Integrative analysis of city systems: Bangkok "Man and the Biosphere" programme study

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SUMMARY: This paper argues that integrative analysis of city systems helps us to see beyond their current environmental and social problems to underlying causes, and it suggests different opportunities for possible interventions. Focusing on a single aspect of a city or its people without understanding its context risks interventions which treat symptoms rather than causes and whose short-term "solution" often means that the problem returns in the same or perhaps a different form. Our integrative analysis of Bangkok suggests that the root of its environmental (and some social) problems lie in decision-making structures and a political culture which has historically fostered self interested decisions by stakeholders rather than the public interest. This has produced a land use and built environment configuration that largely ignores the functioning of the natural flood plain ecosystem and the well-being of residents. People adapt their behaviour to their environment but often in ways that have serious cumulative impacts on the city. This analysis suggests that problems need to be addressed at their source: the nature of decision-making by stakeholders, at every level. This requires the engagement of all parties inside and outside government, the élite and otherwise. To the extent that planning has a viable role, the focus needs to be on the source of the impacts, such as national development planning, rather than in sectors such as transport, where the problems are evident.

I. INTRODUCTION

DESPITE THE GROWING recognition of the seriousness of urban environmental problems and their contribution to global environmental and social concerns, most analysts continue to study cities in parts rather than as a whole; we study sectoral sub-systems such as transport, water pollution or housing, or neighbourhoods such as particular "slums". While specialization is useful for detailed thinking, we also need to see each issue in the context of how each city "works" environmentally, economically, socially and politically. We therefore need integrative approaches to the study of cities and need to understand how they function as systems.(1)

II. WHY DO WE NEED INTEGRATIVE ANALYSES OF CITIES?

CITIES CAN BE viewed as systems involving people's (and their social and economic institutions') interactions with one another and with the

built environments they have created. The built environments interact with the natural ecological processes of their sites. Intervention in one part of a system inevitably affects other parts. We need to understand the likely impacts of planned interventions in a city and, therefore, to understand the features and dynamics of the total system: what affects what. If we do not take an integrative view of the issues we are trying to address, we risk making changes which displace problems to other parts of the system. An integrative, systems-based view can help us to reframe our problems and see new opportunities for intervention.

A system is, of course, a human construct, an analytical artefact. We abstract systems for study from much more complex sets of interactions which occur in the "real world". Where we draw the boundaries of a system, what scale we select (neighbourhood or whole city), which parts of the system we focus on, are all matters of our own choice. It is fine to focus on a particular aspect of a system, or on a small scale, in order to understand it well but we need to understand how this aspect fits into the rest of its system or indeed the web of potential systems. If we study a "slum", how does it fit into the rest of the city system in terms of its built environment and use of the natural environment, its people's lifestyles, its economic and social roles? If we study a city, how does it relate to areas in its hinterland and nationally? What is its "ecological footprint"[2] in terms of use of imported resources and waste-absorbing spaces? How is it tied to rural areas in economic and policy terms, and how does this affect issues such as migration, cultural relations, the distribution of wealth? In turn, how does each urban-rural interactive system fit into global patterns of natural environment and economic and cultural systems?

III. WHAT DO WE MEAN BY INTEGRATION?

INTEGRATION ENTAILS BRINGING parts into a whole. What we need to integrate depends on our theme and context. We propose that an integrated view of cities should include:

- **relationships between society and environment,** each affecting the other. People and their institutions act on the environment, and the environment creates opportunities and constraints for their actions. Here "society" must be considered both as individuals and domestic units, and their institutional arrangements and power relationships arising from the organization of their society (such as economic arrangements and power relationships);
- **scales,** from the parts of the city to the larger systems of which the city is part, from local to larger spatial units, from individual through family, community and institutional or organizational aggregations;
- **sectors** such as transportation, water systems, air pollution and "slums", and issues within these sectors.

This paper illustrates one way of making an integrative analysis of a city system, from a UNESCO Man and the Biosphere (MAB) Programme study of Bangkok.[3] The MAB Programme was the first international venture to consider cities as ecological systems. Its sub-programme on the integrative study of human settlements, established in 1973, seeks to advance knowledge and understanding of these complex systems as a basis for planning, management and decision-making through research, demonstration projects and training. Key themes over the last decade

1. This study was encouraged and financially supported by UNESCO's Man and the Biosphere (MAB) Programme, Canada's International Development Research Centre, AusAid, and our employers, the Australian National University and Mahidol University. We thank the many people throughout Bangkok, community members, NGO leaders, public servants, politicians, academics and business people who have participated in the study and have shown their keen interest in solving the city's problems. We pay tribute to the efforts of Dr John Celicia, of UNESCO's MAB Programme, for his promotion of integrative analysis of city systems and his personal support in establishing this project, to the leadership of Professor Stephen Boyden in developing integrative frameworks, and to the other participants in MAB studies of human settlements. We also thank anonymous reviewers for suggestions for improving the draft.

2. Rees, W E (1992), "Ecological footprints and appropriated carrying capacity: what urban economics leaves out", *Environment and Urbanization* Vol 4, No 2, pages 121-130; also Wackernagel, M and W E Rees (1996), *Our Ecological Footprint: Reducing Human Impact on The Earth*, New Society Publishers, Gabriola Island, B.C.

3. Key publications are: Poungsomlee, A and H Ross (1992), *Impacts of Modernisation and Urbanisation in Bangkok: Preliminary Report*, Institute for Population and Social Research, Mahidol University, Bangkok; also Poungsomlee, A (1991), *An Integrative Study of an Urban Ecosystem: the Case of Bangkok*, PhD thesis, Centre for Resource and Environmental Studies, Australian National

have been the development of models of the relationship between urbanization and environmental transformation, taking into account the rural areas around cities; empirical studies of demographic changes induced by urbanization, and their environmental consequences; demonstration projects aimed at reducing the pressure and impact exerted by cities on their hinterlands; and studies on the planning and management of green urban spaces.(4)

IV. THE BANGKOK STUDY

BANGKOK IS A megacity which has grown rapidly in its 200 years thanks to its rulers' success in unifying the nation and concentrating their power in the capital and, subsequently, to the city's strategic importance within the nation and South-East Asia region for trade with western countries. As in many other major cities of Asia, Africa and Latin America, economic development has been accompanied by severe environmental and social problems.(5)

The aims of the project were to study the impacts of modernization and urbanization on the people and biophysical environment of Bangkok using an integrative method; to develop an integrative framework and methodology that could be applied in future environmental management and policy-making; and to explore societal processes through which improvements in ecological sustainability and human health might be brought about.(6) We interpret "modernization" as the economic growth paradigm of development combined with the cultural manifestation of "westernization" appearing in people's values and behaviour and in the political realm. Bangkok's path to modernization has focused economic development almost exclusively on Bangkok, which has grown as a primate city to more than 30 times the size of the next most substantial urban centre.(7) This is related to uncontrolled urban growth both in terms of the spread of the city and of successive changes in land use within it. There has been little formal planning,(8) and little infrastructure has been provided to cope with the environmental problems created by the uncontrolled growth. For instance, sewerage only began in the early 1990s although the population of the city is estimated at between seven and ten million people.(9)

The study focuses on the impacts of Bangkok's environmental problems, namely: traffic and transportation, land use change (such as the rapid conversion of agricultural land and the displacement of low-income communities through "urban renewal"), flooding, water pollution, air pollution, noise, solid waste disposal and toxic substances.(10) It examines the interactions between these environmental problems and people's perceptions or interpretations of each problem and ensuing behaviour.

a. Integrative Framework

Our integrative framework, which builds upon that of Boyden,(11) emphasizes an interactive cycle between people's and organizations' perceptions of and actions upon the biophysical environment, and the environment's enabling or constraining of possibilities for human action (see Figure 1a). This cycle occurs at all societal scales, from individuals and households to urban communities or neighbourhoods, and through the various levels of city and national government (see Figure 1b). People and organizations

University, Canberra; Ross, H and A Poungsomlee (1995), "Environmental and social impacts of urbanisation in Bangkok" in Rigg, J (editor), *Counting the Costs: Economic Growth and Environmental Change*, Institute of South-East Asian Studies, Singapore, pages 131-151; Ross, H (1997), "Bangkok's environmental problems - what hope is there for change?" in Hirsch, P (editor), *Seeing Forests for Trees: Environment and Environmentalism in Thailand*, Silkworm Books, Chiangmai, Thailand, pages 147-165; Poungsomlee, A, H Ross and R Wiseman (1995), "Trouble with traffic: the effects of rapid urbanisation on Bangkok, Thailand" in Brown, V, D I Smith, R Wiseman and R and J Handmer (editors), *Risks and Opportunities: Managing Environmental Conflict and Change*, Earthscan, London, pages 134-167; Ross, H and S Thadaniti (1995), "The environmental costs of industrialisation" in Krongkaew, M (editor), *Thailand's Industrialisation and its Consequences*, Macmillan, New York, pages 267-288; Ross, H (1995), "An ecological basis for planning in Bangkok" in Birkeland, J (editor), *Rethinking the Built Environment: Proceedings of Catalyst '95, the Design and Environment Conference*, Centre for Philosophy, Planning and Design, University of Canberra, Canberra, pages 34-39; and Punpuing, S (1996), *Commuting Behaviour Patterns in Bangkok*, PhD thesis, Centre for Resource and Environmental Studies, Australian National University, Canberra.

4. Celicia, J (1995), "Towards the resourceful city" in Open University for the Environment MAB/UNESCO Programme, *Qualification of Human Resources, Teaching and Research for the Planning and Management of the Urban Environment*, Open

Figure 1: Integrative Framework

Figure 1a: Interactions between people and environments

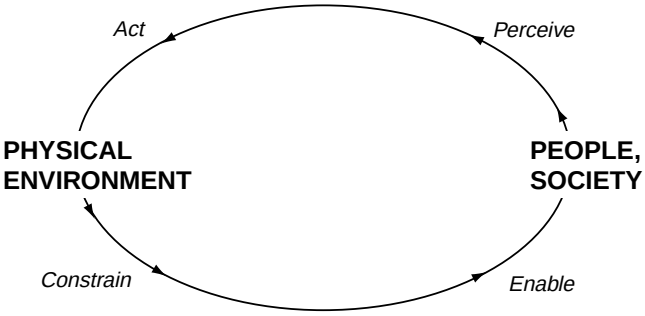


Figure 1b: Societal and geographic scale

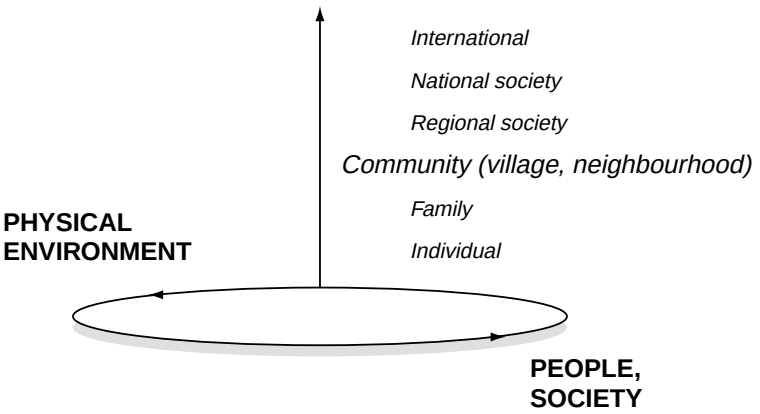
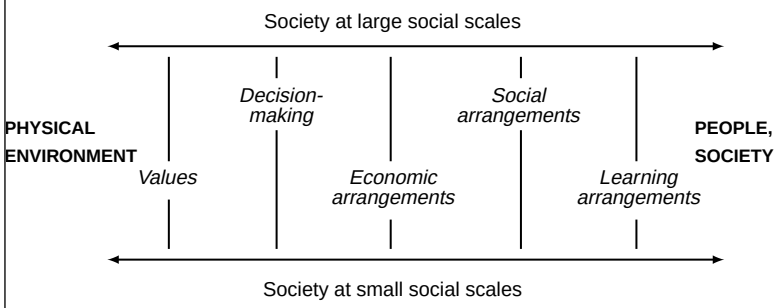


Figure 1c: Societal functions at collective levels (e.g. community, national)



take actions which shape and reshape the environment which, in turn, affects the way they live (and operate). Of course, relative power, attributable to financial means, social status and political influence, strongly influences each party's capacity to affect the environment.

University for the Environment, Curitiba, Brazil.

5. See, for example, Hardoy, J E, D Mitlin and D Satterthwaite (1992), *Environmental Problems in Third World Cities*, Earthscan, London; also Haughton, G and C Hunter (1996), *Sustainable Cities*, Jessica Kingsley Publishers and Regional Studies Association, London; and World Resources Institute, UNEP, UNDP and the World Bank (1996), *World Resources 1996-97: the Urban Environment*, Oxford University Press, New York and Oxford.

6. See reference 3, Poungsomlee and Ross (1992), page 3.

7. This figure is calculated on the administrative areas of the Bangkok Metropolitan Administration and comparator cities. The built environment and economic functions of the city actually spread into 13 surrounding provinces.

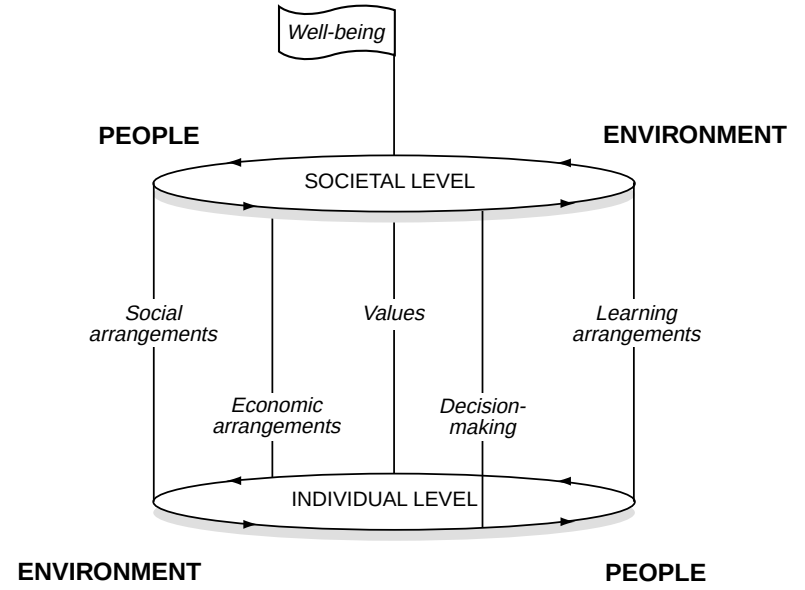
8. Roachanakanan, Thongchai (1999), *Bangkok and the Second Bangkok International Airport: Politics of Planning and Development Management*, PhD thesis, Department of Geography, Australian National University, Canberra.

9. See reference 3, Ross and Poungsomlee (1995).

10. See reference 3, Poungsomlee and Ross (1992).

11. Boyden, S (1979), *An Integrated Ecological Approach to the Study of Human Settlements*, MAB Technical Notes 12, UNESCO, Paris.

Figure 1d: Combined framework showing people-environment interactions at different scales



A number of societal "functions" affect the types of people's actions on the environment at all societal levels (see Figure 1c). We describe these in terms which apply to all societies, not just industrialized ones, for instance, by emphasizing "decision making" rather than "government" or "governance" (see Box 1). If we combine the idea of a cycle of people-environment interactions with that of scales and identification of societal purposes, we have a merry-go-round in which the cycle repeats at all scales and the societal "functions" of values, learning, decision-making and exchange link and transcend the scales (see Figure 1d). The well-being of people and their environments, the ultimate purpose, caps the roof!

Box 1: Societal Functions affecting the Nature of Human Actions on the Environment (see Figure 1c)

Values - personal or shared guiding principles for behaviour.
Decision-making arrangements - formal and informal structures and processes to achieve cooperation and resolve conflicts towards the management of a society and the issues which concern it. (This includes political systems and processes, administrative systems and processes, and legal or normative rule systems).
Social arrangements - meeting people's social and psychological needs through processes of bonding and cooperation.
Economic arrangements - meeting needs and wants through processes of exchange.
Learning arrangements - formal and informal arrangements for encouraging and assisting people to understand the relationships between themselves and their environments. (This includes processes such as socialization, as well as education).
Since culture embraces all of these, we have not identified it separately in this model.

b. Approach

Limitations of budget and a small team have not been a deterrent to looking at the "big picture". We have incorporated existing literature and information where available and targeted information-gathering at social, perceptual and interpretive data which are not available on a city-wide basis.

In the first stage of the study,[12] we documented environmental conditions from published and government sources, and conducted participatory case studies using focus groups in seven urban communities which were affected by different aspects and degrees of urbanization. These communities were located from the inner to the outer areas of the city and included a wide range of socio-economic status and living environments. These community studies gave new insights into the social and health impacts of Bangkok's environmental problems, showing how the problems are experienced differently by people of different socio-economic status and in different locations. They showed that, whilst everyone experiences the same environmental problems in broad terms, the poor are most exposed and have the least ability to adapt. We found that the popular conception of Bangkok's environmental problems is, in fact, a stereotype based on the experiences of the higher socio-economic strata and the inner-city.

In the second stage of the project, a variety of methods were used, including measures of environmental quality, land use and economic studies, and a major survey (1,200 interviews) of Bangkok residents' experiences of living in the city and their behaviour patterns. The survey was based on the findings of the first stage of the project and the sample allowed for comparison of the experiences of people living in the inner, middle and outer administrative zones of Bangkok. Policy issues and opportunities for change were explored through interviews with key informants about formal and informal urban decision-making, and "focus group" interviews with groups of residents to provide more information on city living experiences and to seek their policy suggestions. These methods provided avenues for public participation in the research. The study considers the ways in which residents' perceptions of environmental conditions affect their behaviour patterns, and the ways in which their adaptations to these conditions work cumulatively to change the city environment (as well as having further social impacts).

12. Reported in Poungsomlee (1991), see reference 3; also see reference 3, Poungsomlee and Ross (1992).

c. Insights

We found that Bangkok's environmental problems need to be understood in terms of the particular land use and built environment configuration which has grown up on the natural flood plain ecosystem. Originally, the city was well attuned to its flood plain environment, with housing oriented towards the canals (or on houseboats) and designed to cope with seasonal flooding. The canals formed the focus of social life and transportation, provided food and absorbed or removed wastes. The natural river system of the delta was increased by many built canals which, in turn, increased the drainage capacity of the flood plain. Over the last 130 years, under the influence of western values as the country took on a global economic role, the ecologically and culturally viable canal system has been filled and degraded in favour of road transportation which has not, however, been developed efficiently. Other features of the city's built

environment and land use configuration are the presence of agricultural areas within the city boundaries which provide green spaces and land capable of absorbing water, and the phenomenon of "ribbon development" following major roads out of the city and "superblocks", unusually large urban block sizes between the few wide straight roads. These superblocks are criss-crossed by zig-zagging lanes, remnants of customary land allocation and plot shapes combined with private landholders' right to block roads.

People's behaviour patterns in their use of this built environment contribute to the problems. In some cases, households and small businesses have no option: where there is no sewerage, wastes are discharged directly into the canals. Where they do have options, political and economic incentive structures tend to reward environmentally damaging behaviour. Until regulations and monitoring were tightened up around 1992, it was common for factories to avoid running their waste water treatment plants because of the cost. Traffic conditions are a clear example of the contribution of behaviour patterns. As commuters become frustrated with slow travel times and the discomforts of public transport, they strive to own their own cars. Until the economic crisis of 1997, economic conditions fostered the growth of the middle-class, providing opportunities for more people to buy cars. The ever-increasing number of cars on the roads, however, clogged the traffic for others while creating a political demand for more roads to be built. The traffic police took the sensible policy course of trying to increase speed of movement on the existing roads through a range of strategies to remove impediments and deter poor driver behaviour and bribery.

Understanding behaviour patterns is important for two main reasons. Similar patterns by many individuals have potentially large cumulative effects, to the advantage or detriment of others. Further, policy interventions will work or fail according to their acceptability to the public. If one understands people's and organizations' motivations and behaviour patterns, one has more hope of designing workable policies.

But how did this land use and built environment configuration arise and how does it change over time? It comes from a combination of formal and, more commonly, informal decision-making, in which all stakeholders in the city, and many located beyond it, take uncoordinated decisions in pursuit of very different goals in an unusually "laissez-faire" regulatory context.[13] The land parcels, to some extent, reflect former agricultural land units, developed sequentially as farmers sold the land to developers. The sequence of sales also shows up in a patchwork of built-up and agricultural land in the outer areas of the city. Since Thai tradition allowed right of way across private land, in the past there had been no need to provide public parks. Land conversion for profit has meant that the city remains very short of public park space; there is no financial incentive for developers to provide open spaces when they build and the government has few resources to acquire and set aside highly priced land. The built environment has therefore grown in a vernacular fashion, as particular developers buy land and develop it in certain ways to meet perceived demand and profit opportunities and members of the public buy the shop houses or estate houses so provided. There are few effective planning constraints on the location of industry and retailing, small or large.[14] Over many decades, Thai planners have tried to maintain some restraint on the form of the built environment but with very limited regulations to assist them. They have forecast environmental and efficiency

13. See reference 3, Ross (1997).

14. See reference 8.

problems and have tried to have these addressed, but they have met a lack of political will and problems with inter-departmental coordination. The city has therefore grown up casually and chaotically, the cumulative effect of various interest groups each pursuing different goals over time. The very mixed built environment is part of the city's charm but also the source of much inefficiency and strain for its residents, particularly regarding traffic and flooding problems.

Underlying the "laissez-faire" context for decision-making is a political culture with ancient cultural roots. It favours a top-down exercise of power with a reliance on leaders rather than on reason and persuasion. The system features the traditional Thai "patron-client" system in which those in power command respect and support while furthering the interests of their followers; this combines with a "might is right" ethos in which personal interests, rather than principles, are pursued.[15] Meanwhile, a strong sense of social hierarchy and people's belief in fate rather than personal responsibility work against democratic principles.[16] Lack of control has generally worked in favour of élites, who have maintained a web of mutually beneficial allegiances across the main stakeholder groups of politicians, public servants (including the military) and business. The general public and the public interest have been neglected in the process.[17] We analyzed the nature and effects of interactions among these stakeholder groups and the changing patterns of these interactions which are bringing the public and public interest more strongly to the fore, creating some potential for more enlightened management of the city.

We identified three priorities in addressing the underlying causes of Bangkok's environmental problems:

- **Address the nature of decision-making.** Encourage all stakeholder groups to foster a different political culture which no longer condones the pursuit of self interest against the common interest. Encourage stakeholder groups to cooperate in forming a common vision for the development of Thailand and Bangkok based on sustainability principles rather than on economic growth. Tap the creativity of stakeholder groups, at all levels within the city, to propose new solutions to the city's problems. Continue the rationalization of government departments and their responsibilities. (All of these have begun under the current national plan and new Constitution).
- **Work with the natural ecosystem, not against it.** Consider how the built environment can be developed in the future to cooperate with natural functions and preserve their health.[18] This entails, for example, recognizing the nature of the flood plain system and its drainage requirements and configuring the built environment where possible to complement rather than resist it.[19] Reconsider conventional wisdom on land use and built environmental problems – can "problems" such as ribbon development be turned into new opportunities to pursue ecosystem and human health by using a star-shaped design to organize transport routes while leaving unbuilt and unsurfaced space between the arms to help absorb rain and flood waters?
- **Understand people's behaviour patterns.** Behaviour patterns contribute to the nature and extent of environmental problems and how much people are exposed to them. Do we need to change the opportunity structures for daily behaviour offered by the built environment, economic constraints and social factors in order to improve well-being? Will our policies fail if we don't understand why people behave in the ways they do?

15. For example, Thongchai Roachanakanan explains how different ministries in fragile coalition governments are parcelled out among coalition partners who can then favour their own or their supporters' pecuniary interests through promotion of major development projects - see reference 8.

16. Nakata, Thinapan and Likhit Dhiravegin (1989), "Social and cultural aspects of the Thai polity" in Prasith-Rathsint, Suchart (editor), *Thailand's National Development: Social and Economic Background*, Thai University Research Association, Bangkok, pages 166-196.

17. See reference 3, Ross (1997).

18. See reference 3, Ross (1995).

19. Thongchai Roachanakanan (1999) documents a major example in the location and design of the new international airport, planned and constructed - against clear advice - to block the four kilometre-wide flood way which is supposed to divert annual flood waters away from the city centre, as well as three canals - see reference 8.

d. Case Study - Traffic and Commuting Behaviour

Let us illustrate these ideas with a sectoral case study on traffic. Traffic is widely agreed among Bangkok residents to be the city's worst environmental problem[20] and clearly one with marked social impacts. It is linked to other environmental problems in that it is a major cause of air pollution and noise. The extent of garbage collection is related to traffic and road and land use configuration since there are only three garbage dumps, necessitating long trips through very slow traffic for each load. Most of the trucks are designed for standard roads and only in the last decade have alternative vehicles been provided for narrow lanes – a common vernacular settlement form in Bangkok – and canals. Less obviously, the transportation system is also related to water pollution and flooding since the canal system has been neglected in order to provide road space, and road and other surfaces contribute to high rates of storm water run-off and low availability of land for infiltration. Transportation systems and traffic are a dynamic part of changing patterns of land use. In the late 1980s, those who could afford it pursued the suburban dream and escaped inner-city air pollution and noise by moving to new housing estates in the outer zone of Bangkok (the vanishing "green belt", poorly protected under inadequate legislation). They were able to do so through new highways, economic growth and private cars. This created a land development boom which later contributed to the 1997 economic collapse. As the number of these estates increased and the highways became more clogged, the trend reversed and many bought apartments back in the inner city, either for permanent residence or as weekday second homes.

Space does not allow a detailed description of the land use configurations affecting traffic but a number of features are worth noting. The road system covers only 11 per cent of the urban land surface, a low percentage in international terms.[21] It is also awkwardly configured, with few wide through roads bounding "superblocks" and with inadequate internal distributor roads.[22] The only mass transit available is a cheap (for the rider) but antiquated bus service, slow and uncomfortable in the crowded conditions and hot, humid climate. Air conditioned buses attract a small proportion of users. The number of train lines is limited and interferes with road transport at their crossing points. Fast mass transit is sorely needed, yet three major proposals were developed independently by different national and metropolitan government organizations in an unintegrated way. Two were delayed and one was shelved indefinitely owing to the economic crisis. Canal transport is being revitalized by the metropolitan government, providing some alternative to road transport.

In our focus group studies in seven urban neighbourhoods,[23] people from all income groups throughout the city described graphically the health impacts, stresses and family and neighbourhood impacts of commuting. They described how they were exposed to discomfort, noise and fumes, depending on their mode of transport:

> "Sometimes I go by [hired] motorcycle and then I meet those buses sending out carbon monoxide. My handkerchief (worn as a mask to protect the face) gets all dirty with the black smoke."

They reached home late, tired and stressed, and reported that they tended to take out their frustrations on other family members or shunned their company. They had little time for harmonious family life and little time to supervise their children or teach them skills. Some were also

20. Poungsomlee (1991) identified the environmental problems for analysis using a literature review, an analysis of press clippings and consultation with environmental professionals. The recognition of traffic as people's greatest concern was borne out in our survey of 1,200 Bangkok residents. They were asked to name three advantages and then three disadvantages of living in Bangkok. Traffic was by far the most frequently listed among the disadvantages - see reference 3.

21. Stickland, R (1993), "Bangkok's urban transport crisis", *The Urban Age* Vol 2, No 1, pages 1-6.

22. Halcrow Fox and Associates et al (1991), *Executive Report for the Seventh Plan Urban and Regional Transport*, United Nations Development Programme, Bangkok.

23. See reference 3, Poungsomlee and Ross (1992).

conscious of neglecting their diet because of a lack of time to eat breakfast.[24]

Sureeporn Punpuing[25] studied commuting behaviour patterns from our survey results (567 of the 1,200 survey respondents were commuters) and undertook further qualitative research among commuters resident in an area of Bangkok receiving infill housing. She found that, contrary to popular perception, long commutes are less common among the population than has been believed. Over 60 per cent of the population of the Bangkok metropolitan area itself[26] reaches work within half an hour and 80 per cent within an hour.[27] Surprisingly, almost a third of commuters walked to work. Other travellers were evenly divided between private transport (cars and motorcycles) and public transport (sometimes used in combination with other modes). More than half of the commuters travelled short distances, within their district of residence or to one nearby. Of those who travelled beyond their local area, 45 per cent travelled from outer to inner areas, leaving a high proportion making cross-town journeys of various kinds. This is not surprising given the distribution of employment throughout this multi-centred city. Commuting behaviour patterns are also related to gender, family status, education and socio-economic status. Fewer than half of commuters reported using adaptation strategies but the most common ones were changing transport route, changing mode of transport (to cars) or leaving home early and leaving work late to avoid the heaviest traffic. Despite all the popular grumbling about traffic and transport, commuting difficulties were not a major factor in people's decisions concerning their place of residence and workplace, and very few people moved house or changed their place of work in order to reduce commuting time. It seems that workplace and home are less "elastic" in most Bangkok residents' decision-making than transport.

Successive national and metropolitan governments have attempted various policies and plans to deal with traffic but these have been largely unsuccessful because they have treated symptoms rather than causes, and political instability or lack of political will have led to failures and delays in implementation. Coordination among government departments attempting to solve traffic problems is a near impossibility: two levels of government are involved and numerous departments, each used to working autonomously. Coordination is attempted through committees but their deliberations are prone to stalling and the number of committees is so large as to require further coordination between them. Amelioration of the traffic problems requires simultaneous attention to the transport system, people's behaviour patterns and the institutional and extra-institutional decision-making processes involved in reshaping the built environment and transport system. The initiative is not in the government's domain alone: private stakeholders also have a role in moderating their commuting behaviour and decisions (for example, the location of large new businesses such as shopping centres and office blocks) which affect the movements of traffic. An example of the potential for stakeholders to work together is an initiative by a coalition of stakeholders called "Traffic 94" which used a participatory public process to examine traffic problems and propose a new and integrated set of solutions. It appears to have been successful in generating workable ideas but it did not gain the government endorsement needed for implementation – and then the government changed.

24. See reference 3, Poungsomlee (1991).

25. See reference 3, Punpuing (1996).

26. We were unable to study the surrounding provinces from where many long commutes undoubtedly originate.

27. These figures may be inflated by some sampling bias against commuters since substitutions had to be made where, after repeated visits, respondents could not be found at home. The extent of substitution is not sufficient to negate the trends we have identified.

V. CONCLUSIONS

INTEGRATIVE ANALYSIS OF cities, as systems, enables new perspectives on how the human and physical "parts" of the city environment fit into wholes. These perspectives may suggest new points of intervention for improving problems, for instance, by highlighting causes rather than symptoms. In our case study of Bangkok, using environmental problems as a starting point led to an analysis of land use and built environment configuration and of people's behaviour patterns within it and, ultimately, to the nature of the decision-making which promotes the haphazard land use configuration. We propose that integrated views of cities should include interactive relationships between people and environment, scales, sectors and issues within these sectors.