

MANAGING AN OPERATIONAL GIS: THE UK NATIONAL ON-LINE MANPOWER INFORMATION SYSTEM (NOMIS)

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This chapter describes the characteristics and management aspects of NOMIS, the UK National On-line Manpower Information System. The system provides geographically-detailed information in a series of domains covering employment, unemployment, job vacancies, demography and socio-economic parameters. It represents a GIS because of the nature of the information and operators that may be applied to the massive (20 Gb) database. The chapter concentrates on management and human resource issues in developing such a system and coping with competition, all within a government policy which demands commercial returns on sales of government-derived data and services.

BACKGROUND

The National On-line Manpower Information System (NOMIS) has been developed for the UK Department of Employment Group by the University of Durham. It was first developed for information covering the northern region in 1978 and, since 1982, the system has been in full operational use. The fundamental attraction of NOMIS to the user base is the immediacy and extent of access to official UK government statistics. Unemployment statistics are released on NOMIS as soon as the official statement has been made in the House of Commons. Employment statistics are distributed primarily via NOMIS and enquiries to official sources are referred to the system as being the fastest and most cost-effective source. NOMIS also integrates a huge variety of data by domain, through time and across space. The management of such a system, based as it is in an academic environment, involves meeting a variety of goals. These include the management of change while maintaining system stability; retaining existing users

and attracting new ones; building a cohesive development team, yet allowing for staff changes; developing effective user interfaces and technical documentation; and last, but not least in the academic sector, achieving job satisfaction and rewards for the staff while working in a low pay environment. Thus there is a series of continually evolving management challenges which typify a rapidly evolving system in a highly dynamic geographical and economic environment. These are compounded by the position of NOMIS in the university sector as a fully commercial contract, won by competitive tender. Before considering these management challenges, a description of the complexities of the database is given.

THE DATABASE AND ITS MUTATIONS

As of mid-1990, some 20 gigabytes of local labour market data were held on-line on an Amdahl mainframe at the University of Durham. The

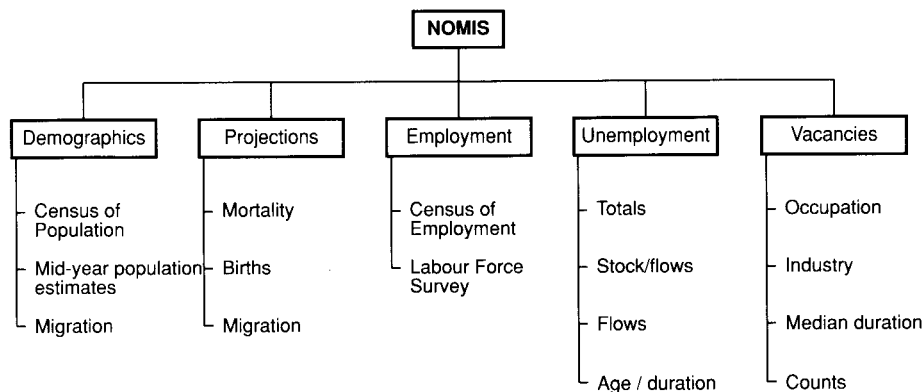


Fig. 33.1 The major data sets available in NOMIS.

information in NOMIS is grouped into five major domains (Fig. 33.1). Demographic data include the decennial Census of Population (some 130 000 Enumeration Districts, each with over 5000 variables), mid-year Estimates of Population, and projections of births and deaths. Migration is estimated quarterly using registrations for National Health Service Family Practitioners Areas, disaggregated by age and sex. Employment statistics are currently biennial (between 1971 and 1977 it was triennial), and is a domain in considerable demand by the commercial sector. The information on unemployment and job vacancies (jobs registered at Job Centres, estimated to be between 30 and 35 per cent of all vacancies) formed the original basis of NOMIS and now exist in several forms, ranging from monthly counts to complex quarterly analyses. Figure 33.2 gives a breakdown of the main data series by area type and periodicity.

The most heavily used data domains have been employment and unemployment; these formed the mainstay of usage in the late 1980s. Into the 1990s, employment remained a dominant domain with use of demographic data increasing very rapidly as users seek to assess the projected 'demographic time-bomb' of declining numbers of youths and growing numbers of the elderly. Data from the decennial 1991 Census, to be released in 1991–93, will be an important new series providing highly detailed and disaggregated lifestyle information.

Primary reasons for using NOMIS are rapid access to the latest information and the comprehensive geographical integration. The system is not oriented to those who want just the occasional table of data – training implications of the support of such casual users are too great and

the cost of user support would outweigh the income generated. However, postgraduate research students are seen as important seed-corn and their access to the system is provided as a loss-leader.

Three main methods are used to access NOMIS, the most basic being telephone dial-up at speeds up to 2400 baud. Then there are two high speed networks running at up to 9600 baud. For academic users the Joint Academic Network (JANET) interlinks all universities and polytechnics in the United Kingdom. Commercial users have access to British Telecom's Packet Switching Stream (PSS), which has both direct high speed lines and also a very cost-effective dial-up service, with calls into NOMIS via local nodes and charged at a local rate.

At present, all information in NOMIS comprises official UK government statistics. The sections of the various government departments supplying these statistics are all under the umbrella of the Government Statistical Service (GSS). The data are collected to serve policy requirements of the UK government and, while they are made available to the wider user community, it is policy development that affects the ways in which statistics are collected and reported. Thus, even during the life of NOMIS so far, there have been recalibrations in the definition of 'unemployment' in the United Kingdom, leading to many discontinuities in the time series. This in particular has led some to assert that the figures are being manipulated for political ends – though, in truth, manipulation can only exist if the precise definition is not communicated. A direct effect then is that those wanting to examine trends through time have to cope with breaks in the time series. Since most space–time models assume

Data Sets by Major Geographical Areas

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Regions
Regions and ex Metropolitan Counties
Rural Development Areas
Training Agency Area Offices
Counties (& Scottish Regions)
Assisted Areas
Local Education Authorities
NHS Migration Area
District Health Authorities
Functional Regions
1984 Travel to Work Areas
1978 Travel to Work Areas
Local Authority Districts
Parliamentary Constituencies
'Standardised' Employment Offices Areas
Employment Office Areas
Postcode Sectors
1984, 1987 Wards
1981 Wards
1981 Enumeration Districts

	Data Files	Periodicity	Start Date	End Date
1.	Census of Employment, Standard Industrial Classification 1980		1981	
2.	(by sex, full-time and part-time)			1984–1987
3.	Census of Employment Standard Industrial Classification 1986	Annual	1971	1978
4.	(by sex, full-time and part-time)			1981
5.	Labour Force Survey	Annual	1988	
6.	Employees in Employment	Q	1990	
7.	Census of Population, Small Area Statistics			1981
8.	Occupational Statistics, 10% Sample			1981
9.	Occupation by Industry 10% Sample			1981
10.	Population Estimates (England and Wales)			
11.	NHS Migration Data (by age and sex)	Q	1984	
12.	OPCS Projections of Population and Migration	Annual	1981	2011
13.	Vacancies and Placings by Industry and Occupation	Q	8/1978	
14.	Vacancies and Placings by Median Duration	Q	3/1986	
15.	Unemployment Claimants by 9 published categories	M	8/1985	
16.	Unemployment Claimants by 9 published categories	M	6/1983	
17.	Unemployment, Claimants by Age and Duration	Q	9/1985	
18.	Unemployment, Claimants by Age and Duration	Q	7/1983	
19.	Unemployment, Inflow and Outflow by Age and Duration	Q	9/1985	
20.	Unemployment, Inflow and Outflow by Age and Duration	Q	6/1983	
21.	Unemployment Register by 7 published categories	M	7/1978	6/1983
22.	Unemployment Register by 7 published categories	Annual	6/1972	6/1978

NOTE: Additional Series disaggregate the Unemployment Register by Ethnic origin, and by last Industry and Occupation until 1981–1982, when these data ceased to be coded.

Fig. 33.2 NOMIS data sets classified by geographical area.

continuity of definition both through time and of the geographical base, this is highly unrealistic when relying on official statistics.

The 'continuity of geographical base' problem is addressed in many domains by publishing the statistics for a variety of geographies. NOMIS makes data available at all aggregations above a base geography. For example (Fig. 33.3) a simple output list for a set of regions may be requested using acronyms such as 'pca' for parliamentary constituencies. Any set of areas may be aggregated in real time to form a single composite one and the top level of definition enables users to define their own 'non-official' geographical bases by creating 'chain' files which again operate in real time. The geographical bases available include administrative 'wards' (Fig. 33.4) which are 'frozen' in their state at the time of the 1981 Census (so giving spatial consistency for a decade); these build into all the higher level zonal structures. Job Centre areas are the basis for vacancies data but these mutate through time and do not nest with the ward-based geographies. Thus an 'amalgamated' super-set is created for time series and best-fit matches have been made of Job Centres-to-ward bases. Post-code sectors – most popular for commercial sector clients – are also liable to mutate but do nest with Job Centres. Data collected for a range of other geographies and stored in NOMIS, such as unemployment benefit offices (constantly changing), Family Practitioners Areas and Training Enterprise Council structures, further complicate the analysis and comparison of data series. Lastly, the employment data are published in ward structures current at the time of collection, most recently 1984 and 1987. (For a review of data integration problems see Flowerdew 1991 in this volume.)

To give rapid access to this multiplicity of structures, full on-line search facilities exist for all geographical hierarchies, with the option of directing the output list into a file for subsequent input as a command file. The dynamism of the UK geographies is one reason for the very large pre-processing element of NOMIS. A considerable amount of the code is taken up with the sequencing of tape arrivals, initial tape validation, verification of fields and contents, cross-checking of totals against other data series and automatic matches against existing NOMIS geographical structures. In this way, for example, NOMIS automatically checks

Some examples of user defined geographies

- Simple list
pca = 34
region = 1–12
1981 opcsward = 1034, 1056–1125, 1127–1200
- Dynamic aggregation to a single area
User = 'United Kingdom' region = 1–12
- Creating customised user geographies
A 'chain' file comprising:
User = 'My area 1' 1984ttwa = 1–12, 15–19
User = 'My area 2' 1984ttwa = 25–60

Key to geographic units employed:
pca = parliamentary constituency area
opcsward = electoral ward used as an areal unit in the 1981 Census of Population
ttwa = travel to work areas

Fig. 33.3 Some examples of user-defined geographies available in NOMIS.

to see if Unemployment Benefit Offices and Job Centres have opened or closed. In such an event, the internal indices are updated, a user message is inserted into system news and documentation is updated and dispatched.

While some may argue that NOMIS is not a GIS in the strict sense (see Maguire 1991 in this volume) – it does not have coverage preparation or an overlay processor – it is widely regarded as such because it delivers cohesive geographically-coded local labour market data, as well as data consistently maintained through time and by thematic classification. Moreover, it copes with typical geographical problems. For example, all NOMIS data refer to UK administrative geographies; while the geographies may be defined through sets of boundaries, their demarcations on the ground are fuzzy and the system has to cope with that characteristic. Furthermore, there are several geographical bases within NOMIS which do not nest yet facilities for matching these exist. But, since the thematic nature of the data is such that within-area homogeneity of density cannot be assumed (while there may be 'x' unemployed in zone 'y' it cannot be inferred that they are equally distributed throughout), use of the 'standard' tool of overlay with such a database would be dangerous.

The way in which the system has developed has been an object lesson in developing management styles. Since 1986, when the system was made available to all user groups, the number of subscribers has increased from 45 to over 300 sites.

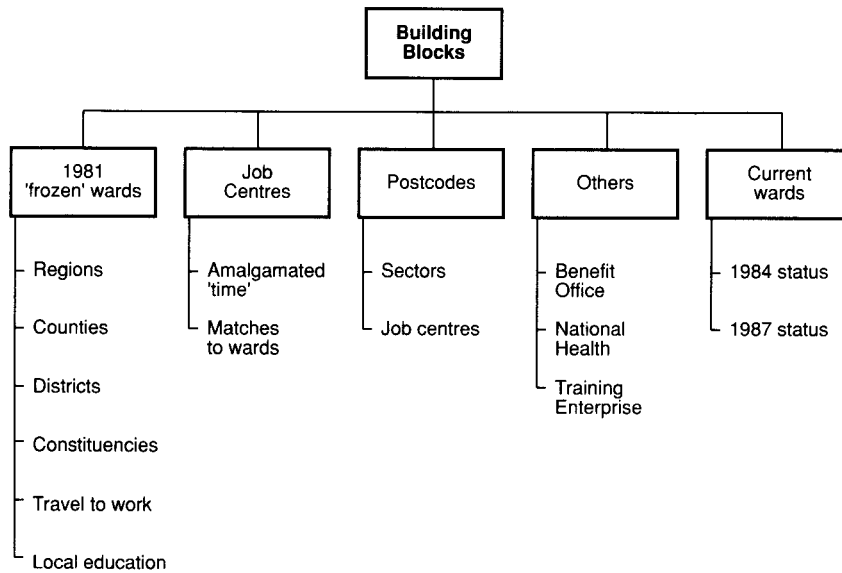


Fig. 33.4 The major geographies available in NOMIS.

The range of information domains also has expanded to include 10 major government suppliers, all of whom have their own internal supply standards, tape formats and geographical labelling; links are maintained with nominated individuals in each data supplying agency to ensure rapid correction of errors. The variety of data suppliers highlights the disaggregated nature of information collection in the United Kingdom. While the US decennial census of population is collected by a single agency (the US Bureau of the Census), the UK census is collected semi-independently by the Office of Population Censuses and Surveys for England and Wales, the General Register Office for Scotland, and the Department of Economic Development in Northern Ireland. Population estimates are collected by the same organizations with the addition of the Welsh Office for Wales. Not only do these different agencies have different technical and other standards but also they have different policies regarding access to data.

CHALLENGES IN MAKING NOMIS A SUCCESS

These challenges will be considered under the following headings:

- Management structures;
- Human resources in the development team;
- Computing resources and service provision;
- User support and financial policy;
- Facilitating new developments while maintaining stability for users.

Management Structures

NOMIS is owned by the Department of Employment Group (ED Group). System development is carried out under contract by the University of Durham, but the equity value of the system resides with the UK Civil (or Public) Service. For the ED Group, the goals are well defined. NOMIS should offer them rapid, timely and comprehensive access to integrated local labour market information; this should facilitate the development of policy, support the briefing of senior management and provide better targeting of resources in the long-term training and development of the UK labour market. It is mandatory that the system must be demonstrably cost beneficial and, increasingly, it must be possible to recover investment from users other than those in the core central government group; both of these objectives reflect UK government policy in general. For the Durham team, the financial objectives are

reflected in a goal to reduce dependence on the core central government user group.

The cost benefits of NOMIS can be expressed in both direct and indirect terms. The former are the crucial ones since HM Treasury prefer to see tangible savings in budget as being the main determinant of success. At 1986/87 prices, NOMIS has been saving ED Group £236 000 a year over and above the contract price. This was calculated by the staff savings made directly in the 11 regional Intelligence Units (IUs), where clerical staff formerly had to prepare information manually. This alone justified the existence of the system. The intangible benefits could not easily be directly quantified – a common problem inherent in the benchmarking of complex GIS (see Clarke 1991 in this volume; see also Dickinson and Calkins 1988). Nevertheless, it is clear that they include: the added value of immediacy and enlarged access to detailed national and local information; the cost savings incurred by more effective policy generation; and unspecified direct benefits on staffing experience by the increasing range of other government departments using the system. These now include the Department of Trade and Industry, the Department of the Environment, the Home Office, the Office of Population Censuses and Surveys (the census-taking agency in England and Wales), the Department of Transport, the Welsh Office and the Scottish Development Agency. Further societal benefits accrue to local government, which is now an extensive user of the system, but these are not taken into account in the basic cost-benefit model. Lastly, there is a tangible benefit to the Civil Service in the form of more effective research in the academic community. This forms an important component of advice and briefing material for decision makers.

The position of NOMIS in a higher education institution gives further benefits in the provision of the latest information to the research community at highly advantageous rates. Research students are not charged for the use of NOMIS *per se*, but only for the nominal computer time used on the university mainframe. NOMIS staff have been instrumental in persuading data suppliers that academic researchers should not have to pay for data being accessed, so generating further savings. Moreover, such agreements have long-term benefits to the public service in training individuals who can then work in the various departments using NOMIS

data or who can evaluate the data effectively even if in other jobs.

Human resources in the development team

NOMIS is an idiosyncratic system. It has not emerged through either of the commercial or purely academic routes, but has straddled both. In addition, it has never been part of the development strategy to 'break free' of the predominance of the ED Group and other central Civil Service departments who constitute the main user base. The simple rationale is that, since it is owned by ED Group, this 'freedom' can never be on the agenda. However, there has been a firm policy – agreed with ED Group – of diversifying the user base.

The origins of the system were in 1978 with a contract between the then Manpower Services Commission (the forerunner of the Training Commission or TC, thereafter the Training Agency or TA and now re-absorbed back into ED Group as TEED, the Training Education and Enterprise Division) and the Universities of Durham and Newcastle (David Rhind and John Goddard being the principals). Over a period of four years, the code developed into an operational system. The author's personal involvement has been since late 1983. At that time, the system design was the responsibility of a single programmer, Robert Nelson, who now is the NOMIS System Manager. The development team initially comprised him and a mapping assistant (Peter Dodds), both of them were employed on short-term (and hence unsatisfactory) contracts. Thus there was inherent instability at a time when NOMIS was becoming increasingly important as an operational tool for central government. To be fair, blame must be attributed on both sides – the University for allowing strategically important staff to be employed on such unrewarding terms (a situation that exists commonly today in the UK university sector) and the contract sponsors for not evaluating the threat to their investment adequately.

One time-consuming management exercise since 1983 has been to strengthen and professionalize the team. By 1990 there were five main programming and development staff, plus two support staff and a much more effective operational relationship with computer colleagues in the Civil Service. The team still is relatively small for a user base of over 300 sites, but the stress that has been

put on team building and skill development has meant that, since 1983, very few staff have left and those few occurrences have been for positive career moves. One final point regarding staffing changes: within the NOMIS team there is a policy of asking staff what they wish to do 'after NOMIS'. This attitude aims to nurture career prospects by encouraging the interchange of information. It means that staff transitions can often be planned with the minimum of disruption. Staff are also encouraged to take on consultancy work for clients and to visit key sites on a regular basis. This allows them to obtain near-market expertise, as well as direct financial reward. Too often in the university sector, research and development staff have been treated as chattels attached to projects – to be discarded when expedient. Conversely, in the Civil Service, the policy of moving staff from job to job every three years or so often means that it is not possible to build the stable base of expertise that is demanded by software and database development.

Computing resources and service provision

At the time of writing (1990), NOMIS is based on an Amdahl mainframe running the Michigan Terminal System (MTS) operating system. In UK terms this is an anachronism, particularly in these days of increasing UNIX orientation. The demise of MTS will occur in 1992, after 25 years of operation in the Universities of Newcastle and Durham. The planned demise offers the opportunity to look at the way in which NOMIS, developed in a FORTRAN-77 context and using the advanced features of a particular operating system, can migrate to more standard systems. This is more than just moving 30 000 lines of code on to another hardware and software platform, although that has been the first 'insurance policy' stage achieved late in 1990. It involves extensive redesign of data and file structures, as well as the user interface. The new system must maintain the highly effective task sharing, facilitated at present by a very tight dynamic overlay design. NOMIS is contracted to enable up to 20 simultaneous 'sign-ons' for central government users alone within the proportion of the university mainframe which is available for the project. The data files are also designed with this in mind. Instead of a relational structure, NOMIS data files are flat files, structured by time-period and directly indexed by the geographical look-up tables.

Data compaction is absolutely crucial. The 20 gigabytes (Gb) of raw data, growing at over 2 Gb a year, are compacted by a two-stage process (Fig. 33.5) into about 13 per cent of the original storage. The file structures allow for arbitrary length direct access files with line lengths of up to 32 767 bytes. This allows all the data for any one area to be stored on the same line, so directly keying them into the geographical indices. Each line is scanned, first to run length encode any zeros (all NOMIS data are non-negative integer) and then to ascertain the maximum value. According to this value, the line is then assembler-compacted into fewer bytes and an extra byte inserted at the beginning to record the compaction level. The impact of this regime is twofold. First, there are massive savings in on-line disk storage – at full commercial contract costs this is a saving of several million pounds a year. Secondly, the fact that some files are compressed to only 1 per cent of original size allows them to be read in a single buffer and rapidly reconstructed in virtual memory. Not only does this mean a faster response time for users, but it is also cheaper since fewer relatively expensive disk-reads are required. This also helps ensure the ease of sharing outlined above. The compaction regime has been replicated on a UNIX host, thus completing another stage in the transition.

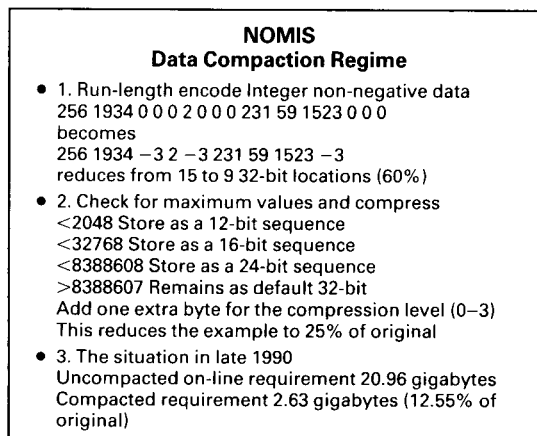


Fig. 33.5 The NOMIS data compaction regime.

System security and integrity builds upon the compaction regime. This is fundamental for an on-line system such as NOMIS. It is accepted as fact that once the data are on a user's screen there is no technical way of stopping them from capturing the screen image/contents on a micro (indeed the

carefully planned development of effective downloading and data capturing mechanisms is discussed later); thus they must not be available on the system to users before the official release date. But, since NOMIS releases many official statistics on-line at the moment of publication, this means in some cases having them in advance of that date for loading and pre-testing; for users to be able to access them before official release would be a catastrophe. MTS has a multi-layer protection capability which affords protection against such an outcome. All accounts are password protected – normal for any system, of course – although the incentive for NOMIS users to be secure is that they agree to pay all costs on their account. Every use of NOMIS is logged and this forms the basis of the billing system as well as providing a monitoring function if misuse occurs. Misuse has occurred only once and that was an academic user trying to transfer boundary files over JANET. In this instance, the GIMMS mapping package was being used without maps being produced and the file transfer protocol was being accessed; the user formally agreed to destroy all files. Another layer of protection is given by first compacting each NOMIS data file, then encrypting it and finally it is made accessible *only* via NOMIS, and in some cases, only to specified users via a passkey function. Time triggers are set for release of new data. Matching these levels of protection is clearly essential on the UNIX platform and, in a time of increasing threats, needs to provide extra layers of security from file storage to network integrity.

Given all of the above, the three most crucial areas of concern over a period of two years of rapid change are: ensuring a transparent transition to the new system for the user base; retaining and enhancing current data compaction and security regimes; and re-evaluating current storage strategies against reducing real disk costs. The user base will not accept a transition which reduces response times, requires significant re-training or costs more per unit of usage. These all are long-term design issues, involving upward compatibility and long-term testing of systems in parallel.

User support and financial policy

In April 1986, NOMIS was made available to all potential client groups. Until then, its primary remit was to serve the core Civil Service clients and a

small number of local authorities and academics. At that time, the user base was around 60 accounts. Since then there has been considerable growth of around six accounts a month. An account normally is used at a single site by staff authorized to have access to NOMIS. The user base has also diversified (Fig. 33.6) with central government now forming only 31 per cent of the total number of sites, although significantly more in terms of income. The commercial agencies now active as clients include business location and geodemographics consultancies, but the largest group by far is the property market consultancy sector. There also has been a significant increase in the number of local government users.

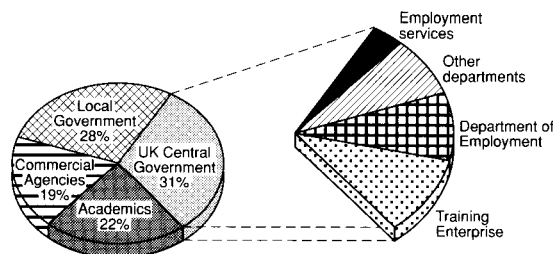


Fig. 33.6 A classification of NOMIS users (percentage number of sites in each category).

The most difficult aspect of this expansion among non-core clients was that of how to charge for an on-line system which delivers such a variety of data and analysis. Most existing on-line databases are 'flat', in that they are mainly free text of the bibliographic or newspaper type. They mostly have fixed charges, based on the amount of time a user is logged on and on the number of transactions made (i.e. abstracts or paragraphs selected). NOMIS charges are based on a collection of items which includes elapsed 'sign-on' time, disk use, processor use, output media and mapping produced. This 'by use' rather than 'flat rate' charging may seem difficult for new users to comprehend so prospective users are offered a number of free runs to help them visualize end costs. Those attending training courses also have access to free-resourced accounts that enable them to experiment without financial penalty.

Charging for use of data is difficult. Since 1986, the UK Department of Trade and Industry's Tradeable Information Initiative has encouraged government departments to generate commercial returns on the sales of their information. The UK

attitude to government data is enshrined in a review of the Government Statistical Service (the Rayner Review) carried out in 1981, which formalized the view that information is collected for the purposes of the government and that – unlike the situation in the United States – any other public or private use should be undertaken at a commercial cost. At the time NOMIS was requested to implement charging, there were no other comparable on-line charging regimes in government. The cost structures used by data suppliers assumed outright purchase of data, yet this was unworkable on-line since no user would require all the data; to check an individual account's use of variables would have needed a binary matrix held for each user for every data set. Moreover, the software overheads of checking would have been prohibitive. A regime of bulk discounting over a monthly period was proposed, applicable only to full commercial users; NOMIS successfully persuaded the data suppliers not to charge local authorities or academics for access to their data. This charging regime simply aggregated the number of cells used in each data series and matches the end-month total against a published charge table. All users are advised of the computer time charge and those who are charged for data access are advised of the charges incurred at the end of each run. All those charged for data access can run an audit command to ascertain the running total for the month.

NOMIS pays proper commercial rates for all the software and infrastructure used. But, because it is based in the academic environment, it is university policy only to charge marginal costs to academics using NOMIS for *bona fide* research. Regular management statistics produced include monthly summaries of use by account and charging group, a daily profile of usage peaks, and a day-by-day summary of processor use. Also produced monthly are disk status by data domain, with forward warnings of any capacity problems, and statements of chargeable data use by individual account, plus how that is to be apportioned to data-supplying agencies. 'Sleeping' users, who access NOMIS infrequently, are easily identified using these statistics, although being an 'on-demand' on-line system there has not been a policy of enforcing minimum charges other than the cost of the extensive documentation; this comprised some 2000 pages in 1990, including complete listings of geographical hierarchies and background metadata

on the information domains. The documentation itself forms an extensive primer on the UK's local labour market information base.

The actual number of on-line sessions (Fig. 33.7) shows a buoyancy of demand. Central government use is increasing consistently as more departments join. In 1989, for instance, the global amount for all groups increased by some 30 per cent. A matter of considerable concern has been the decline in usage by postgraduate students, a symptom of the decline in both student numbers and their available resources. Such a decline is clearly not in the long-term interest of central government, let alone higher education.

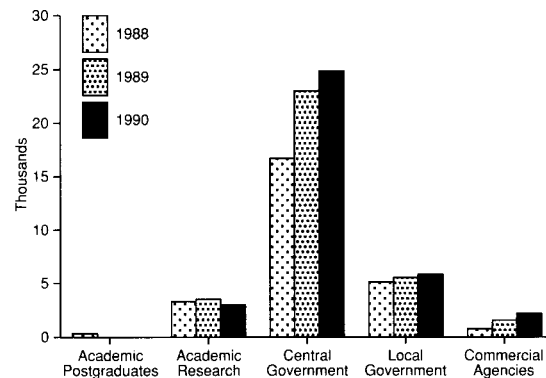


Fig. 33.7 The number of on-line NOMIS session classified by user group.

Facilitating new developments

In the past, NOMIS has been dominantly a centralized on-line system. Users had the ability to route output to line printers, laser printers and plotters but they have relied on the output being posted on to them. In effect, the postal system itself has formed a subset of the NOMIS code, with all user outputs being monitored through the print queues and matched against a daily list to avoid anything being lost or delayed. Optional flags can be used to request fax or courier services. Since 1988, NOMIS has moved more towards being a powerful 'data engine' with an emphasis on downloading outputs into microcomputer packages. Network speeds and reliability now enable this approach to be used operationally, especially when supplemented by more effective error-correcting modems and use of more widely accepted standards

and protocols. Structures available include headed files for microcomputer mapping systems, flat data files for statistical analysis, tabular data for word processors and comma-separated value files for spreadsheets. Increasingly, terminal emulator packages are used to customize access, with transparent automatic network dial-up and 'sign-on' and single key functions to upload and download files. While it is supported by NOMIS, the downloading of data is not an unconstrained facility. It is not in the interests either of NOMIS or of the data suppliers to see ever-increasing amounts of data disappearing down the networks. Downloading implies data purchase for subsequent re-use and so is a chargeable facility. The downloading of tabulated outputs, as opposed to raw data, will always automatically include statements on temporal or spatial discontinuities in the selected data, on any important background data and a warning on Crown Copyright. In this way, NOMIS aims to protect the integrity of the data and the rights of data suppliers by making 'best endeavours' to monitor usage. It also aims to make 'best endeavours' to facilitate rapid and effective access to data for the user community. In this way, speed of response does not mean a loss of control over the information base.

Computer mapping is provided by two options: a mainframe interface to GIMMS or a microcomputer route detailed below. On the mainframe, a simple file interface provides a transparent link into a menu-driven interface to the widely used GIMMS package (Carruthers and Waugh 1988). An extensive set of pre-prepared boundary templates are accessible (up to all 9289 wards for England and Wales) and answering a series of questions allows users to produce output ranging from A4 laser to A0 pen plots. Some exploration has been undertaken of the feasibility of providing topographic underlay although it must be admitted that Ordnance Survey pricing policy has been a major constraint in pursuing this. A possible alternative may be the road database developed by the Automobile Association containing roads, settlement outlines and names gazetteer and hydrography. As of mid-1990, discussions on this were still at an early stage.

For microcomputer systems, the main moves are towards the development of customized front ends. This is particularly important for mapping since a supported microcomputer mapping system

needs to be able to 'recognize' an arbitrary list of geographical areas requested by a NOMIS user. The PCMAPICS system, developed at University College London, contains full digital mapping facilities and, importantly, has a boundary database facility called GEOBASE. Users can demand a unique group of areas and GEOBASE extracts the relevant boundaries, builds them into a map file, calculates scaling and positioning. This can all be constructed as a menu-driven front end to MAPICS which makes the entire process of extracting information from NOMIS to producing a desktop map into a relatively transparent process. Such developments now increase the amount of consultancy and advice needed by and provided to users, with ever-increasing sophistication of equipment at their sites.

User support and training on a wider scale now takes up a much greater percentage of time than hitherto. Training for use of NOMIS is residential in Durham, using a 'deep immersion' approach over three days with specific training documentation and follow-up opportunities. Video and computer-based tutorial facilities, such as the use of hypertext/hypercard tutorials have been evaluated and discounted for the present. Such is the need for understanding of the information content on NOMIS (as opposed to the mechanical and technical functions of most GIS) that it may be easier actually to move the command parser down on to micros, together with most of the on-line help documentation, and create a new menu-driven local front end to the system. Like many vendors, the NOMIS team are concerned that, if others take on a training function for NOMIS, then they should be fully trained and legitimated. Most of all, such a policy helps to maintain standards. The success of such a policy is exemplified by the ESRI training policy for ARC/INFO; this has developed from basic courses and primers to a highly structured strategy including training the trainers, extensive workbooks and videos and a comprehensive GIS primer.

Irrespective of its past success, technical sophistication and user growth, the future of NOMIS is very much bound up in the UK government policy regarding the supply and cost of information. For each new data domain, the lead time from first discussion to on-line supply has a mode of around 12–18 months. Some discussions never result in data being added to the system. In

terms of management time, some 30 per cent of effort is spent at the acquisition end and another 40 per cent on support for the key users. A goal for the mid-1990s is to be a major host for the 1991 UK Census of Population yet, even in late 1990, there was no indication of cost structures to be charged by the government so that market research could be undertaken to gauge demand. In 1992, the European Community becomes an open market (with the removal of tariffs and trade barriers, and the unconstrained movement of labour) and information dissemination to the 12 member states represents a considerable opportunity. Even here, the opportunities and threats are bewildering. Some multinational corporations are moving rapidly into the on-line information market, supplemented by 'frozen' if frequently redistributed databases in CD-ROM form. Presently, the physical capacity of CD-ROM is a limitation for NOMIS, but a more direct limitation may be the attitude of UK data suppliers who fear the loss of control over their own data when available on distributed media.

UK government policy on a wider scale poses many questions. The 'Next Steps' initiative seeks to move many parts of government into agency status, or even into full privatization. In this, an 'Executive Agency' becomes a separate 'business' or budget centre in its own right, needing to present a balanced budget. This may hasten the development of full cost recovery policies regarding data. The Ordnance Survey and the Employment Service are now two such Executive Agencies. The Health Service is being fundamentally reorganized and the information technology implications of this are considerable. Companies such as British Telecom are starting to market their own employer/employment database on a national coverage in competition with those from government departments and agencies. Inevitably, therefore, the next five years will see major changes in the structure of the UK information market. The main aim for NOMIS will be to maintain and enhance its reputation of being an efficient and cost-effective broker primarily of government, and eventually European, data relating to the widest definition and requirements of a multinational labour market. Whether such a goal is achievable while remaining based in an academic environment is a debatable point. It may be that significant cash injection will be needed to provide enough resource to compete against other information vendors. The main aim

will be to maintain and enhance the reputation of NOMIS as a 'bespoke' information service in a niche market that comprises regular users of local labour market information. Thematically, the information base will expand to embrace domains which strengthen the labour market information (LMI) – but LMI remains the core.

Other systems and resources will address other sectors. The SASPAC system, a self-contained retrieval and analysis package for census data, will again be used widely by those who either wish to analyse only their local area or to concentrate on census data. For academics, it must be admitted, SASPAC also may present an attractive option since its central purchase for the higher education sector will make it a 'free' resource, in sharp contrast to NOMIS. Other users may continue to use the services of the ESRC Data Archive at the University of Essex from where whole data series can be acquired, although not with the immediacy of response possible using NOMIS. Such other services are viewed as complementary to NOMIS and the continuing developments of all three can serve only to strengthen the quality of information handling and use in the United Kingdom. Lastly, there are companies which operate on a global scale, such as Maxwell Communications Group and other on-line hosts. Their strategies are global, highly resourced and potentially highly acquisitive. The only certainty is that the pace of change in the 1990s will make the first ten years of the NOMIS GIS seem like a very leisurely perambulation.

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