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A RESOURCE ALLOCATION FRAMEWORK FOR STRATEGIC PLANNING

by

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There are three pressures currently operating to focus local government attention on questions of resource allocation. First, despite periodic setbacks and reverses, there appears to be a long term trend towards more corporate decision-making in local government, with the allocation of resources between and within departments providing a unifying concern. Secondly, because of the current economic situation, central government is imposing tight financial constraints on the overall level of local government activity. Finally, further to its overall financial control, central government is extending its involvement in the formulation of specific local authority programmes via the new resource-based investment plans that service departments are required to produce—Housing Investment Programmes (HIPs), Transport Policies and Programmes (TPPs), etc.[1]

This growing emphasis on resource allocation is forcing a re-examination of the traditional functions of planning within local government, and in particular posing problems as to the content and implementation of structure plans. The reason for this is the paradoxical manner in which local strategic planning has evolved in Britain. On the one hand, it is out of the land-use planning tradition that structure planning has arisen, which means that our most comprehensive attempt to plan the development of a local area has no resource base to support it. In contrast, the rapidly proliferating departmental investment programmes seem likely to draw much more for their formulation on the short term budgeting tradition in local government, with few effective links to structure planning so far evident. There is consequently a danger of the parallel, but separate, development of ineffectual structure plans without the resources or policy instruments to implement them, and fragmented departmental investment plans without the longer term perspective provided by an integrated, resource-based plan for the authority as a whole.

This paper starts by summarising the shortcomings of the current treatment of both resources and departmental policies in structure planning. It then attempts to confront one aspect of the general problem by suggesting an analytical framework for strategic planning which can be used both to explore the underlying processes of economic, social and physical change in a local area, and to integrate the resource-based policies and programmes of different service departments. Following an outline of the general elements of the framework, its use is illustrated first as a descriptive model of the structure of a local economy, and then as a method for generating alternative housing programmes within the descriptive framework. The presentation of the approach is schematic, with appropriate reference made to other papers in which equation systems and further technical detail can be found.

Current Structure Plan Practice

The Planning Research Applications Group (PRAG) at the Centre for Environmental Studies has recently completed a project sponsored by the Department of the Environment to investigate the use of operational techniques in structure planning. The purpose of the

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project was both to review current structure plan practice and to make suggestions for improvements to the analytical base of plan-making. The review of current practice adopted a conceptual framework which emphasised the need for the supporting analysis in the plan to take account of the underlying development processes in an area (for example, the decline of manufacturing industry, residential decentralisation, commercial redevelopment of city centres etc.) and the powers and resources of the different types of agencies involved (for example major national enterprises, local service firms, central government, households, and the local authority itself).[2] This conceptual framework was used to investigate a selection of twenty plans, to determine how the 'system of interest' of the plan was defined, how the past and present behaviour of the local area was described, how forecasts of future trends were derived, and then how this analysis was used to support the generation and testing of alternative plan policies and strategies.

From this review,[3] various shortcomings in current practice were identified as widespread, although there are signs that several are now being realised and at least partially overcome in some of the most recent plans. The following findings emerge as especially relevant to the problem of planning local authority resource allocation:

1. While the analysis of separate 'subject' areas (for example, population, employment, housing, etc.) is usually quite substantive, there is inadequate integration of these partial analyses via the key supply and demand linkages in the system (for example, the labour market links between 'population' and 'employment' or the housing market links between 'population' and 'housing').
2. The activities of major external agencies are never considered in any detail (for example, the investment plans of major firms, or levels of private sector housebuilding).
3. Policies are not derived with respect to any specific, comprehensive statement of the scope of local authority resources and implementation powers, beyond implicit reference to development control.
4. Despite the land use planning tradition from which they derive, none of the reviewed plans provides any quantitative assessment of the overall land supply situation in its area (for example, land under different uses, potential redevelopment land, derelict land, ownership patterns).
5. While there is some treatment of 'finance' as the key local authority resource, it is usually confined to costing final plan alternatives once they are derived. The likely availability of resources is never introduced as a potential constraint on policy-making at the beginning of the plan-making process, which means that the strategies that eventually emerge may be quite unrealistic in cost terms. Furthermore, in some cases, likely local authority capital expenditure is forecast as an exogenous trend, rather than considered as a policy variable.
6. The treatment of 'housing' is often rather thin, with the main emphasis on translating aggregate demographic trends into some measure of housing 'need' with respect to existing stock, planned demolitions, vacancies etc. In some plans the level of future population growth is assumed to be dependent upon policies for housing provision, but the nature of the assumed relationship is, in several cases, obscure or confused. There is little disaggregation of the analysis, for example to examine the effect of changing household size and structure upon the demand for dwellings of different sizes, or of the relationship between social structure and tenure.
7. 'Transport' is the most neglected subject area, with several plans referring to their on-going TPP studies as the source of analysis and policy discussion. Where some analysis is conducted as part of the structure plan, it is again at the aggregate level, forecasting the effects of population and car ownership trends upon travel demand. There is little substantive policy discussion as to alternative mixes of public and private provision, or of the effects of alternative routes upon the spatial distribution of activities.

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To summarise, it can be said that so far there is only a one-way link between structure plans and the policies and programmes of service departments. While structure plans are being used to examine medium- and long-term demographic and economic trends and translate these into estimates of total demand for housing, transport and social services, there is as yet little sign of a reciprocal feedback relationship whereby the programmes of service departments are recognised as influencing future development trends in the area. This is partly because departmental investment plans are a recent and evolving innovation, with their relationship to structure plans still properly to be determined, but also partly because of the continuing fragmentation of local authority decision-making, which has been exacerbated by the division of functions between county and district authorities (especially for housing).

Activity Analysis

The second part of the PRAG project was directed towards the development of an operational framework which could encompass an integrated analysis of the behaviour of a local system.[4] The framework that has been developed is based upon economic activity analysis.[5,6] By applying this theoretical approach, an urban or sub-regional system can be characterised as a system of inter-related 'activities', such as residential, manufacturing, service and local government activity, each producing and consuming one or more of a set of 'commodities' such as land, labour, floorspace and finance. These commodities, or resources, are the basic physical entities of the system, and it is through their production and consumption, interpreted in the widest possible sense, that the different activities are inter-related. The level of definition of an activity is dependent upon the level of detail of the analysis so that, for example, residential activity can be disaggregated by location and by the size and socio-economic group of households.

To illustrate how the framework can be built up, Fig. 1 shows, in both flow diagram and matrix form, a simple structure for an urban system in terms of four activities, that is, residential, retail, manufacturing and local government activity. The linking commodities are land, housing and other floorspace, labour, finance (rates), consumer goods, local authority services, manufacturing goods, wholesale goods and raw materials. Thus, the residential activity (households) produces labour while consuming housing, retail goods and local government services. Retailing 'imports' wholesale goods from outside the local area and also consumes labour in order to 'produce' retail goods ready for household consumption. Manufacturing similarly 'imports' raw materials from outside the area, employs local labour and produces industrial goods for 'export'. The local authority 'consumes' finance from central government and local rates (levied on households and local firms), employs local labour and produces housing and other services for consumption by local households. All activities 'consume' land and their respective types of floorspace.

As described so far, this is essentially a resource-based accounting framework that documents the relationships between activities in terms of commodity flows. In this form it can be used as a data structure, ensuring consistency between data sets for different subject areas (for example, matching household structure to the existing stock of dwellings by size and tenure). By expressing each activity as a vector of coefficients, corresponding to the quantities of commodities it consumes and produces at a unit 'level of activity', such a data structure can be translated into a linear model[5] of the structure of an urban or sub-regional system. Such a model can be used to explore the basic processes of system behaviour under alternative assumptions about the supply of different resources such as land and finance and the demand for goods and services, labour, housing etc. Thus, returning to Fig. 1, the framework allows for assumptions about the 'independent' driving forces of the local economy, for example, the local manufacturing base and local households, to be interrelated

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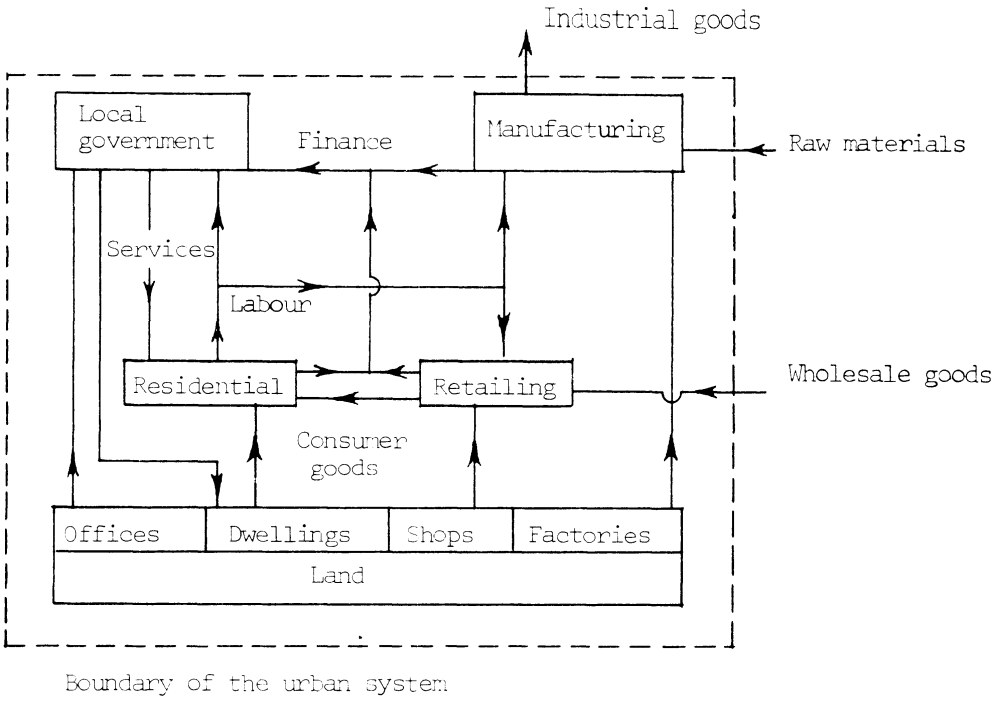

	ACTIVITIES			
Commodities	Residential	Retailing	Local government	Manufacturing
Labour	+	-	-	-
Land	-	-	-	-
Housing	-		+	
Other floorspace		-	-	-
Consumer goods	-	+		
Local authority services	-		+	
Industrial goods				+
Finance	+	+	-	+

+ Denotes production of a commodity
- Denotes consumption of a commodity

Fig. 1 Simple activity-commodity representation of an urban system: (top) flow diagram form; (bottom) matrix form

via labour market behaviour and to be translated into 'dependent' demands for local services, housing, transport etc.

The next section describes the structure of such a model for the Teesside sub-region. It has been built as a framework for strategic planning, incorporating external basic and service sectors, residential activities and local government services. Within such a model the local government sector constitutes one sub-system. Its activities can, however, be expanded in

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terms of the service activities of different departments, thus providing a set of sub-models for departmental resource allocation within the overall system model. A consistent set of relationships between local government activity and the rest of the urban or sub-regional system can thus be established as an analytical basis for relating departmental investment programmes to the wider framework of structure planning. The subsequent section illustrates how such a model can be developed for housing investment activities, and indicates how mathematical programming methods can be used to transform the descriptive model into a normative framework, identifying alternative investment programmes that make efficient use of given resources to meet alternative policy objectives.

A STRATEGIC PLANNING MODEL FOR URBAN DEVELOPMENT

The concepts introduced in the previous section have been used to construct a strategic planning model for the development of an urban system, implemented with data for the Teesside conurbation.[7] Two types of activities are defined: 'production' activities which use land and floorspace and produce and consume goods, services and labour, and 'investment' (construction) activities which create new productive capacity in the form of floorspace of different types. The production activities are defined according to the type of 'commodity' they produce, that is, primary and manufacturing (basic goods); office, transport and storage, retail, education and miscellaneous (services) and non-manual, manual and inactive households (labour). The model is structured into a set of sub-models, with activities defined for each local district within the urban area. The fundamental mechanism in the model is the interaction of two opposing processes which determine the levels of different 'production' activities within each sub-area and across the conurbation as a whole. On the one hand, the capacity of the floorspace and/or land in different uses (that is, the fixed capital) is assumed to determine the maximum level and location of activity within the urban system at any point in time. On the other, internal and external demand for the products of different activities (labour, goods and services) limits total levels of activity across the system as a whole. To complete the framework, a construction sub-model produces new floorspace over a given time period, updating productive capacity and moving the model forward through time. The model structure is illustrated in Fig. 2.

The mechanisms of the model are expressed as a set of balance equations for each type of commodity,[8] with the net production or consumption of that commodity matched to a 'constraint' which can represent an internal balance (zero constraint), the exogenous supply of a resource such as land, existing floorspace or finance (negative constraint), or the final demand for the output of basic goods (positive constraint). Such constraints are defined for each district, and across the urban system as a whole, so that the conurbation constraints link the district sub-models together. The following are the main constraints defined at district level:

1. The 'capacity' of the floorspace/land in different uses (that is, land, factories, offices, shops, schools, warehousing, other service space and housing) determines the level of activities, and thus output, in each district.
2. The demand for labour (manual and non-manual) by district employment sectors is contrasted with labour supply by district households, and the differences expressed as a net commuting flow in or out of the sub-area (a spatial interaction version of the model, with journey to work flows between each pair of districts, has also been developed[9]).
3. As with labour, the demand for 'district services' (that is, retailing, education, other personal services) by local households is contrasted with local supply (determined by floorspace capacity), and the difference expressed as net flows of services in or out of the district.

The following are the conurbation level constraints:

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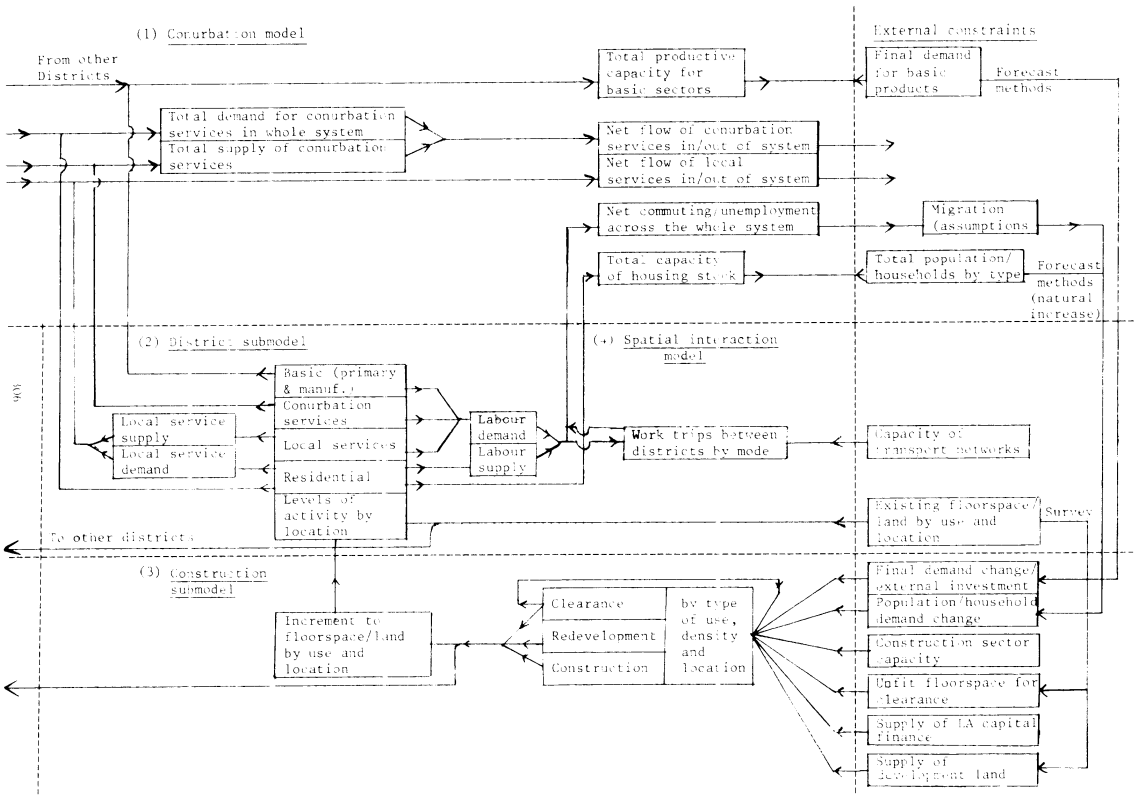

Fig. 2 Structure of the Cleveland modelling system

1. Externally determined levels of 'final demand' for the primary products and industrial goods produced within the conurbation are contrasted with the levels of 'capacity' output summed across all districts. Differences represent the effect of nationally determined demand upon local supply.
2. The demand for 'conurbation services' (transport/storage and office services) by households and employment sectors in all sub-areas is contrasted with the 'capacity' output of these services summed across all districts. Differences represent a net outflow of services from the conurbation to surrounding areas, or else a shortage of capacity within the urban system.
3. The net flows of labour and local services in or out of each district are summed across all sub-areas to give the net commuting (allowing for unemployment) and service flows in or out of the conurbation as a whole.
4. The 'capacity' of the housing stock in each district (owner-occupied, private rented and local authority) is summed across the conurbation and matched with independent estimates of population and household demand by non-manual, manual and inactive households.

The version of the model that has been constructed for the Teesside conurbation has four district sub-models, corresponding to the Districts of Cleveland County, that is, Hartlepool, Stockton, Middlesbrough and Langbaurgh. A 1971 base year was chosen, and the model coefficients were calculated using Census and Employment Register data plus information from local floorspace and land use surveys. For this 1971 base year, Table 1 shows the net flows of labour and local services in or out of each district, in absolute terms and as a proportion of total production (for outflows) or consumption (for inflows) of each

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TABLE 1: *Net flows of labour and services between districts in Cleveland (1971)*

Commodity	*District*			
	Hartlepool	*Stockton*	*Middlesbrough*	*Langbaurgh*
Labour—non-manual				
total activity	14 367	26 706	27 147	22 579
net flow	+636	+73	−4162	+3601
	(4.4%)	(0.3%)	(15.3%)	(15.9%)
Labour—manual				
total activity	26 754	46 655	39 634	39 276
net flow	+2294	−7109	+6093	−890
	(8.6%)	(15.2%)	(15.4%)	(2.3%)
Services—retail				
total activity	3221	5270	7062	4800
net flow	−324	−76	+2134	−1729
	(10.1%)	(1.4%)	(30.2%)	(36.0%)
Services—education				
total activity	2910	4656	6411	4300
net flow	−636	−369	+1991	−982
	(21.9%)	(7.9%)	(31.1%)	(22.8%)
Services—other (health, recreation)				
total activity	4630	7817	10 722	6923
net flow	−736	+154	+3619	−3024
	(15.9%)	(2.0%)	(33.7%)	(43.7%)

Total activity (labour)—total level of employment for net inflow of labour; total level of economically active population for net outflow.
Total activity (services)—total level of consumption (expressed in terms of employment) for net inflow: total level of production for net outflow.
Net flows (labour and services)—flow measured as a level of employment (+ for outflow, − for inflow) and percentage of total activity (production or consumption)

commodity. The main labour flows are an inflow of non-manual labour to the Middlesbrough district, principally from East Cleveland, and an inflow of manual labour to Stockton, principally from Middlesbrough. These net flows are an indicator of the imbalance both between total households and employment, and between household and employment structure (manual and non-manual), across different districts. For service flows, major differences in the level of provision emerge when comparing districts. Thus, while Stockton is relatively self-supporting, around one-third of Middlesbrough's output of services (measured in terms of levels of employment) is consumed in Hartlepool and East Cleveland. The latter district shows the most severe under-provision, having a level of population, and thus service demand, almost as high as Stockton and Middlesbrough, but only between one-half and three-quarters of their level of provision.

This base year version of the model can be used as a framework for integrating more detailed partial analyses of different aspects of system behaviour. Thus input-output analysis can be used to explore the economic linkages between different sectors within manufacturing,[10] while spatial interaction models allow examination of the detailed work and service trip flows both within and between districts.[11] The addition of the construction sub-model takes the framework a stage further, allowing alternative development policies to be tested. This requires independent estimates of the main exogenous changes affecting the system over a given time period, that is, changes in the capacity and demand for manufacturing activity, the natural increase in population and changes in household structure, increases in household demand for services, and changes in activity rates. Balance equations then establish overall changes in residential and service activity, with net migration balancing the labour demand of employment sectors against the labour supply of

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residential activites. Estimates must also be made of the resource constraints likely to affect development over the period, for example, the availability of development or redevelopment land, unfit housing to be cleared, available capital finance for local authority investment in housing, schools etc., and any manpower or construction sector constraints considered significant. With investment activities defined for each type of floorspace in each district, alternative spatial mixes of housing and service floorspace development can be tested, such that the total increase in capacity is sufficient to support the estimated changes in residential and service activity and all the resource constraints are satisfied. For given alternative policy objectives, mathematical programming methods can be used to identify the mix of development activities that best achieves each objective within the given constraints.[12]

The Teesside model is currently being extended by means of such a construction sub-model. The model is moved forward through time in five year increments, from the 1971 base year to a final target date of 1986. Forecasts of anticipated changes in basic employment, population and service demand have been made available by Cleveland County Planning Department,[13] as well as information on existing planning permissions for housing, office and shop development in each District. Within this framework alternative development policies will be tested, taking into account existing commitments and attempting to explore the implications of some of the potentially conflicting policy objectives of the County, for example:

1. to make each District as self contained as possible in terms of employment and service provision;
2. to achieve, via housing provision, a greater degree of social mix within each District; and
3. to build up Middlesbrough as a major regional service centre.

A HOUSING INVESTMENT MODEL

The activity analysis approach can also be used to specify models for assisting local authority resource allocation, either for a single department or across the authority as a whole.[14] The range of possible revenue service and capital investment activities must be defined at the appropriate level of detail, in terms of their consumption of resources such as finance, manpower, land and floorspace, and their production of services for different client groups or floorspace for different services (housing, schools etc.). With appropriate constraints defined on resource availability and demand for services, alternative programmes can be general urban development model determining the level of demand or 'need' for different local commodity structure, such local government service or investment models can be elaborated as sub-models within the overall development planning framework outlined in the previous section. A two-way flow of information can be established between the models, with the general urban development model determining the level of demand or 'need' for different local authority services, while the production of local government services and its investment in housing and other floorspace can be fed into the overall development process.

The Housing Investment Programmes, which local authorities are now required to prepare as bids for capital resources, provide a good medium for applying the approach. The programmes are built round the major types of local authority housing activity—construction, conversion, improvement, clearance and acquisitions, plus loans and grants for private sector purchase and improvement. Each of these activity types can be disaggregated to the desired level of detail, for example, by size, condition and tenure of dwelling, and by each year within the four year programme. For each activity type, profiles can be constructed using available data on unit capital costs, site area requirements, use of manpower (both manual and non manual), the before and after condition of buildings, implications for the revenue account etc. Table 2 shows how some simple housing activity profiles might look (the data are artificial). The corresponding set of constraints will include the capital budget for each spending block in each year,[15] the supply of vacant or clearance

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TABLE 2: *Example activity profiles for Housing Investment Programmes*

	Construction	*Improvement*	*Clearance*	*Acquisition*	*Improvement grants*
Resources used					
Dwelling (tenure/condition)	—	L2	L1	P2	P2
Land (acres per dwelling)	0.04	—	—	—	—
Labour—non-manual (man years per dwelling)	0.08	0.04	0.03	0.02	0.02
Capital cost (£ per dwelling)	17 000	7000	3000	12 000	2000
Outputs					
Dwelling	L3	L3	—	L2	P3
Land	—	—	0.05	—	—
Revenue implications (£ per dwelling)	1800	800	300	1200	100

Codes: Tenure: L = local authority; P = private
Condition: 1 = unfit; 2 = substandard; 3 = fit

sites for development, and the manpower establishment in different departments (architects, valuers, engineers, direct labour, etc.), as well as existing commitments and schemes underway, and estimates of likely future household demand and private sector provision. If set within the strategic planning framework, these latter estimates can be derived as part of the overall development planning process. For alternative policy priorities, mathematical programming methods can then be used to identify the best mix of activities within cost and other constraints. Such priorities could, for example, vary from providing the greatest number of available dwellings (construction emphasis), to raising the overall quality of the existing stock (improvement emphasis), with various combinations in between.

Table 3 shows two hypothetical programmes that might be generated by the method, one with a new construction emphasis and the other weighted towards improvement, using the artificial activity profiles presented in Table 2. The given constraints are an establishment of 100 non-manual staff, 100 acres of available land for housing, a capital budget of £20 million a year for four years. In addition, a minimum increase of 2500 new dwellings, a committed programme of improvement for the authority's own dwelling stock of 500 dwellings per year and a committed slum clearance programme of 100 dwellings per year are assumed. With the 'construction' option, it is available land that is the operating constraint, despite a doubling

TABLE 3: *Example housing option profiles*

	Option 1	*Option 2*
Levels of activity (nos. of dwellings)		
Construction	3500	2500
Improvement	2000	3805
Clearance	800	400
Acquisition	0	805
Use of resources (* = constraint reached)		
Capital (£m)	75.9	80*
Manpower (non-manual staff)	96	95
Land (acres—net of clearance)	100*	80
Net increase in public sector dwelling stock	3500	3305

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of the slum clearance programme to increase the supply of sites, whereas with the 'improvement' option it is the capital budget constraint that is reached first. This second option allows for the rate of improvement of the authority's own dwelling stock to increase by 50 per cent, plus the acquisition and improvement of 800 substandard dwellings from the private sector. Once all the required programme options have been generated in this way, they can be assessed by the decision maker—and some selected for further examination. The trade-offs between selected pairs can then be plotted in more detail, in order to observe how a change in emphasis between, say, construction and improvement is reflected in a changing mix of activities and a switch between operational constraints (for example, between land availability and the capital budget).

Conclusions

Having discussed the shortcomings of current structure planning practice as far as resource allocation and the incorporation of departmental investment policies is concerned, this paper has sketched out an analytical framework which could help to integrate the preparation of departmental programmes within an overall strategic planning process. The development of the methods is still proceeding, and having obtained the collaboration of Cleveland County Planning Department in the development of the strategic planning model, case study work is now being initiated to develop and test the housing investment model in one or more local authorities. Although the approach makes use of mathematical programming methods, it is the planner or departmental decision maker who must make the crucial specification and testing choices at each stage in the development and use of the method.

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