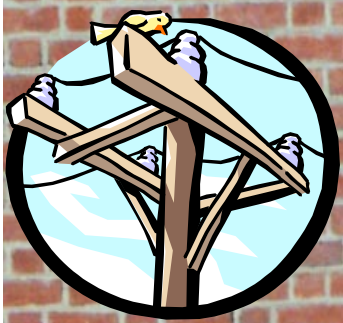
While the passage of the Electricity Bill, 2001, may pave the way for the unbundling of integrated SEBs and the setting up of independent regulators by the states, it may not bring about any major change in the sector beyond that. Open access and limited competition by the traders, though envisaged in the bill, is likely to play a relatively minor role till an appropriate tariff framework is in place and some leeway is available within long-term contracts between generators and suppliers / distributors without their consent. Unfortunately, the bill is quite restrictive on the use and evolution of appropriate tariffs by regulators. The bill does not positively remove restrictions on inter-state trading of electricity, does not enable excess supply of captive generators to meet peak demand, and does not create enough pressures for the removal of cross-subsidies and inefficiencies in the system.

More damaging than all of these criticisms is of course the provisions which preclude the possibilities for the sector in future of competition in supply and development of pool or spot markets. Any such move will require further legislative change, a time-consuming and costly process. The passage of the bill, however, can be expected to hasten the reforms and restructuring at state level (even though the



direction may be away from optimal), more inter-state transfer of electricity (once again, less than optimal), and possibly the emergence of new sets of problems and issues built in the new framework. These are expected in the areas of regulatory coordination, conflicts between state and the regulators, T&D losses, and conflicts between state and central transmission utilities, besides the political fallout of attempted tariff rationalizations. The details of Professor Pandey's contributions are available in the following chapters:

Pandey, Ajay (2002). "Power Sector Reform and the Proposed Electricity Bill," Ch.9.4 *IIR2002.*

Failures in the Governance of the Financial Sector

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Several individuals and a few organizations bore the brunt of penal action arising from the scams, but the regulators have typically escaped without having to pay a price. The euphemistic phrase 'system failure' is invariably used to describe regulatory failures and hide glaring shortcomings in the governance structure. Improvements would have to recognize the following issues: (1) The regulations for different segments of the financial sector must be harmonized to reflect the basic inter-connected nature of operations of different segments. (2) There is a need to separate the two functions of regulation and supervision, and development. (3) Similarly, the prudential supervision through extensive use of appropriate statistical tools for data analysis, including real time surveillance to anticipate and defuse a developing crisis, must happen. (4) The process for dealing with frauds committed in the operation of financial infrastructure must be speedier. (5) Professionalization of management of financial infrastructure as well as extensive involvement of professionals in the governance of the infrastructure created ought not be constrained by restrictive rules and conditions. As in other spheres, bureaucratic and political interventions must cease in the operation and regulation of financial infrastructure. Professor Barua's analysis is incorporated in:

Barua, S.K. (2002). "Crises in the Governance of Financial Infrastructure," Ch.6.5, *IIR2002.*

Contract Design and the Indian Railways

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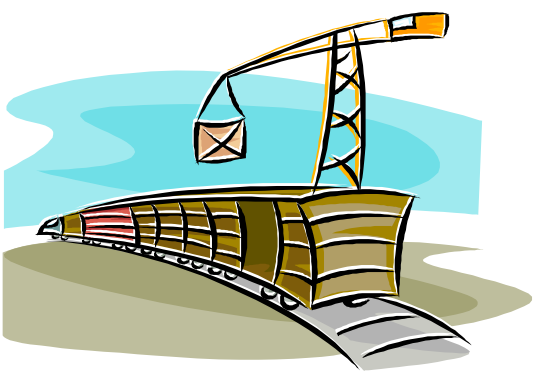
Professor Raghuram brings out key aspects in the governance in the relationship of the Ministry of Railways with various service delivering commercial entities that it has promoted. Problems arise when both ministerial (policy and regulation) and commercial and executive powers are vested in the same body, namely the Railway Board. The attempt in these ventures was to bring about commercial orientation. Success has varied. The key dimensions that are examined are: (1) degree of separation of the regulatory and policy roles from the commercial activity, (2) extent of private participation, (3) extent of improvement in transparency, contestability, and competition, and (4) appropriateness of regulations.

Using the salient features from each of the cases Professpr Raghuram brings out the key design issues that need recognition for better results from commercial partnerships. The cases taken up are: (1) CONCOR (wholly owned autonomous company); (2) Palace on Wheels (revenue, cost, and investment sharing); (3) Railway Sidings (investment sharing); (4) Pipavav Railway Corporation Limited (SPV with equity partnership); (5) Konkan Railway Corporation (BOT); (6) Own Your Wagon Scheme (lease payments and service guarantees); and (7) catering contracts (licence fee and revenue sharing basis). Professor Raghuram's study is presented in:

Raghuram, G. (2002). "Experience of Various Forms of Commercial Partnerships in the Indian Railways" Chapter 10.1, *IIR2002.*



Problems with the First Private Airport

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Professor Biju Varkkey and G. Raghuram study the Cochin International Airport Limited (CIAL) which became the first Indian joint sector airport registered under the Companies Act. The airport has been formed through financial partnership of private individuals comprising industrialists, businesses, and airport users and public institutions led by the Government of Kerala, the largest shareholder. The airport became a reality under the leadership of Mr V. J. Kurien, an administrator, who had to brave political and social forces to ensure that the project was completed. The CIAL business model was different from other Indian airports, where practices like single agency system for aircraft handling, involvement of project affected personnel in the value chain, and equity / financial participation of airport service providers, etc. were tried out.

However, lack of clarity about the status of private airports and delay in resolving policy issues has resulted in CIAL facing difficulties in operations like licensing, revenue sharing between Airport Authority of India and CIAL for services, payments for security services, etc. Though, operationally the airport made surplus from the first year, high interest burden from bank loans and uncertainties on the business front owing to policy issues raised questions about its financial viability. Since the projected assumptions regarding traffic and revenue failed to become true, CIAL defaulted on repayment of loans and that has affected investor confidence. The case documents the experiences of the social and financial dimensions of a green field airport project and governance issues connected with air traffic infrastructure privatization. The CIAL case study is covered in:

Varkkey, B. and Raghuram G. (2002). "Governance Issues in Airport Development: Learnings from Cochin International Airport Ltd.," Ch. 10.4, *IIR2002*.

Mathematical ...

electrical energy using a mathematical model developed by Tata Iron and Steel Company reports a benefit of US$ 73 million. This gives an indication of the potential financial benefits of applying optimization techniques to the problems of the steel industry.

From the survey of different applications and authors' personal experience in modelling steel plants, the following can be considered as potential areas for future research:

1. Simultaneous optimization of product-mix, inventory, and transportation problems over multiple periods. This would represent an extension of Fabian and product mix to the multi-period case with inventory and transportation requirements as additional constraints.
2. Cutting stock optimization to maximize overall yield of multi-stage production processes. This would go beyond most previous work on the cutting stock problem, which has used single stage models.
3. Scheduling problems in the continuous caster.
4. Stochastic linear programming models where not only the means and variances of the stochastic entities but also their distributions are known.
5. Any research that increases the reliability and validity of data. The success of mathematical programming models depends heavily on availability of relevant data. Often the desired data do not exist, or must be collected from multiple sources.

The paper is available at *http://iems.nwu.edu/~4er/STEEL/survey.html*, and the complete journal reference is given below:

Dutta, G. and Fourer R. (2001). "Mathematical Programming Applications in Steel Plants," *Manufacturing and Services Operations Management*, Vol. 3, No. 4, Fall.