

Economics of Solid Waste Management



A Brief Bibliographical Survey

Prepared by: Ram Chandra Bhattarai and Anuradha Kafle



SANDEE Bibliography No. 8-04

Table of Content

Topics	Page	References
1. Economics of Solid Waste Management	1	1-25
2. Community and Informal Sector Management	3	26-57
3. Institutional And Policy Analyses	9	58-90
4. Case Studies of Specific Cities	15	91-131
5. Others	18	132-146
6. Internet Sources	22	147-148

Economics of Solid Waste Management

1. Beede, D. N. and D. E. Bloom (1995), 'The Economics of Municipal Waste', The World Bank Research Observer 10(2):113-150.

Abstract: This article examines the generation and management of municipal solid waste through the lens of economics. The authors estimate that the global burden of municipal solid waste amounted to 1.3 billion metric tons in 1990, or two-thirds of a kilogram of waste per person per day. Industrial countries account for a disproportionately high share of the world's waste relative to their share of world population, while developing countries account for a disproportionately high share of the world's waste relative to their share of world income. Analyses across countries and over time reveal that the generation of municipal solid waste is positively related to variations in per capita income and that the generation of municipal solid waste per capita does not vary with population size among countries with comparable per capita income.

2. Bhattarai, R. C. (2000), 'Solid Waste Management and Economics of Recycling: A Case of Kathmandu Metro City', Economic Journal of Development Issues 1(2): 90-106.
3. Bhattarai, R.C. (2003), 'Household Behavior on Solid Waste Management: A Case of Kathmandu Metropolis', Economic Journal of Development Issues 4(1):79-93.
4. Bubel, A. Z.(1990), 'Waste Picking and Solid Waste Management', Environmental Sanitation Reviews 30, December.
5. Chongwoo, C. and I. Fraser (1999), 'An Economic Analysis of Household Waste Management', Journal of Environmental Economics and Management 38: 34-246.
6. European Commission (1996), 'Cost-Benefit Analysis of the Different Municipal Solid Waste Management Systems: Objectives and Instruments for the year 2000,' European Commission.
7. Fullerton, D. and T. C. Kinnaman (1996), 'Household Responses to Pricing Garbage by the Bag', The American Economic Review 86 (4): 971-1000.

Abstract: Employs individual household data to estimate the effect of per bag pricing of garbage on the garbage's weight in Charlottesville, Virginia. Inelasticity of garbage weight to price; Garbage volume's response to the scheme; Demographic considerations; indirect measures of the increase in illegal dumping; Pros and cons of collecting revenue from unit pricing.

8. Fullerton D. and T. C. Kinnaman (1995), 'Garbage, Recycling and Illicit Dumping', Journal of Environmental Economics and Management 29: 78-91.
9. Hong, S., R. M Adams and H. A. Love (1993), 'An Economic Analysis of Household Recycling of Solid Wastes: The Case of Portland, Organ', Journal of Environmental Economics and Management 25: 136-146.
10. Hong, S. and R. M. Adams (1999), 'Household Responses to Price Incentives for Recycling: Some Further Evidence', Land Economics 75 (4):505-514.

11. Jenkins, R. R. (1993), 'The Economics of Solid Waste Reduction: The Impact of User Fees,' Edward Elgar.
12. Kinnamann, C. T. and D. Fullerton (1999), 'The Economics of Residential Solid Waste Management', National Bureau of Economic Research Working Paper 7326 <http://www.nber.org/papers/w7326>
13. Koli, P. A. and V. V. Mahamuni (2005), 'Environmental Economics of Solid Waste Management', Jaipur University Book House Pvt. Ltd.
14. Kumar, S., V. Gawaiakar, S. A. Gaikwad and S. Mukherjee (2004), 'Cost-benefit analysis of landfill system with gas recovery for municipal solid waste management: a case study', International Journal of Environmental Studies 61(6): 637-651.

Abstract: The advantages and disadvantages of alternatives for urban solid waste management are discussed. Landfill is considered to be a suitable and simple technology for tropical countries such as India. The recovery and reuse of landfill gas generated in MSW landfills is economically viable in most situations. A case study of cost-benefit analysis of landfill system with gas recovery option has been carried out for Port Blair City, Andaman Islands, India. A saying of about Rs 0.09 billion per annum with reference to existing system of MSW disposal is evaluated.

15. Leu, H.G and S.H. Lin (1998), 'Cost-Benefit Analysis of A Recycling Program in Taiwan', Journal of Environmental Systems 26(4): 415-423.
16. Lundin, M., M. Olofsson, G. J. Pettersson and H. Zetterlund (2004), 'Environmental and economic assessment of sewage sludge handling options', Resources, Conservation and Recycling 41(4): 255-278.

Abstract: The environmental and economic consequences of four recycling and disposal options for municipal sewage sludge have been assessed. The four options were: agricultural application, co-incineration with waste, incineration combined with phosphorus recovery (Bio-Con) and fractionation including phosphorus recovery (Cambi-KREPRO). Life cycle assessment (LCA) was used to assess the environmental consequences, while effects in the district heating system were analysed using the energy system model MARTES. Co-incineration had the best energy balance, but without recovery of phosphorus. In the Bio-Con and Cambi-KREPRO processes both phosphorus and energy could be recovered. Compared to Cambi-KREPRO, Bio-Con was more effective in most respects, but suffered from higher emissions to air. Spreading sludge on agricultural land was the least preferable option from an environmental point of view. Energy was required for transportation, spreading and pasteurisation of the sludge, whereas the other three options enabled energy recovery. Spreading also caused release of nutrients and acidifying substances and transferred the content of heavy metals in the sludge to agricultural soil. The economic assessment showed that agricultural application had the lowest cost of the options, whereas co-incineration had the highest cost. The difference in cost between Bio-Con and Cambi-KREPRO was small, but since the technologies are new and untried in a commercial context, these results are uncertain. This study has shown that two sludge handling options, incineration and direct application to agricultural soil, have respectively economic and environmental restrictions. The development of relatively low cost phosphorus recovery technologies has the potential to reconcile the environmental and economic aspects of sustainability.

17. Miranda, M. L., J. W. Everett, D. Blume and Barbeau A. Roy, Jr. (1994), 'Market-Based Incentives and Residential Municipal Solid Waste', Journal of Policy Analysis and Management 13(4): 681-698.

Abstract: Coalitions of free-marketers, politicians, and environmentalists increasingly are turning to the use of market-based incentives in formulating environmental policy. One promising application of market-based incentives is in the management of residential municipal solid waste. This article focuses on unit-based pricing programs established in conjunction with community recycling programs. Using data gathered through telephone and mail surveys of 21 cities, we demonstrate the strong potential for unit pricing to improve the efficiency of residential solid waste management.

18. Morris, G.E., D. M. Holthausen (1994), 'The Economics of Household Solid Waste Generation and Disposal', *Journal of Environmental Economics and Management*, 26 (3): 215-34.
19. Palmer, K., S. Hillary and W. Margaret (1997), 'The Cost of Reducing Municipal Solid Waste', *Journal of Environmental Economics and Management* 33(2): 128-150.
20. Pearce, D. and R. K. Turner (1994), 'Economics and Solid Waste Management in the Developing World', Working Paper WM 94-5, Centre for Social and Economic Research of the Global Environment (CSERGE), London
21. Porter, R. C. (2002), 'The Economics of Waste', *Resource for the Future*, Washington D.C.
22. Richardson, R. A. (1978), 'Economic Analysis of the Composition of Household Solid Wastes', *Journal of Environmental Economics and Management* 5: 103-111.
23. Starreveld, F. and E. C. van ierland (1994), 'Recycling of Plastics: A Materials Balance Optimization Model', *Environmental and Resource Economics* 4: 251-264.
24. Tin, A. M., D. L. Wise, Wei-Han Su, L. Reutergardh and Seong-Key Lee (1995), 'Cost- Benefit analysis of the municipal solid waste collection system in Yangon, Myanmar', *Resources, Conservation and Recycling* 14:103-131.
25. Wertz L. Kenneth (1976), 'Economic Factors Influencing Household's Production of Refuse', *Journal of Environmental Economics and Management* 2: 263-272.

Community and Informal Sector Management

26. Ahsan, T. and S. A. Ahmad (2000), 'Community Based Solid Waste Management Pilot Project in Khulna City: Problems and Prospects', in Sinha et al., eds., *Community Based Solid Waste Management: The Asian Experience*, Waste Concern, Dhaka, Bangladesh.
27. Atri, S. and T. Schellberg (1995), 'Efficient Management of Household Solid Waste: A General Equilibrium Model', *Public Finance Quarterly* 23(1): 3-39.
28. Bhattarai, R. C. (2005), 'Role of informal sector for reuse and recycling of waste in Kathmandu', *Nepalese Journal of Development and Rural Studies* 2(1): 76-89.
29. Bartone, C. R. (2001), 'The Role of the Private Sector in Municipal Solid Waste Service Delivery in Developing Countries: Keys to Success', the challenge of urban government: Policies and practices: 215-23, *WBI Development Studies*. Washington, D.C.: World Bank Institute; Toronto: University of Toronto, Centre for Urban and Community Studies.
30. Bartone, C. R. and H. D. Bernstein (1993), 'Improving Solid Waste Management in Third World Countries', *Resources, Conservation and Recycling* 8: 43-54.
31. Cheng, S., C.W. Chan and G. H. Huang (2002), 'Using multiple criteria decision analysis for supporting decisions of solid waste management', *Journal of Environmental Science and Health Part-A-Toxic/Hazardous substances and Environmental Engineering* 16: 975-990.
32. Eggerth, L. L. (2005), 'The evolving face of private sector participation in solid waste management', *Waste Management* 25(3): 229 -231
33. Furedy, C. (1992), 'Garbage: Exploring Non-conventional Options in Asian Cities', *Environment and Urbanization* 4(2): 42-54.
34. Furedy, C. and M.S. Shivakumar (1990), 'Reforming Solid Waste Management Perspectives of Concerned Citizens', Paper presented at the International Seminar on Solid Waste Management and Resource Mobilization, October 28-Nov. 4, 1990 Kathmandu, Nepal.
35. Furedy, C. (1994), 'Decentralized composting: An emerging technique of solid waste management', *ASEP Newsletter* 10(1):1-12.
36. Huysman, M. (1994), 'The Position of Waste Pickers in Solid Waste Management in Bangalore', in Baud et al, eds., *Solid Waste Management Modes, Assessments, Appraisals and Linkages in Bangalore*, Manohar Publishers and Distributors New Delhi, India.
37. Jayaratne, K. A. (1996), 'Community Participation in Urban Solid Waste Management, Case Study of Siddharthapura Low Income Settlement, Colombo Srilanka', in *Solid Waste Management A Case Study from Colombo, Srilanka*, SEVANATHA, Srilanka
38. Kaseva, M. E and S. E. Mbuligwe (2005), 'Appraisal of solid waste collection following private sector involvement in Dar es Salaam city, Tanzania', *Habitat International* 29 (2): 353-366

Abstract: This paper presents findings of a study, which was carried out in Dar es Salaam city to assess post-privatisation of solid waste collection and disposal. Prior to the assessment, fieldwork studies indicated that current solid waste generation rate in the city is 0.4 kg/cap/day and total waste generation is within the range of 2425 tons/day. This study also indicated that out

of the total waste generated, a total of 957 tons/day is collected by the three city municipalities (231 tons/day or equivalent to 10% of the total generation), private solid waste collection contractors (592 tons/day or equivalent of 24.4%) and through recycling (134 tons/day or equivalent of 5.5%). These findings suggest that as a result of privatisation of solid waste collection activities in Dar es Salaam city, solid waste collection has improved from 10% in 1994 to 40% of the total waste generated in the city daily in 2001. The paper recommends that waste recycling and composting activities be encouraged since this approach is considered to be the right measure in attaining sustainability in waste management.

39. Kinnaman, T. C., D. Fullerton (1997), 'Garbage and Recycling in Communities with Curbside Recycling and Unit-Based Pricing', National Bureau of Economic Research, Working Paper 6021.

Abstract: This paper estimates the impact of a user fee and a curbside recycling program on garbage and recycling amounts, allowing for the possibility of endogenous policy choices. Previous estimates of the effects of these policies could be biased if unobserved variables such as local preference for the environment jointly impact the probability of implementing these policies and the levels of garbage and recycling collected in the community. A simple sequential model of local policymaking is estimated using original data gathered from a large cross-section of communities with user fees, combined with an even larger cross-section of towns without user fees but with and without curbside recycling programs. The combined data set is larger and more comprehensive than any used in previous studies. Without correction for endogenous policy, the price per unit of garbage collection has a negative effect on garbage and a positive cross-price effect on recycling. When we correct for endogenous policy, then the effect of the user fee on garbage increases, and the significance of the cross-price effect on recycling disappears.

40. Kuniyal, J.C. (2005), 'Solid waste management techniques for the waste generated and brought down from campsites in the hill spots, trails and expedition tops', *Waste Management & Research* 23(3): 182-198.
41. Kuniyal, J.C. and A. P. Jain (1999), 'Public involvement in environmental assessment of solid waste management in UP Himalayan tourists' treks, India', *Environmental & Waste Management* 2(4): 279-291.
42. Kuniyal, J.C., A.P. Jain and A.S. Shannigrahi (1998), 'Public involvement in solid waste management in Himalayan trails in and around the Valley of Flowers, India', *Resources, Conservation and Recycling* 24(4): 299-322.
43. Menell, P. (1990), 'Beyond the Throwaway Society: An Incentive Approach to Regulating Municipal Solid Waste', *Ecology Law Quarterly* 17 (4): 665-739.
44. Misra, V. and S.D. Pandey (2005), 'Hazardous waste, impact on health and environment for development of better waste management strategies in future in India', *Environment International* 31(3): 417-431.

Abstract: Industry has become an essential part of modern society, and waste production is an inevitable outcome of the developmental activities. A material becomes waste when it is discarded without expecting to be compensated for its inherent value. These wastes may pose a potential hazard to the human health or the environment (soil, air, water) when improperly treated, stored, transported or disposed off or managed. Currently in India even though hazardous wastes, emanations and effluents are regulated, solid wastes often are disposed off indiscriminately posing health and environmental risk. In view of this, management of

hazardous wastes including their disposal in environment friendly and economically viable way is very important and therefore suggestions are made for developing better strategies. Out of the various categories of the wastes, solid waste contributes a major share towards environmental degradation. The present paper outlines the nature of the wastes, waste generating industries, waste characterization, health and environmental implications of wastes management practices, steps towards planning, design and development of models for effective hazardous waste management, treatment, approaches and regulations for disposal of hazardous waste. Appraisal of the whole situation with reference to Indian scenario is attempted so that a better cost-effective strategies for waste management be evolved in future.

45. Mongkolnchaiarunya, J. (2005), 'Promoting a community-based solid-waste management initiative in local government: Yala municipality,' *Habitat International* 29 (1): 27-40

Abstract: Yala is a city of some 80,000 people in southern Thailand, and is well known for tidiness and clean conditions. However, it has experienced problems in waste disposal and has sought ways of addressing these through alternative techniques, including recycling. A package of new practices was introduced, one of which ("Garbage for Eggs") is described here. Residents were encouraged to bring recyclable material to exchange for eggs, at monthly exchanges in local communities, with emphasis on poorer communities. The project aimed not only at garbage reduction, but also at community empowerment through self-reliance, establishing new relationships of more equality and less dependence, between poor communities and the municipal administration. The project succeeded initially in promoting clearance of a backlog of discarded items, especially glass, thus improving the environment of the communities; but the quantities brought for exchange then reduced steadily over a year of monitoring, to much lower levels. Various factors accounting for this are discussed, and the impacts of the exchange practice on other poor groups, such as waste-buyers, are analyzed.

46. Murtaza, Md. G. and Md. A. Rahman (2000), 'Solid Waste Management in Khulana City and a Case Study of a CBO: Amader Paribartan', in Sinha A. H. Md. Maqsood and I. Enayetullah, eds., *Community Based Solid Waste Management: The Asian Experience*, Waste Concern, Dhaka, Bangladesh.
47. Ogu, V. I. (2000), 'Private Sector Participation and Municipal Waste Management in Benin City Nigeria', *Environment and Urbanization* 12(2):103-117.
48. Pratt, R. M. and P. S. Phillips (2000), 'The Role and Success of UK Waste Minimization Clubs in the Correction of Market and Information Failures', *Resources, Conservation and Recycling* 30(3): 201-219.

Abstract: The UK waste strategy is based upon a concept of a hierarchy of preferable options for handling and disposal of waste. Minimization is at the top of this hierarchy and several policy strategies have been introduced to encourage the uptake of waste minimization methodology by industry. Waste minimization clubs are a key component of the UK waste strategy and an essential vehicle for encouraging industry and commerce to undertake waste minimization methodology. There have been ~75 such clubs and they receive support from a wide range of sources, including the Environmental Technology Best Practice Programme and Environment Agency. The majority of clubs have facilitated a significant reduction in solid, liquid and gaseous waste arising alongside financial savings achieved through increased efficiency. Academic literature claims that waste minimization clubs are highly successful, but this has never been quantified. To address this, the study identifies economic reasons leading to excess waste production, namely market and information failure and then evaluates the role of waste minimization clubs in overcoming these failures.

49. Read, A. D., P. S. Phillips, A. Murphy (1997), 'English country council and their agenda for waste minimization', *Resources, Conservation and Recycling* 20(4): 277-294.

Abstract: Minimization is the top priority of the waste management hierarchy, which is one of the guiding principals for national solid waste management planning throughout the developed world. As such it should be encouraged as a means for reducing wastes which require treatment and disposal, whether they be household, commercial or industrial in source. This paper suggests that minimization is not being given the necessary policy frameworks or legislation within which to develop in the UK, and questions whether minimization is being afforded the respect and attention, from all levels, that is due the most preferable waste option according to the hierarchy. This theme is investigated by surveying the county councils of England as a representative sample of waste disposal authorities in England, and former waste regulation authorities. They are responsible for guiding local and district waste policy and are the regional waste planners in the UK. If they are not seriously taking on board the message of minimization, then there is little chance that it will succeed without further legislative developments. Some 59% of English counties have a minimization policy, whilst only 47% have participated in and supported a minimization programme or trial within their region. The majority of these developments have occurred within the last three years, and 78% of counties who have participated in a programme have found it a successful venture. By 1999 79% of English counties will have been actively involved in a minimization programme in their region, which is a positive scenario. This trend must continue if waste minimization is to become the key theme of future sustainable waste management in the UK as was intended by declarations at the Rio '92 conference and in subsequent UK Government policy and strategy.

50. Ristic Z. (1999), 'Analyzing some motivational factors of recycling behavior in Zagreb Coratia,' *Journal of Environmental System* 27(4): 265-278.
51. Sinha, A.H. et al (eds.) (2000), 'Community Based Solid Waste Management: The Asian Experience', Waste Concern, Dhaka, Bangladesh
52. Sinha M.M.H.A and N.M.T.A. Amin (1995), 'Dhaka's Waste Recycling Economy: Focus on Informal Sector Labour Gropus and Industrial Districts', *Regional Development Dialogue* 16(2): 173-195.
53. Srinivas, V. C. (1996), 'The Role of Informal Sector in Urban Waste Management- Some Issues', *Encology* 11(7): 15-20.
54. Tchobanoglous, G., H. Theisen and S. Vigil (1993), 'Integrated Solid Waste Management: Engineering Principles and Management Issues', McGraw-Hill, Inc. New York.

Abstract: Topics covered include: the evolution of solid waste management; legislative trends and impacts; sources, types, composition and properties of municipal solid wastes; sources, types and properties of hazardous wastes found in municipal solid waste; engineering principles of solid waste generation, collection, separation, storage, transport, processing and transformation both at the source and off-site; disposal of solid wastes and residual matter (landfills, landfill leachates and landfill gases); separation, transformation and recycling of waste materials, including biological conversion technologies; closure, restoration and rehabilitation of landfills; and solid waste management and planning issues.

55. UNDP-World Bank (1999), 'Community-Based Action Planning for Effective Solid Waste Management', Water and Sanitation Program in South Asia, United Nations Development Program and The World Bank.

56. Van Houtven, G. L. and G. E. Morris (1999), 'Household Behavior Under Alternative Pay-as - You Throw System for Solid Waste Disposal', *Land Economics* 75 (4): 515-537.

57. Ueta, K. (1994), 'The Role of Local Government in Urban Environmental Management', *Regional Development Dialogue* 15(2).

Institutional and Policy Analyses

58. Achankeng, E. (2003), 'Globalization, Urbanization and Municipal Solid Waste Management in Africa', Proceedings of a Conference on "African on a Global Stage", of African studies association of Australasia and the Pacific.
59. Agunwamba, J.C. (1998), 'Solid Waste Management in Nigeria: Problems and Issues,' *Environmental Management* 22 (6): 849-856.

Abstract: This paper is a presentation of the problems of solid waste management in Nigeria and the important issues that must be addressed to achieve success. At the core of the problems of solid waste management are the absence of adequate policies, enabling legislation, and an environmentally stimulated and enlightened public. Government policies on the environment are piecemeal where they exist and are poorly implemented. Public enlightenment programmes lacked the needed coverage, intensity, and continuity to correct the apathetic public attitude towards the environment. Up to now the activities of the state environmental agencies have been hampered by poor funding, inadequate facilities and human resources, inappropriate technology, and an inequitable taxation system. Successful solid waste management in Nigeria will require a holistic program that will integrate all the technical, economic, social, cultural, and psychological factors that are often ignored in solid waste programs.

60. Baud, I. and H. Schenk (eds.) (1994), 'Solid Waste Management Modes, Assessments, Appraisals and Linkages in Banaglore', Manohar Publishers and Distributors, New Delhi, India.
61. Beukering, P. V., M. Sekher, R. Gerlagh and V. Kumar (1999), 'Analyzing Urban Solid Waste in Developing Countries: a Perspective on Bangalore, India', Working Paper No. 24, Collaborative Research in the Economics of Environment and Development (CREED), London.
62. Chaturvedi, B. (1998), 'Public Waste Private Enterprise: An enquiry into the issue of integrating rag pickers into formal Solid Waste Management Systems', The Heinrich Boell Stiftung, Berlin.
63. Chung-Chiang, C. (2005), 'An Evaluation of Optimal Application of Government Subsidies on Recycling of Recyclable Waste', *Polish Journal of Environmental Studies* 14(2):137-144.
64. Eriksson, O. et al. (2004), 'Municipal solid waste management from a systems perspective', *Journal of Cleaner Production* 13(3): 241- 253.

Abstract: Different waste treatment options for municipal solid waste have been studied in a systems analysis. Different combinations of incineration, materials recycling of separated plastic and cardboard containers, and biological treatment (anaerobic digestion and composting) of biodegradable waste, were studied and compared to landfilling. The evaluation covered use of energy resources, environmental impact and financial and environmental costs. In the study, a calculation model (Orware) based on methodology from life cycle assessment (LCA) was used. Case studies were performed in three Swedish municipalities: Uppsala, Stockholm, and Älvdalen. The study shows that reduced landfilling in favour of increased recycling of energy and materials lead to lower environmental impact, lower consumption of energy resources, and lower economic costs. Landfilling of energy-rich waste should be avoided as far as possible, partly because of the negative environmental impacts from landfilling, but mainly because of the low recovery of resources when landfilling. Differences between materials recycling, nutrient recycling and incineration are small but in general recycling of plastic is somewhat better than incineration and biological treatment somewhat worse. When planning waste management, it is important to know that the choice of waste treatment method affects processes outside the waste

management system, such as generation of district heating, electricity, vehicle fuel, plastic, cardboard, and fertiliser.

65. Gupta, S., K. Mohan, R. Prasad, S. Gupta S and A. Kansal (1998), 'Solid waste management in India: options and opportunities', *Resources, Conservation and Recycling* 24(2): 137–154.

Summary: In India, the collection, transportation and disposal of MSW are unscientific and chaotic. Uncontrolled dumping of wastes on outskirts of towns and cities has created overflowing landfills, which are not only impossible to reclaim because of the haphazard manner of dumping, but also have serious environmental implications in terms of ground water pollution and contribution to global warming. Burning of waste leads to air pollution in terms of increased TSP and PM10 emissions, which is equivalent to vehicular emissions at times. In the absence of waste segregation practices, recycling has remained to be an informal sector working on outdated technology, but nevertheless thriving owing to waste material availability and market demand of cheaper recycled products. Paper and plastic recycling have been especially growing due to continuously increasing consumption levels of both the commodities. Composting-aerobic and anaerobic, both the options are available to the country for scientific disposal of waste in future. However, country also needs something in terms of policy and guidelines to enable the municipal corporations to run the waste services efficiently.

66. Horen, B. V. (2004), 'Fragmented Coherence: Solid Waste Management in Colombo', *International Journal of Urban and Regional Research* 28(4): 757-773.

Abstract: Notwithstanding the increasingly fragmented organizational relationships within Colombo's urban governance system, the cooperative nature of stakeholder relationships lends a high level of coherence to the overall system. Since 1995, Colombo's solid waste management system has been characterized by the increased role of the private sector, community-based organizations and NGOs. Whilst the increasingly fragmented nature of this system exhibits some deeply ingrained problems, there are also a number of positives associated with the increased role of civil society actors and, in particular, the informal sector. Reforming regulatory frameworks so as to integrate some of the social norms that are integral to the lives of the majority of urban residents will contribute to regulatory frameworks being considerably more enforceable than is currently the case. Such reform requires that institutional and regulatory frameworks need to be flexible enough to adapt to the changing social, political and economic context. In the Colombo case, effective cooperation between public sector and civil society stakeholders illustrates that adaptive institutional arrangements grounded in pragmatism are feasible. The challenge that arises is to translate these institutional arrangements into adaptive regulatory frameworks— something that would require a significant mind shift on the part of planners and urban managers.

67. Kandil, S. H., H. A. Bakr and L. Mortensen (2004), 'Incorporating Environmental Awareness of Solid Waste Management within the Education System: (A Case from Egypt)', *Polymer-Plastics Technology & Engineering* 43(6):1795-1803.

Abstract: This case study is a presentation of systematic development of an awareness and communication multimedia package in solid waste management that was produced for Egyptian technical secondary schools. Representative teachers were very much involved in the design and pretesting of the technical content of the package. They even suggested and influenced the format of the produced materials. The awareness and education materials, to be included in the package, were classified into four main sections: Environmental concepts: basic definitions, environmental spheres, identification of the environmental systems, Environmental issues: international, national, and local, Solid waste management: sources of waste, life cycle analysis, recycling, technological aspects, environmental auditing, legislation for solid waste management, and Case studies: including specific success stories on solid waste management in various parts of Egypt. The threading skeleton of this package was a set of 25 extra-curricula

activities. These were specially designed to help clarify the environmental concepts, convey the messages for the environmental protection, and identify the required attitudes to help sustainable development. The multimedia package is composed of an activity book equipped by concept papers and fact sheets, a set of transparencies for overhead projector (or power point illustrations), a video film that stresses the economic and environmental benefits of recycling, and a compact disc that contains all the components of the package. It is interesting to note that while developing this package with the technical help of the Academy of Educational Development, the basic criteria for excellence in environmental education and communication were fully observed. The feedback from the pilot schools was collected to monitor the implementation and impact of this package. The package was adopted by the Ministry of Education and was distributed to technical secondary schools in Egypt.

68. Kansal, A., R. K. Prasad and S. Gupta (1998), 'Delhi Municipal Solid Waste and Environment-An Appraisal', *Indian Journal of Environmental Protection* 18(2): 123-128.

Abstract: Poor solid waste management has serious implications on environment, society and economy. This paper assesses the impacts associated with the present system of solid waste management in Delhi on environment and community health.

69. Kuniyal, J.C., A.P., Jain and A.S. Shannigrahi (1998), 'Solid wastes: a refuse or resource in the Himalayas?', *Research for Mountain Development: Some Initiatives and Accomplishments*, Himavikash Publication, Gyanodaya Prakashan, Nainital, pp. 215-234.
70. Lohani, B.N. (1984), 'Socio-political Aspects of the Recovery and Recycling of Urban Wastes in Asia', *Conservation and Recycling* 7 (2-4): 167-173.
71. Ludwig, C., S. Hellweg and S. Stucki (2005), 'Municipal solid waste management, strategies and technologies for sustainable solutions,' *Waste Management*, Springer.
72. Macauley, M. K. and M. A. Walls (1995), 'Solid Waste Reduction and resource Conservation: Assessment Policy', *Resource for the Future Discussion Paper* 95-32, *Resource for the Future*.
73. Michaelis, P. (1995), 'Product Stewardship, Waste Minimization and Economic Efficiency Lessons from Germany', *Journal of Environmental Planning and Management* 38(2): 231-243.
74. Miedeman, A. K. (1983), 'Fundamental Economic Comparisons of Solid Waste Policy Options', *Resource and Energy* 5: 21-43.
75. McBeana, E.A., E. del Rossob and F.A. Roversb (2005), 'Improvements in financing for sustainability in solid waste management', *Resources, Conservation and Recycling* 43(4): 391-401.

Abstract: Contributing elements toward the development of a sustainable solid waste management system in Tucumán, Argentina, are described. Changes in the working environment for the wastepickers have been instrumental in providing a livable wage and diminished health and environmental risks to the wastepickers and to neighboring residents. Income levels to the wastepickers are now approximately 1.75 times minimum wages in Tucumán and are being driven almost entirely by the recycling of plastics. Educational improvements in Tucumán, which are assisting sustainability of the solid waste system, are being significantly improved by the operation of a pilot scale project, by demonstrating opportunities to government officials and school children. Improved financial sustainability to the solid waste management system is also potentially available from carbon credit trading opportunities, presenting the opportunity for 1.2 times the income available from recycling efforts.

76. Morris R. J., P. S. Phillips and A. D. Read (1998), 'The U.K. Landfill Tax: an Analysis of its Contribution to Sustainable Waste Management', *Resources, Conservation and Recycling* 23: 259-270.
77. Palmer, K. and M. Walls (1996), 'Optimal Policies for Solid Waste Disposal Taxes, Subsidies and Standards', *Journal of Public Economics* 65: 193-205.
78. Pearce, D.W. and R.K. Turner (1990), 'Market-based Approaches to Solid Waste Management', *Resources, Conservation and Recycling* 8:63-90.

Summary: This Paper briefly reviews the failures that have inhibited efficient waste management policy and practice in the past. It then goes on to provide an economic analysis of the comparative merits and limitations of the regulatory approach to waste management policy and the market-based approach. The latter approach is examined in the context of three typical economic policy instruments: packaging taxes, deposit-refunds and marketable permits.

79. Poerbo, H. (1991), 'Urban Solid Waste Management in Bandung: Towards an Integrated Resource Recovery System', *Environment and Urbanization* 3(1): 60-69.
80. Reddy, S. S. and S. Galab (1998), 'An Integrated Economic and Environmental Assessment of Solid Waste System in India: The Case of Hyderabad', An unpublished report, Centre for Economic and Social Studies, Andhra Pradesh India.
81. Rouso, A. S. and S. P. Shah (1994), 'Packaging Taxes and Recycling Incentives: The German Green Dot Program', *National Tax Journal* 47 (3):689-701, September.
82. Seldman, N. (2005), 'Removing the blinders to analyze solid waste history', *Biocycle* 46(1): 54-55.
83. Singhal, S. and S. Pandey (2001), 'Solid waste management in India: status and future directions', *TERI Information Monitor on Environmental Science (TIMES)* 6(1):1-4.
84. Tawil, N. (1999), 'Flow Control and Rent Capture in Solid Waste Management', *Journal of Environmental Economics and Management* 37:183-201.
85. Thorpe G. S. (2000 – 2001), 'Integrated Solid Waste Management: A framework for analysis,' *Journal of Environmental System* 28 (2): 91-105.
86. Trucker, P., D. Speirs and D. Smith (2000), 'The Impact of Change in Collection Frequency on Kerbside Recycling Behavior', *Journal of Environmental Planning and Management* 43(3): 335-350.

Abstract: The research monitors the changes in recycling performance indicators arising from halving the collection frequency of a kerbside newspaper collection scheme. The changes in the performance parameters are explained in terms of the underlying behavioural changes that could have occurred within the community. This interpretation is aided by a computer simulation of the kerbside recycling activity of the community. Moving from a 2-week collection to a 4-week collection did not substantially affect the number of households recycling, nor the overall weights collected. A small weight loss, however, may have occurred, from a small minority of households, unable to accommodate the extra storage demand of the new regime. Model

predictions were consistent with the observed performance data. It is postulated that the scheme could withstand considerable intervention before significant behavioural changes are induced. It demonstrates that cost-cutting interventions can be undertaken without significantly compromising individual participations. The case-study also highlights the caution needed in the interpretation of the recycling performance indicators themselves.

87. Tuladhar, B. (1996), 'Kathmandu's garbage simple solution going to waste', *Studies in Nepali History and Society* 1(2), A Mandala Book Point Journal.
88. Turner, R.K., R. Salmons, J. Powell and A. Craighill (1998), 'Green Taxes, Waste Management and Political Economy', *Journal of Environmental Economics and Management* 53:121-136. http://www.uea.ac.uk/env/cserge/pub/wp/wm/wm_1996_03.htm

Abstract: Interest among policymakers has recently focused on the role, efficiency and effectiveness of so-called green taxes. This paper surveys recent developments in the context of waste management policy and the emergence of resources such as recycling credits and the landfill tax. It is concluded that there is an important role that economic instruments can play in this policy area. The inherent efficiency gains that economic instruments will provide should be highlighted and advocated. The application of such instruments in the current political economy settings will however serve to reduce such efficiency gains, as multiple and conflicting policy objectives are introduced by the political process.

89. Veasna, K., A. Sharp and N. Harnpornchai (2004), 'Improving the solid waste management in Phnom Penh city: a strategic approach', *Waste Management* 25(1): 101-110.

Abstract: Though the solid waste management (SWM) system in Phnom Penh city in general has been upgraded since the waste collection service was franchised out to the private sector, the performance of the existing SWM system is still low. Unreliable and irregular collection service still exists. This means that there are shortcomings in the existing SWM system that needs correction. This paper is an attempt to identify those shortcomings in order to find ways to improve the existing system. First, the present SWM system is reviewed. Then the system is evaluated to find constraints and shortfalls and finally some appropriate strategies are proposed that may help make SWM in the city more effective and efficient to meet environmentally sound objectives.

90. Wenger, R. B., C. R. Rhyer, E. E. Wagoner (1997), 'Relating Disposal-based Solid Waste Reduction Rates to Recycling Rates', *Resource Conservation and Recycling* 20: 267-276.

Case Studies - Specific Cities

91. Abu-Hijleh B. A. K., M. Mousa, R. Al-Dwairi, M. Al-Kumoos and S. Al-Tarazi (1998), 'Feasibility study of a municipality solid waste incineration plant in Jordan', *Energy Conversion and Management* 39(11): 1155–1159
92. Agrawal, A., K. K. Sahu and B. D. Pandey (2004), 'Solid waste management in non-ferrous industries in India', *Resources, Conservation and Recycling* 42(2): 99-120.

Abstract: This paper highlights the production capacity, type and quantity of solid wastes generated their chemical composition and treatment/disposal options for the Indian aluminium, copper lead and zinc industries. Red mud, spent pot lining (SPL), fly ash from aluminium industries; scrap, slag, dross, reverts, slime, flue dust, mill scales, sludge etc. from copper industries; zinc tailing, slag, leach residue, jarosite residue, -cake, etc. from zinc industries and BF slag, flue dust, ISF slag etc. from lead industries are the major solid waste generated from the process. Common practices of waste management in these industries are through recycling and recovering the metal values and dumping. Owing to the presence of the toxic elements in some of the solid wastes cause environmental degradation. Stringent pollution control rules are being enacted and implemented as a result of which all the metal producing industries in organised sector are now taking care of the environment and waste management related problems, but pollution from unorganized lead units are the major cause of concern. Permissible limits of toxic constituents in zinc based secondaries and threshold zinc concentration for both indigenous and imported raw material were worked out at National Metallurgical Laboratory (NML) and based on these results a recommendation to MOEF, Government of India was made to specify the permissible limits for the import of zinc secondaries. An overview of the attempts made to recycle/recover metal values and production of value added products, at NML are also mentioned in the text.

93. Agunwamba, J. C., O. K. Ukpai and I. C. Onyebuanyi (1998), 'Solid waste management in Onitsha, Nigeria', *Waste Management and Research* 16(1): 23–31
94. Baldesimo, J. M. (1988), 'Scavenging of Municipal Solid Waste in Bangkok, Jakarta and Manila', *Environmental Sanitation Reviews* 26, December, Asian Institute of Technology, Bangkok.
95. Bartone, C. R., L. Leite, T. Triche and R. Schertenleib (1991), 'Private Sector Participation in Municipal Solid Waste Service: Experiences in Latin America', *Waste Management and Research* 9: 495-509.
96. Betts, M. et al (1982), 'Report of an Evaluation of the Project Solid Waste Management in the Kathmandu Valley', German Agency for Technical Cooperation, Project No. 76. 2051.1.
97. Braunegg, G., R. Bona, F. Schellauf and E. Wallner (2004), 'Solid Waste Management and Plastic Recycling in Austria and Europe', *Polymer-Plastics Technology & Engineering* 43(6): 1755 -1768.

Abstract: During the last decade plastic waste has become a major problem within the industrialized countries. Many new waste management associations have been founded, and new technologies for sorting, reutilization, and/or energy recovery from sorted or mixed plastic recycling fractions have developed. The main developments will be demonstrated based on the examples of plastic waste treatment in Austria and Germany, and an outlook for the development in Europe will be given.

98. Buenrostro, O. B. and V. J. Gerardo (2001), 'Forecasting generation of urban solid waste in developing countries - a case study in Mexico', *Journal of the Air and Waste Management Association* 51(1): 86–93
99. Chen, M. C., A. Ruijs and J. Wesseler (2005), 'Solid waste management on small islands: the case of Green Island, Taiwan', *Resources, Conservation and Recycling*, February 2005.

Abstract: Municipalities of small islands have limited capacities for waste disposal. In the case of Green Island, Taiwan, continuing with business as usual would only allow the disposal of waste on the island for another 8 years. Three alternatives for solid waste management (SWM) are compared. The cost-effective solution is the one, which is the most expensive in the short run: continuing business as usual and introducing an incineration plant in the year 2010. The results indicate furthermore that deviations from optimal timing of investment only slightly change average annual costs. In the long run, the municipality can hardly avoid transporting waste to the mainland. By investing in an incineration plant, they can buy additional time to investigate alternative SWM strategies

100. Chularatna, H. M. U. and R.M R. Ratnayake (2000), 'Use of Compost Bin as an Alternative Solution to Household Solid Waste Problem in Urban Areas: A Case Study of Colombo, Sri Lanka', A. H. MD. Maqsood Sinha and Iftekhar Enayetullah eds., *Community Based Solid Waste Management: The Asian Experience*, Waste Concern, Dhaka, Bangladesh.(Book)
101. Cointreau, S. J. (1987), 'Solid Waste and Recycling: Case Studies in Developing Countries', Washington DC: World Bank.
102. Flintoff, F. (1984), 'Management of Solid Waste in Developing Countries', World Health Organization, South East Asia Series 1, New Delhi.
103. GTZ (1996), 'Report on Fact Finding Mission for the Solid Waste Management in Nepal Project NP 93.22033-01.100', Prepared on behalf of German Agency for Technical Cooperation, Kathmandu.
104. Jain, A.P., J.C. Kuniyal and A.S. Shannigrahi (1996), 'Solid Waste Management in Mohal', In: Proc. of 22nd WEDC Conference: Discussion Paper: Reaching the unreached-Challenges for the 21st Century, pp. 328-329
105. Hasan, S. (1998), 'Problems of Municipal Waste Management in Bangladesh: An Inquiry into its Nature', *Habitat International* 22 (2): 191-202.
106. Kuniyal, J. C. and A.P Jain (2001), 'Tourists' Involvement in Solid Waste Management in Himalayan Trials: A Case Study in and Around Valley of Flowers India', *Journal of Environmental Systems* 28(2): 107-1.
107. Kaseva M. E. and S. K. Gupta (1996), 'Recycling - an environmentally friendly and income generating activity towards sustainable solid waste management: Case study-Dar es Salaam City Tanzania', *Resources, Conservation and Recycling* 17(4): 299–309.
108. Kumar R and A. Srivastava (2000), 'Health impacts of municipal solid waste composting facilities in India', *Journal of Indian Association for Environmental Management* 7(1): 151–153.
109. Kuniyal, J.C., A.P. Jain and A.S. Shannigrahi (2003), 'Solid waste management in and around the Valley of Flowers and Hemkund Sahib', *Waste Management* 23(9): 807-816.

110. Kuniyal, J. C., and A.P. Jain (2001), 'Tourists' involvement in solid waste management in Himalayan trails: a case study in and around Valley of Flowers India', *Journal of Environmental Systems* 28(2): 91-115.
111. Kuniyal, J.C. (2005), 'Solid Waste Management in the Hill spots, Trekking Regions and Expedition Summits in the Himalaya', in Joshi, T.K., Chowdhry, SVS, Kishore, J., Mohan Sneh (eds.) *Proc. Of National Conference on Solid and Hazardous Waste Management: Problems and Solutions*, 28-29 April 2005, IDC, New Delhi, 42-49.
112. Lal, M. (2000), 'Profits from Waste: NGO Led Initiative for Solid Waste Management in Lucknow', in Sinha, et al., eds., *Community Based Solid Waste Management: The Asian Experience*, Waste Concern, Dhaka, Bangladesh.
113. Misra K. Girish (1988), 'Problems of Solid Waste Management in Delhi', *Nagarlok*, January-March, No. 1, Vol. XX: 53-68.
114. Muttamara S, C. L. Sales and S. Phunsiri (1996), 'Solid waste recycling, disposal and management in Bangkok', *Journal of Solid Waste Technology and Management* 23(4): 226-234.
115. Mwanthi, M. A., L.O. Nyobola and E. Tenambergen (1997), 'Solid Waste Management in Nairobi city: Knowledge and Attitudes', *Journal of Environmental Health* 60 (5):23-30.
116. Ngoc, D. (1994), 'Women and Waste Recycling in Ho Chi Minh City', *ICRW Report in Brief*, International Centre for Research on Women, Washington D.C.
117. Nissim, I., T. Shohat and Y. Inbar (2005), 'From dumping to sanitary landfills – solid waste management in Israel', *Waste Management* 25 (3):323-328

Abstract: To address the problem of solid waste in Israel, the Ministry of the Environment has formulated a policy based on integrated waste management. The policy calls for reduction of waste at source, reuse, recycling (including composting), waste-to-energy technologies, and landfilling. Due to the implementation of this policy, all the large dumps were closed, state-of-the art landfills were built, and recovery rates have increased from 3% in the beginning of the 1990s to almost 20% in 2003. More than 95% of the municipal solid waste is disposed and treated in an environmentally sound manner – in comparison to a mere 10% just a decade ago. The policy was implemented utilizing both enforcement and financial support (“stick and carrot” approach).

118. Nirmal, M.B. (2000), 'Community Based Solid Waste Management: Experience of Exnora', in Sinha, et al., eds., *Community Based Solid Waste Management: The Asian Experience*, Waste Concern, Dhaka, Bangladesh.
119. NPC/ IUCN (1992), 'Solid Waste Management in Urban Nepal', *National Planning Commission/ The World Conservation Union*, Kathmandu. (Find from Library)
120. Ojeda-Benitez, S., C. Armijode Vega and M. E. Ranirez-Barreto (2000), 'The potential for recycling household waste: a case study from Mexicali, Mexico', *Environment and Urbanization* 12 (2):163-173
121. Pokhrel, D. and T. Viraraghavan (2005), 'Municipal solid waste management in Nepal: practices and challenges', *Waste Management*.

Abstract: Solid waste management in Kathmandu valley of Nepal, especially concerning the siting of landfills, has been a challenge for over a decade. The current practice of the illegal dumping of solid waste on the river banks has created a serious environmental and public health problem. The focus of this study was to carry out an evaluation of solid waste management in Nepal based on published information. The data showed that 70% of the solid wastes generated in Nepal are of organic origin. As such, composting of the solid waste and using it on the land is the best way of solid waste disposal. This will reduce the waste volume transported to the landfill and will increase its life.

122. Post, J. et al. (2003), 'Trial and Error in Privatization: Experiences in Urban Solid Waste Collection in Accra (Ghana) and Hyderabad (India)', *Urban Studies* 40 (4): 835-852.
123. Qureshi, A. P. (2000), 'Waste Busters: An Experience of Pakistan', in Sinha, et al., eds., *Community Based Solid Waste Management: The Asian Experience*, Waste Concern, Dhaka, Bangladesh.
124. RESTUC (2000), 'A Study of Solid Waste and its Management in Kathmandu', Research and Study Center (RESTUC), Kathmandu, Nepal.
125. Sisodia R. P. (2000), 'Innovations in Community Based Solid Waste Management Initiatives: Hyderabad Experiment', in Sinha, et al., eds., *Community Based Solid Waste Management: The Asian Experience*, Waste Concern, Dhaka, Bangladesh.
126. Srivastava, P. K., K. Kulshreshtha, C. S. Mohanty, P. Pushpangandan and A. Singh (2005), 'Stakeholder-based SWOT analysis for successful municipal solid waste management in Lucknow, India', *Waste Management*, Feb. 2005.

Abstract: The present investigation is a case study of Lucknow, the main metropolis in Northern India, which succumbs to a major problem of municipal solid waste and its management. A qualitative investigation using strengths, weaknesses, opportunities and threats analysis (SWOT) has been successfully implemented through this community participation study. This qualitative investigation emphasizes the limited capabilities of the municipal corporation's resources to provide proper facilitation of the municipal solid waste management (MSWM) services without community participation in Lucknow city. The SWOT analysis was performed to formulate strategic action plans for MSWM in order to mobilize and utilize the community resources on the one hand and municipal corporation's resources on the other. It has allowed the introduction of a participatory approach for better collaboration between the community and Municipal Corporation in Lucknow (India). With this stakeholder-based SWOT analysis, efforts were made to explore the ways and means of converting the possible 'threats' into 'opportunities' and changing the 'weaknesses' into 'strengths' regarding a community-based MSWM programme. By this investigation, concrete strategic action plans were developed for both the community and Municipal Corporation to improve MSWM in Lucknow.

127. Thapa, G. B. and S. R. Devkota (1999), 'Managing Solid Waste in Metro Kathmandu', Asian Institute of Technology, Bangkok: Thailand.
128. Timilsina B. P. (2000), 'Reuse and Recycling: Options for Waste Diversion from Landfilling- A Case Analysis in Kathmandu Valley', *A Journal of Environment*, Ministry of Population and Environment, Nepal.
129. Wei J-B, J. D Herbell and S. Zhang (1997), 'Solid waste disposal in China - situation, problems and suggestions', *Waste Management and Research* 15(6): 573-58.

130. Woodard, R., M. K. Harder and N. Stantzios (2004), 'The optimisation of household waste recycling centres for increased recycling—a case study in Sussex, UK', Waste and Energy Research Group (WERG), School of the Environment, University of Brighton, Lewes Rd., Brighton, Sussex, UK

Abstract: Sixteen percent of household waste in the UK is handled at household waste recycling centres (HWRC). These facilities will play an important role if the UK is to achieve the national target of recycling 25% of household waste by 2005, as most sites now provide containers for recyclables as well as a mixed waste pile. However, few published studies have been conducted regarding the activities of HWRC site users and the composition of waste that is delivered, especially to the mixed waste pile. This paper presents the results of a site survey in Sussex, UK and discusses the role of HWRC in handling household waste. During the week of sampling 969 site users were monitored. The target group was only those depositing material on the mixed waste pile. Two main categories of waste dominated. The first, identified as garden waste, was deposited by 37% of the target group and represents approximately 20% of arisings by observed volume. The second was miscellaneous bagged waste, present in 34% of loads and equating to approximately 21% of arisings by observed volume. Despite the availability of containers for segregating recyclable and compostable materials, 29% of users deposited these onto the mixed waste pile. The site was clearly not able to operate at its optimum. The reasons for this and potential solutions are presented.

131. Yhdego, M. (1995), 'Urban Solid Waste Management in Tanzania: Issues, Concepts and Challenges', Resources, Conservation and Recycling 14: 1-10.

Others

132. Agarwal, A., A. Singhmar, M. Kulshrestha and A. K. Mittal (2005), 'Municipal solid waste recycling and associated markets in Delhi, India', *Resources, Conservation and Recycling* 44 (1): 73-90.

Abstract: Recycling of the municipal solid waste (MSW) was investigated and analyzed in the Indian capital city of Delhi. It was found that an informal sector comprising waste recyclists and a hierarchy of recyclable dealers plays an important role in the management of solid waste. The associated activity transports nearly 17% of the waste to the recycling units (RU). In this process an entire market is created for the recycle trade. The present work covered an extensive study of this waste trade with emphasis on the most important unit of the waste chain, the recyclists. Extensive interviews and surveys with recyclists from various slums helped in evaluating the market mechanisms of the recycle trade in Delhi and in revealing details of this informal sector. Through a number of field interviews undertaken on recyclists, recyclables dealers and municipal authorities, a complete hierarchy from recyclists to the final sellers of the recycled product was identified and delineated and the profits at each level determined. The value addition to each product at every level of the waste trade was also determined. Two models were subsequently proposed to evaluate the possibility of formalizing the unorganized waste trade. It was concluded that it is possible to organize the sector, but this would leave more than 66,000 recyclists without employment, a consequence of organizing an activity that presently provides employment and daily living to nearly 89,600 recyclists who belong to the poorest strata of the society. The work also probes into the various aspects of the lives of the recyclists and provides details of the economics of MS.

133. Chang, Y. H. and N. B. Chang (1998), 'Optimization analysis for the development of short-term solid waste management strategies using presorting process prior to incinerators', *Resources, Conservation and Recycling* 24(1): 7-32
134. Chang S. Y. and Z. Li (1997), 'Use of a computer model to generate solid waste disposal alternatives', *Journal of Solid Waste Technology and Management* 24(1): 9-18
135. Chang N. B. and Y. T. Lin (1997), 'Analysis of recycling impacts on solid waste generation by time series intervention modeling', *Resources, Conservation and Recycling* 19(3): 165-186.
136. Cotton, A., M. Snel and M. Ali (1999), 'The challenges ahead – solid waste management in the next millennium,' *Waterlines* 17(3): 2-5.
137. Furedy, C. (1990), 'Social Aspects of Solid Waste Recovery in Asian Cities', *Environmental Sanitation Reviews* 30, Bangkok: Asian Institute of Technology.
138. HMGN (1996), 'Solid Waste Management National Policy', Ministry of Local Development, His Majesty's Government of Nepal.
139. Jurczak G. M. (2003), 'The relation between education, knowledge and action for better waste management in Poland,' *Waste Management & Research* 21(2-18).
- Abstract:** In recent years a significant increase in municipal solid waste (MSW) amount has been noted in Poland, and yet there is no fully efficient system for its treatment. Undertaking projects for rational MSW management requires considering both technical facilities and social barriers (waste reduction, re-use and segregation in households). In Poland, attempts to educate and mobilise society to segregate recyclables have not yet produced satisfactory results. Society's awareness in this field needs to be raised. The purpose of this study was to determine the level of knowledge and understanding about MSW management and the relationship between knowledge possessed and actions undertaken for various residential age groups in two Polish provinces. In all groups, 30% of the respondents showed a satisfactory level of knowledge, whilst an equally small number of individuals had undertaken actions for MSW

management at home; people with a higher level of knowledge undertook such actions slightly more often. No significant differences between the provinces were found, but residents of town, where waste segregation has been introduced simultaneously with an information campaign, showed a higher level of knowledge. The study points to the need to further educate people about MSW, and to encourage the teaching of pro-environmental attitudes.

140. Runkel, M. (2003), 'Product durability and extended producer responsibility in Solid Waste Management', *Environmental and Resource Economics* 24:161-182.
141. Shrestha, R. M. (2000), 'A Quest for Environment Friendly Solid Waste Management in Nepal', Kathmandu Metropolitan City Office.
142. Singh, Rajiv K. (1997), 'Waste Bomb: The threat to Bury the Humanity', *Environmental Crisis and Human at Risk: Priority for Action*, INA Shree Publications, Jaipur India.
143. Singh S. K. (1998), 'Solid waste management: an overview', *Environmental Pollution Control Journal* 1(3): 50-56.
144. Stypka, T. 'Integrated solid waste management model as a tool of sustainable development'.
145. Tao, D., S. Chen, B. K. Parekh and M. T. Hepworth (2000), 'Feasibility study of an integrated process for solid waste utilization', *International Journal of Surface Mining, Reclamation and Environment* 14(4): 325-335.
146. Tongleta, M., P. S. Phillips and M. P. Batesb (2004), 'Determining the drivers for householder pro-environmental behaviour: waste minimisation compared to recycling', *Resources, Conservation and Recycling* 42(1):27-48.

Abstract: New mandatory household recycling targets present a serious challenge to UK Local Authorities. Public participation in Local Authority schemes is key to increasing household recycling levels; however, the most effective way to reduce waste is to deal with it at source, through waste minimization. Understanding waste minimization behaviour is key to achieving sustainable waste management and householder based projects which are theoretically underpinned by cognitive psychology and are promoted by carefully designed marketing/communications, over the long-term, should result in reductions in Municipal Solid Waste (MSW). Cognitive psychological modeling can provide the means to identify the driving forces behind recycling and waste minimization behaviors and in a given area determine the main likely success factors. Once these factors have been established, cost-effective campaigns can be designed to maximize the outcome. The Theory of Planned Behaviour provides a cognitive framework to understand and explain behavior, and its use in this study has provided valuable insights into the factors which underpin recycling behaviour. The findings suggest that recycling attitudes are the major determinant of recycling behaviour, and that these attitudes are influenced firstly, by having the appropriate opportunities, facilities and knowledge to recycle, and secondly, by not being deterred by the issues of physically recycling (e.g. time, space and inconvenience). Previous recycling experience, and a concern for the community and the consequences of recycling, are also significant predictors of recycling behaviour. The findings also provide support for the proposition that recycling; waste minimisation through point of purchase and waste minimisation through repair or re-use represent different dimensions of waste management behaviour, and thus will require different strategies and messages. It is suggested that waste minimisation behaviour is likely to be influenced by a concern for the environment and the community, and is likely to be inhibited by perceptions of inconvenience and lack of time and knowledge.

Internet Sources

147. World Bank (1999), 'What a Waste: Solid Waste Management in Asia', Urban Development Division, The World Bank.
<http://web.mit.edu/urbanupgrading/urbanenvironment/resources/references/pdfs/WhatAWasteAsia.pdf>

148. <http://www.ecorecycle.vic.gov.au/www/default.asp> retrieved on 15th Sept 2003
<http://www.europa.eu.int/comm/environment/waste/index.htm> retrived on 20th May, 2004.