Chapter 2 - Review of the Literature

This chapter reviews the literature on subjects that relate to Value Mapping, particularly with respect to Britain. The review begins with a look at the only known study devoted to the uses of Value Mapping in Britain, by Howes (1980) and then some less expansive but more recent, computer-age studies of this main topic. It then looks at the theory and purposes of property valuation, focussing on applications that use computer assistance. The impact of spatial analysis techniques used in conjunction with automated valuation is discussed briefly, before an account of how global and European developments in policy relating to the purposes for - and issues around - re-use of spatial datasets have been interpreted in Britain.

The period 2003-2009, during which this doctoral thesis has been prepared and written, has seen significant developments in information and communications policy and technology, also a recent dramatic change in the fortunes of global property markets. Climate change has also become a much more significant policy issue. These developments have yet to be fully reflected in academic writings, therefore much of the literature covered in this chapter is official and general (trade press and conference papers), not peer reviewed.

A large part of this chapter was written after the empirical research was carried out, in order to ensure the analysis reflected recent changes in the policy environment.

2.1 The Howes Study

The seminal work on Value Mapping from a UK perspective was written on the cusp of the digital era. In his preface to ***Value Maps***, Christopher Howes (1980:3) noted that although "many important contributions to the knowledge of land and property values have been made, not by academics or full-time researchers, but by practising planners and surveyors", nevertheless "the cause and effect of [these] changes [in value] remained largely uncharted".

Howes was interested in "three related areas of study: the gathering of information concerning property values, the illustration of such information and the conclusions to be drawn from it". He noted that it was then a "neglected area" of research. He had found no previous studies of the extent to which value maps were being used. However he cited Anstey's attempts to contour map property values in a small part of the City of London in the immediate post-World War II era, illustrated in Lichfield (1965). He also noted other pre-computer-age examples from overseas, such as Denmark, mentioned in Wilks (1964); also New York City, where land value maps began to be publicly available from 1900 (Howes, 1980:53; Batt, 2008).

Howes' definition of a value map was: "a cartographic or spatial representation of statistical data which reflects the value of land or buildings" (Howes, 1980:7). His research approach was to gather data on the nature and extent of uses of value maps from English local authorities, then to study selected examples from UK and overseas in order to draw conclusions as to their potential in the future. He also surveyed the attitudes of British property firms and professionals towards value maps. This research was concluded in 1975 and covered the period from 1961. Finally he was instrumental in preparing maps himself, of the city of Norwich where he had worked. He made no prior assumptions as to their uses and in particular to any link with property tax administration. His was no future forecasting exercise, nor an attempt to construct a business case for value mapping: it was purely fact-finding.

In his survey of local authorities, Howes (1980:27-33) found that only 30 out of 175 planning authorities had produced any value maps in the period. Most used their own transaction-based property data or rating lists. All were "purely

generalised descriptive maps of existing values of a limited land use in a specific location" and prepared for a single purpose, typically relating to land acquisition, regeneration or shopping centre studies. Few of his respondents had heard of other similar studies and each "considered their work was unique". Of those authorities that had not commissioned value maps, 34 had considered doing so and 23 thought they would in future. None had considered using computers but most of those that replied to his question on reasons for not producing them (either at all, or more often) stated "if resources were made available" they would. Only four (of 98) authorities gave "lack of data" as the reason for non-production, whereas "no uses" was a reason given by most of them. Howes conclusion was:

> there does not appear to be a lack of interest in the topic, although there does seem to be a lack of knowledge regarding the methods of production and possible uses of value maps (Howes, 1980:34).

In the private sector, Howes found a greater awareness of problems with data availability, particularly "confidentiality of transaction data" (Howes, 1980:9). He thought that estate agents particulars "could show a pattern of relative values" that might enable value maps to be produced (*op cit*, p.16) and that "a map, being complementary to existing data, in its generalised representation would have allayed any fears of infringement of confidentiality". He made no mention of possible commodification of data but did conclude that "Inland Revenue should adopt a more flexible policy towards the release of data for *bona fide* research purposes" (*op cit*, p.127), going on to suggest that value maps "for rating purposes could ensure more equitable assessments ... and for this equity to be displayed in map form as is the case of many overseas countries".

Howes' preface to his book surmised that the latter part of the 1970s saw "an increase in the amount of published work concerning land and property values", which "may well have been as a result of an increased public awareness of the effects of changes in property values upon our environment". He thought this was unlikely to diminish. However he found no sign of any move towards standard value mapping products and deduced that hitherto the "inherent weakness if the maps are produced manually" is that they are time-consuming and quickly out of date. He saw that computers would "enable the rapid production of maps", also that already "techniques such as regression analysis" – which implied use of

powerful computers – “can enable planners and valuers to seek to attribute certain causation factors to the pattern and distribution of values” (*op cit*, p.135).

In discussing how value maps might be used in future, he thought (*op cit*, p.132) that their purpose firstly would be to make value data “more comprehensible”, secondly to “demonstrate and clarify...locational context”, thirdly “to produce a source of information for purposes other than the original requirement” for the value data. In this, his anticipation of the ‘collect once, use many times’ philosophy of the modern *e-government* era was far-sighted. As for categories of use, he saw “facilitating equitable taxation” as one, the “plan decision making process” another, with the more analytical and academic “demonstrating a hypothesis relating to land and property values or cartographic techniques” a third, based on his own observations.

Howes’ original hypothesis had been that value maps were not available because firstly value data were not available, secondly “there was no demonstrable demand” (specifically by local authorities) for them, thirdly that “the data could not be displayed in a satisfactory manner”. He claimed his research had “partially refuted these three premises” and that, it being “necessary to ensure a more effective operation of the property market”, they were one tool that enables this by “facilitating greater knowledge” of “the dynamics of land values” (*op cit*, p.136).

2.2 Later Studies of Value Mapping

Several British academic and professional papers have mentioned value maps since Howes (1980) but none has focused on the subject, although “Using GIS for property valuation” was the title of a paper by Wyatt (1995), in a property journal where the same issue reported on work into “modelling the influence of location on value” (Gallimore *et al*, 1995). Orford *et a*l (1998) set the use of GIS in the wider context of a review of visualisation more generally in social sciences, including planning. In the USA, Batt (1998:10) notes that he first saw demonstrations of the use of standard GIS software to model land values using “contours” in 1994.

Batt (2008) is currently re-assessing the history of land value maps from a global perspective. In a draft paper, he attributes the origins of the earliest land value maps - of New York City (NYC) in 1909 - to plans for Lloyd George’s 1910 land value tax, citing Kain and Baigent (1992:261), who said “it finally gave England [*sic*] its first and only comprehensive mapped cadastral survey covering every individual hereditament”. Lawson Purdy, President of the NYC Department of Taxes and Assessment from 1906, went on to greatly influence the early years of the US National Association of Assessing Officers (NAAO, forerunner of IAAO) and is credited by Batt (2008) with being “responsible for instituting the separate listing of land and improvement values” from 1902 and later with the publication of the lists, culminating in a NYC land value map.

Gallimore *et al* (1995) described how a “location value response surface” could be derived using multiple regression analysis (MRA) and GIS. The authors found no evidence that extensive work on the subject had been carried out in Britain but mentioned studies using MRA for location value analysis in USA, Australia and Singapore, generally for taxation purposes. Their own study was of some 200 records of property transactions in Stafford, the aim being to see if their model could predict sale price (*op cit*, p.7).

Both Gallimore *et al* (1995) and Wyatt (1995) pointed to the relative dearth of property data in Britain as a major reason for there being little research into – let alone use of – value maps here. Nevertheless “even with the limitations imposed

by existing recording systems for property characteristics, the results approach levels of predictability that merit further exploration" (Gallimore *et al* 1995:17).

Wyatt (1995) explicitly stated that "GIS-based value maps are ... a means of displaying variations in value at the individual property level" and examined their potential. The author claimed that "comprehensive and good quality data" already existed for the purpose in the UK, "within the public and private sectors of the property market" but that "it will take an initiative such as the National Land Information System [*sic*] to ensure that such data is disseminated". For the first time, Wyatt explicitly pointed to data sharing between data supply agencies as being the key to developing value mapping in Britain. He was more concerned about benefits to valuers and their market clients than any use within the tax system. He noted that aggregation of data "to some degree" might be necessary to allay concerns about breach of confidentiality.

There has never been a government sponsored study in Britain of the potential uses of value maps, although research commissioned in 2001 by the Scottish Executive on "Land Values and the Implications for Planning Policy" alluded to "the complex contours of land value maps within cities" as though they existed, whereas in fact these 'maps' were merely in the researchers' minds (Scottish Executive Central Research Unit, 2002).

One area which has attracted academic and official interest worldwide is the relationship between transport infrastructure investment and property values. Vadali and Sohn (2001) and Rybeck (2004) are typical of many studies. Smith and Gihring (2006) provide a comprehensive annotated bibliography of nearly 100 other studies where financing infrastructure by capturing land values was the aim. However the use of value maps is not mentioned in this bibliography.

Transport for London (TfL) has shown considerable interest in the land value uplift effects of investments (actual and planned) in transport infrastructure, which has led to it commissioning, either on its own or jointly with other public or private sector partners, studies of value mapping (ARW *et al*, 2003; Atisreal and Geofutures, 2005). Mark Thurstain-Goodwin, founder of Geofutures, even before his commission for TfL to investigate the potential of value mapping, had undertaken work through the Henry George Foundation (HGF), in 2001-3 (Geofutures, 2002; Mitchell and Vickers, 2004). His Geofutures (2002) paper for

HGF was limited to public domain datasets of non-domestic rating list valuations but included 'medium scale' value maps that were visually effective (see Figure 2/1 below).

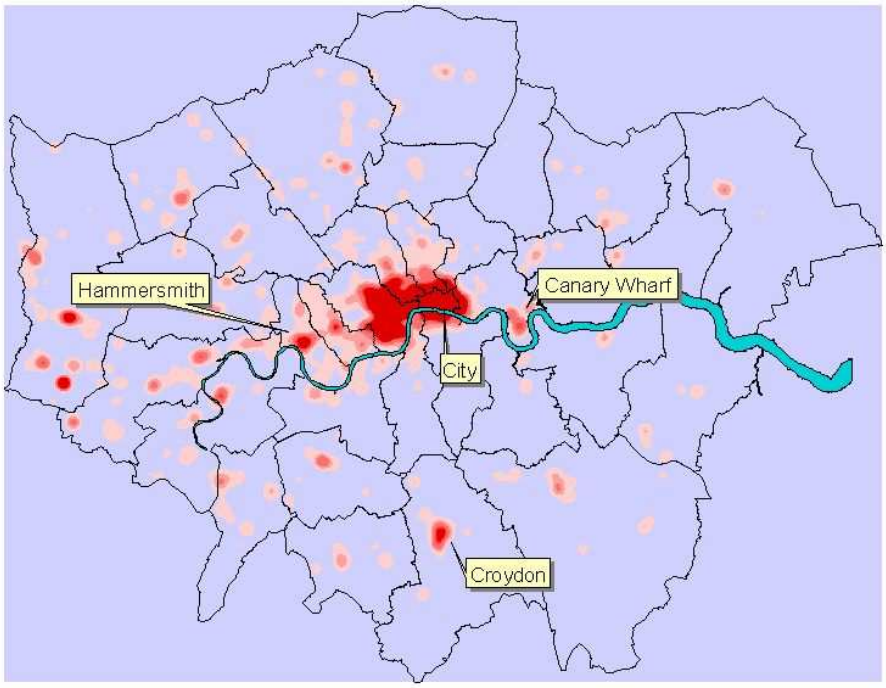

Figure 2/1 – London: 1995 office rateable values
Source: Geofutures (2002:11)

In his foreword to the more detailed study for TfL (Atisreal and Geofutures, 2005:1), Gwartney commented on the "lack of information on land in Britain compared to the rest of the world". Lacking the comprehensive data that he would have expected to be freely available from public agencies in his native North America, Gwartney nevertheless acknowledged that TfL's researchers had achieved "findings identifying the positive relationship between transport and property values" despite "absence of land valuation information". This 'positive relationship' was found to be an uplift of approximately £2bn around just two of the ten new stations on the Jubilee Line Extension (JLE) of the London Underground. A study in Chile at about the same time (Agostini and Palmucci, 2008), indicated that much of this uplift occurs before construction begins, proving that land use decisions result in value effects before expenditure is incurred. Atisreal, a major commercial property agency, had to resort to its own (and TfL's) transaction data to produce anything resembling value maps, "using

Geographic Weighted Regression and hedonic pricing (*sic,* see below) to explain property values within the data availability constraints that exist in the UK".

The later study for TfL looked at the Croydon Tramlink project and its effect on property values (ARW *et al*, 2003). Researchers were briefed by a group of clients including RICS and the Government Office of the Deputy Prime Minister (ODPM) to test a methodology for analysing "how occupier demand expressed through property values varies according to transport provision", which could be applied throughout Britain. Their first-stage report (ARW and UCL, 2002) had consisted of a comprehensive literature review on the subject, citing many of the studies featured in Smith and Gihrman (2006). They noted that "the quality and availability of data from North America is good and allows the use of more sophisticated methods" with "recent work" in Europe making more use of property values. However the focus of the TfL study was not on the typology of methods of measuring land value effects (value maps being possibly one tool) but on the range of results achieved.

The ARW and UCL (2002) literature review appeared to lack any input from a spatial analyst or geographer such as Thurstain-Goodwin. No mention was made of the potential of value maps to assist studies of property value effects, although it was noted that VOA data "may be embedded with GIS to allow more detailed spatial … analysis" (ARW and UCL, 2002:27). However with the addition of Thurstain-Goodwin and drawing on Geofutures' capabilities, the Croydon Tramlink study included some quite detailed value maps, down to postcode level (red pecked lines in Figure 2/2). More important, the report included an illustrated discussion of the merits of different techniques for spatial analysis and representation in value maps of property value changes over space and time (ARW *et al*, 2003:12-16). This will be returned to later in this chapter.

ARW *et al* (2006:19) noted that British property value data do not include property characteristics that they needed in order to isolate the "location element" of variations in price within their analysis, which limited their ability to map land value *per se*. The researchers were not permitted, allegedly by law, to use the more richly attributed VOA data and had to rely largely on HMLR's quarterly postcode data. This, they said, was "just not detailed enough to detect any change since transaction price alone hides great variation in properties'

attributes" (ARW *et al*, 2003:26). By contrast, North American property transaction datasets, publicly held, contain full details of property characteristics (Gloudemans, 2002).

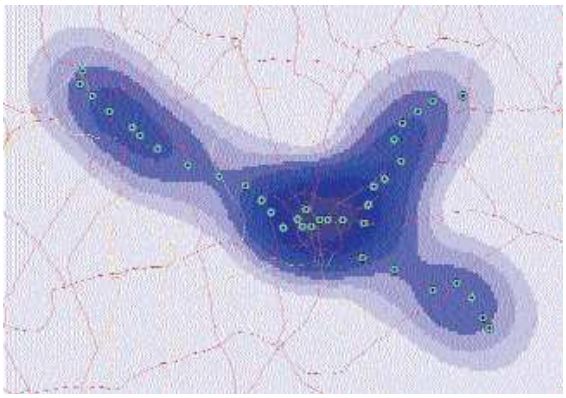

Figure 2/2 – Hypothetical impact of Croydon Tramlink on property prices
Source: ARW *et al* (2003:16) Figure 8.

Possibly because improvements in availability of British property data since the above studies have not been significant enough, there has been no further published work on the subject in this country (but see below, section 2/4). Meanwhile the potential for "making public data such as parcel and property tax records more public through maps on the Internet" and for other online applications has grown globally, as noted by Schlossberg and Shuford (2003:16), in their review of literature on the growing field of public participation GIS (PPGIS). In their words:

> the spatial visualization and analysis capacities inherent in GIS present a unique opportunity for enhanced citizen involvement in public policy and planning issues (*op cit*).

Conclusion

What this section shows is that two out of three of the reasons by which Howes explained the non-availability of British value mapping a quarter century earlier still apply. Property and land value data are still not sufficiently available and there is no effective demand for displaying them in mapped form, although technical barriers to such displays are no longer a problem. Reasons for the lack of moves in Britain towards the original NLIS concept are discussed in Section 2/5 below, from the perspective of information polity. However first the nature of

what “value” it is that Value Maps might in future depict is explored, since this too has been influenced by developments in technology as well as policy.

2.3 Valuation theory and purposes

This section discusses theories of valuation and purposes for which real property values are assessed. The next section deals with valuation methods, in particular as applied to mass valuation of areas and/or types of property.

One leading global authority on valuation theory and practice is the International Valuation Standards Council (IVSC), based in London. IVSC is "a non-government, private standard setter with robust and open procedures for setting, maintaining and interpreting international valuation and reporting standards" (IVSC, 2008). It has no legal authority over valuers or valuations but its corporate membership is drawn from over 50 countries and mainly consists of professional associations and international firms of valuers, who base their professional practice on IVSC guidance.

In IVSC's ***International Valuation Standards 2005*** (IVSC, 2005) the meanings to practitioners of some key words used in the introductory chapter of this thesis are given. There are other sets of definitions of 'value' and associated terms commonly used by British valuation surveyors, such as those given by Millington (1988), Richmond (1994),Turner (1977) and, pre-eminently, in RICS' "Red Book" (RICS, 2007). However there is an increasing need for "uniformity in the valuation approaches used in real estate markets" (IVSC, 2008), for which it is desirable that terminology also be standardised as property and other asset markets become more globalised (Dale *et al*, 2002; Schulte, 2003; Gilbertson and Preston, 2004).

This section discusses some of the main types (purposes) of valuation and the theory underlying methods employed, as they underpin comprehensive area-wide assessments of land value that feed data into value maps. The next section deals with the impact of computers on valuation practice.

Price and Value

'Price' is a fact: "the amount asked, offered or paid for a good or service" (IVSC, 2005:25). 'Cost' is either "the price paid for goods or services" or "the amount required to create or produce the good or service". Price and cost imply the existence of a market in which are traded goods and services, more or less freely. According to IVSC (2005), a market is "the environment in which goods

and services trade between buyers and sellers through a price mechanism". Like other environments, markets fluctuate over time, so prices and costs also fluctuate. Unlike price, cost and market, 'value' is not a fact but "an economic concept …an estimate of the likely price to be paid …at a given time in accordance with a particular definition of value" (IVSC, 2005:26).

For the concept of value to be useful, there needs to be a "particular definition" of the purpose and/or type of market in which the specific good or service is being used or exchanged. Because market conditions vary with time as well as location, values need to be calculated to take account of different times at which transactions were recorded. With land and property, there are also numerous markets, differentiated according to "estates and interests" (Turner, 1977:32), e.g. freehold (for owner occupation, investment and/or rent) or leasehold. Therefore numerous kinds of 'value' and potentially many 'valuescapes' can exist simultaneously: one for each purpose or kind of valuation. Hence ARW *et al* (2002) and Geofutures (2003) mapped different kinds of property values separately. Each kind of 'value surface' comprising collections of normalised valuation records will also change over time.

De-monetised Value

Besides definitions for professional property valuers, there are many other reasons to place a value on an asset or commodity. The word 'value' is used both in a precise sense associated with a monetary figure and more subjectively without direct monetary association, in ways relating to cultural norms. To those who study the latter 'ethical' value, any monetary association with the word 'value' might be entirely alien: they regard all "domains of value" as relative, capable of being seen differently through "a variety of viewpoints" (Riukas, 1998). Increasing difficulty in devising any consistent property valuation system may be a consequence of the diversity of cultures found among and even within developed states. Clashes in value systems can result from competition for control or rights over the use of scarce resources such as land, which "are created by society, they don't occur in nature" (Barnes, 2002).

Attempts have been made to relate the different perceptions of 'value' assigned by various stakeholders in a property, such as the Value in Design (VALiD) research project at Loughborough (VALiD, 2005). If 'value' and Value Maps are

to become tools for use in spatial planning decision making (see Section 2/6 below), then culturally differentiated value systems may produce clashes over the outcomes of those decisions within societies affected, which VALiD attempts to mediate through the construction design process. “Value assessment” to the VALiD Project bears little relationship to what “assessors” do in terms of market-based property valuation, which happens throughout the life cycle of any ‘real property’. The Commission for Architecture and the Built Environment (CABE, 2006) cites the VALiD project in a recent report whose title includes the term “mapping value” but then has no mention of maps in the sense intended here. However only with valuation systems that assign figures in monetary terms can there be an objective basis upon which to determine property rights within a market-based society.

There have been two main theories of valuation recognised by the UK profession: value in use and value in exchange (Sayce and Connellan, 2002). During the course of this research, the former theory has begun to lose favour among British valuers. However valuation practice can accommodate both theories to some extent in preparing sets of values for taxation and other purposes.

In theories of valuation, a complicating factor is that the same or similar terms are used in different countries – even in countries that generally use the same language – to mean different things. Similarly, different terms are used to mean the same thing. In what follows, the definitions used are those that apply in England. Other definitions may be given for comparison but the purpose of this research is to develop a concept for Britain and British property.

Business model approaches

The value of land or property to an existing or potential owner will generally be different to its value to the occupier and value to an occupier depends largely on the ability to transfer beneficial user rights without reference to the owner. Where the occupier of the property is not the freehold owner, some rent will be paid and rental value will be dependent on what can be earned from occupation (Richmond, 1994:28). However for an owner-occupier, Sayce and Connellan (2002) point to a paradigm in accounting: should financial accounts reflect the value of the property in use to/by the occupying business or its potential value in

the property market, i.e. in exchange? There has been a change of emphasis in British practice during the course of this study, reflecting international developments in accounting practice.

IVSC (2001) notes that Existing Use Value (EUV) “was developed specifically for financial accounting”. When discussing the emerging term Value in Use (VU) as their preferred alternative, Sayce and Connellan (2002:6) state that the ‘value gap’ between EUV and Open Market Value (OMV – see below) must, if it is significant, also be reported within the accounts so that “the business should not bear …property values that are unreflective of the ability of the business to support that value”. EUV had its origins in the 1970s, when RICS guidance on British valuation standards recommended abandoning the ‘going concern’ basis for valuing assets, because of “inconsistent practice and a lack of transparency” (Sayce and Connellan, 2002:7).

IVSC (2005) has now dropped all reference to EUV: its VU definition, in a revised IVS 2 (IVSC, 2005:94), is “the value a specific asset has for a specific use and to a specific user”. This is identical to that given by Sayce and Connellan (2002:11). RICS has adopted these international standards (RICS, 2007:1) and now makes no mention of either EUV or VU. The “business model” approach to valuation, especially where the properties in question have an existing use for which there is no “ready market”, is problematic for valuers. “It is comparable sales data rather than business factors that drive valuations” (Sayce and Connellan, 2002:5). They note (*op cit,* p.10) that VU is “non-market related” and “not necessarily ... a figure which a valuer is competent to determine” any more than EUV. However in the absence of transactions in property of a similar use class in open market conditions nearby, EUV/VU may be the only evidence available to a valuer, who should “have a specialised knowledge of a particular business” whose properties they value (Sayce and Connellan, 2002:11).

EUV, VU and all business model approaches to valuation present problems when attempting to produce Value Maps or modelling Landvaluescape, precisely because they are not market related. Therefore market based methods of producing valuations are next reviewed.

Market Value

In general, a valuer assumes a client requires ‘market value’ “in the absence of a statement to the contrary” (IVSC, 2005:26). However a client’s required “basis of value” should “be clearly identified”. Market Value is also known as Open Market Value (OMV) in some countries and is formally defined as:-

> the estimated amount for which a property should exchange on the date of valuation between a willing buyer and a willing seller in an arm’s-length transaction after proper marketing wherein the parties had each acted knowledgeably, prudently and without compulsion. (IVSC, 2007:27)

Market valuation is usually applied to identified rights of ownership in specified property, land in conjunction with buildings and other improvements on it, also other encumbrances such as wayleaves, i.e. the continuing rights of other parties in respect of that property. Except where re-development is envisaged (i.e. for “development appraisal”) in a strong and stable economy, it is seldom easy, in a developed urban environment, to directly and objectively assess the value of land alone. Market evidence of transactions in bare land is normally scarce. Statistical methods of establishing land value (covered here in more detail later in this chapter) require plentiful accurate information about the properties involved in transactions (Gloudemans, 2002) which, as was shown by ARW *et al* (2003) in the previous section, is not yet the case in Britain.

Even an open market is subject to some limitations: physical, legal and other constraints on what the “highest and best use” (HABU) for any particular parcel of land can be, taking account of its location. However “the determination of the HABU of a property is fundamental to valuations performed on the basis of market value” (Sayce and Connellan, 2002:3). HABU valuation is described below. Acting ‘knowledgeably’ includes exercising knowledge of limitations on land use, such as statutory Local Development Plans set out by LPAs in Britain. However British planning law does not involve prescriptive land use zoning and therefore involves much uncertainty for valuers seeking evidence of HABU, although transparency of such evidence as there is has improved under the Planning and Compulsory Purchase Act 2004.

In theory, parties to a market transaction (or their professional advisers) should also have knowledge of information about other comparable transactions. In

practice, the nature of both the British planning system and English statute law on release and re-use of property transaction data (see section 2/6 below) have until now limited the ability of any valuer, especially one not familiar with the particular local market, to achieve a robust MV. The property profession has long called for measures to improve the availability of property market information (RICS, 1996; Dale *et al*, 2002, 2006) and has sometimes been critical of Government actions in this area (Manning Stainton, 2007).

Fair Value

A term increasingly used is Fair Value (Sayce and Connellan, 2002). IVSC (2005:31) defines Fair Value as:

> the amount for which an asset could be exchanged, or a liability settled, between knowledgeable willing parties in an arm's length transaction.

This market oriented definition sits uneasily alongside another IVSC statement, quoted in Sayce and Connellan (2002:3) from a business accounting perspective:

> The Fair Value of real estate included among the assets of a corporate enterprise may consider the contribution of the real estate to the enterprise

RICS research "has demonstrated that real property … constitutes … 40% of the entire non-cash assets of listed companies" (RICS, 1996:14), hence the way in which it is valued for accounting purposes is extremely important. Barth and Hodder (2006:3) note that, in the European Union since 2003, "assets and liabilities are accounted for using different conventions", with assets but not liabilities accounted for at fair value in IAS 39, which uses the first definition above (IASB, 2003).

It appears that Fair Value, for real estate, has attributes of value in exchange and value in use, the choice of calculation being "within the control of the property owner, not the valuer" (Sayce and Connellan, 2002:7). However, as Gilberton and Preston (2004:14) point out:

> If revaluations at fair value negatively affect profits, the changes could act as a major disincentive for companies to revalue as long as it remains optional, not mandatory.

The logic of this is to make regular market valuations mandatory for company accounting purposes. Global investment fund managers may, the authors of this RICS Leading Edge paper go on to say, require "appropriate valuations" to be done "at least quarterly", with "big property fund managers…already" (in 2003, when Gilbertson and Preston delivered their paper) doing valuations "on a monthly basis" to keep up with market fluctuations. Such fluctuations are in land values, not building values.

The new IVSC definition is leading to major changes in the way fixed assets are valued for financial reporting, in all sectors and worldwide (Tissier, 2002, 2003). The effects of this continue to be widely debated in financial and valuation circles (Fama and French, 2002; Gilbertson and Preston, 2004; Armstrong *et al*, 2008) in the light of the developing global crisis in corporate finance, because it can impact on actual and predicted investor expectations. Gilbertson and Preston (2004:5) outline the links between "poor valuation" and such crises in the past twenty years and conclude "valuers are in the eye of the global financial reporting storm" (*op cit*, p.13). The 'efficient market hypothesis', discussed in Malkiel (2003), assumes that "when information arises, the news spreads very quickly and is incorporated into the prices of securities without delay". Failure to regularly, consistently and accurately revalue fixed assets can therefore impact on the efficient working of the entire global market economy.

'Highest and best use' value

HABU has already been mentioned in relation to Market Value and is defined by IVSC as:

> the most probable use of a property which is physically possible, appropriately justified, legally permissible, financially feasible and which results in the highest value of the property being valued (IVSC, 2005:29).

It is the whole property, not just the land, which is valued for a HABU valuation. This takes account of the possible re-use of buildings in another capacity, as well as complete site clearance.

IVSC accepts that "land is regarded as a permanent asset, but improvements upon or to the land have a finite life" (IVSC, 2005:28). Being immobile, "each real estate parcel [of land] possesses a unique location". A land parcel's

characteristics “determine its optimal utility”. The implication is that while the value of ‘improvements’ tends to reduce in value with time (depreciation) the value of each land parcel’s unique location in the market for such parcels will vary in a different manner and, given the scarcity of land, will generally increase as its utility for different competing uses increases relative to that for which it is currently used.

Sayce and Connellan (2002) found this paradox (that EUV/VU decreases as HABU value increases) to lie at the heart of a significant and still unresolved problem for valuers. Since a property in use cannot be detached from its underlying land/location, how can a combined (land plus improvements) MV be derived? Although, as they point out, there are circumstances when the combined MV may be higher in an existing use (i.e. that use is also HABU), in many cases a site is worth more on the open market in a different use, discounting any residual value of ‘improvements’ already on it, than that to which its current occupier puts it.

In a perfectly efficient market, land would always be occupied for HABU purposes. However, being of limited and fixed supply and having high costs associated with a change of use (i.e. redevelopment) as opposed to mere change or continuation of ownership, in the absence of a significant holding charge in the form of tax many sites do not quickly (re-)develop in their HABU (Gwartney, 1999:1).

The costs associated with change of use may be largely external, i.e. they impact on adjoining land sites and the wider community, through demands made on local infrastructure. Knowledge of MV can be of benefit to planners, by informing them of the opportunity costs of allowing alternative uses for a site. This is the very essence of spatial planning. Where these costs are robustly internalised, for example through the British system of ‘planning obligations’ (requiring developers to pay for mitigation of harm caused by their proposals), ‘financial feasibility’ of redevelopment and hence MV of a site will be adjusted downwards and HABU expectations might be reduced.

The uplift in value between EUV and HABU or MV can be extremely large, in England typically 200-fold for agricultural land with planning permission. The expectation of such future uplift ‘windfall’ through re-designation of land for

housing leads to ‘land banking’, i.e. land deliberately held out of use or held for future use. This distorts the operation of the property market, a phenomenon that has long been recognised by economists, from Adam Smith (Smith, 1776) through to Kate Barker in her recent review of housing supply for HM Treasury, where it is described in her Interim Report as “economic rent” (Barker, 2003:116) and associated with tax and infrastructure investment. Connellan (2004) traces the history of attempts to recover this windfall through various means, including a land value tax (LVT).

Mortgage lending value

So far, it is the owner-occupier view that has been discussed, especially with regard to non-domestic property and land approaching a new HABU. With commercial property in particular, owners may be investors. Mortgage lending is akin to investment: investors and lenders take a similar, longer-term approach to property value, depending on the period for which they are lending or investing, also whether the loan or investment is fixed in term or redeemable at specified notice.

The current MV may be unrepresentative of the longer term trend in value for a particular location or for properties of a specified class generally. Brett (2002) translates the German *Beleihungswert* as Mortgage Lending Value (MLV) and describes it as “a ‘smoothed’ view of market movements”. The German tradition is to use *Beleihungswert* for valuing loan collateral, as a ‘sustainable value’. MLV is now built into the EU Capital Adequacy Directive (CAD) and features in The European Group of Valuation Authorities’ (TEGOVA) ‘Blue Book’ of European valuation standards (Brett, 2002:18), in recognition of the strength of Germany within European institutions.

Whereas British companies traditionally have employed EUV in their accounts (whether or not they use RICS valuers to produce them) and IVSC seeks universal adoption of MV in an increasingly globalised property investment market, a compromise might be found in the more conservative but market-based MLV. The idea of smoothing values over time is in accord with the smoothing over a geographic surface that Landvaluescape implies and may assist market players in their decision-making more than either EUV/VU or MV.

RICS opposed the incorporation of MLV into the CAD (EC, 2006), despite its letter seeking UK Government support for its position stating:-

> It is essential that internationally active banks, whatever countries they operate in, value their property collateral on a consistent basis. Without this, there can be no level playing field for capital adequacy worldwide. (Craig, 2004)

The RICS Red Book does not recognise MLV and even the European Mortgage Federation (EMF) accepts that it "is determined entirely independently from the market value" (European Mortgage Federation, 2007).

Daly *et al* (2003) emphasise how much influence "lender pressure" has had on housing markets and the wider economy, because of the way valuers exercise a "social role" mediating between short-term home-buyer behaviour and the market, especially "when sale price information is scarce, unavailable or unreliable" (Daly *et al*, 2003:299). Monetary "sustainability of the asset for loan security purposes" (*op cit* p.312) would seem to merit a place in valuers' thinking. Any tool to help visualise long-term trends in real property values (both relative and absolute) could assist risk management in financial institutions operating across national boundaries, especially in the EU. MLV would seem to have a role in the future and is capable of being mapped.

Contingent and ecological value: hedonic pricing

Economic theory has long acknowledged a mathematical relationship between location and value (Von Thunen, 1826) and the factors influencing the value of a site and the property on it are many. The use of hedonic models, which identify and evaluate these factors, has increased with the availability of computing power to process the complex algorithms devised by modellers and the data volumes obtained from modern cadastres (Malpezzi, 2003; Cervero and Duncan, 2001). Kilpatrick (2004:3) states that they have been "widely used in the valuation field for at least three-quarters of a century".

The interplay between market and non-market influences on price and value has been studied in the context of property consumer choice between local governments with different spending priorities (Tiebout, 1956; Oates, 1969) and where ecological value or contamination are major factors (McLean *et al*, 1999;

Diamond, 2000; Hannon, 2001). The latter, utility-based approaches are known as ‘contingent valuation’ or ‘stated preference modeling’ and are now accepted in courts of law where market evidence of value is absent or insufficient.

Application of hedonic pricing methods in conjunction with GIS to produce value maps for tax purposes is discussed below. Such applications are most probably what Gallimore *et al* (1995) refer to (see section 2.2 above).

Taxable value

Although indirectly MV and MLV are increasingly referred to in formal international agreements, such as the Basel II Revised Framework (Bank for International Settlements, 2004:20 and 2006:24) and the EU Capital Adequacy Directive (EC, 2006), basis of value is not often specified in law. However where valuation for property taxation is concerned, there are statutory definitions of what is the basis for *ad valorem* (literally ‘by value’) taxes.

In Britain there is a considerable overlap between valuers who specialise in property tax matters and those who mainly advise purchasers and vendors. The fact that UK property taxes are paid by occupiers not owners also affects the professions since, as has been shown (pp.34-5 above), ‘value’ is not the same to an occupier as to the owner of a property. The term ‘rating’ is used in most Anglophile countries to signify property taxation applied to local government. There is a distinct Rating Surveyors Association (RSA), which is independent of the two professional institutions based in the UK, which in turn have overlapping membership: the Royal Institution of Chartered Surveyors (RICS) and the Institute of Revenues Rating and Valuation (IRRV). RICS’ list of specialisations includes “rating advice and appeals”, as distinct from “property taxation advice” (RICS, 2008). The former deals in valuation for rating; the latter in valuations for all purposes.

The general rating system across Britain (but not Northern Ireland) was abolished in 1988, replaced by Business Rates (on commercial property only) and, for domestic property, first Community Charge (not based on property values at all) and then Council Tax (see below). The demise of British rating was caused by failure of successive governments to revalue, exacerbated by prevarication over reform of local government finance from the mid-1970s through the 1980s (Layfield Committee, 1976; Boyne, 1986). A substantial

decrease in central grants to councils during the 1980s put further strains on the rating system as an equitable and stable revenue base (Dixon, 2000:7).

Dixon (2000) is the standard guide to the current Business Rates for the non-specialist; Plimmer (1998) is a more comprehensive reference on rating law and valuation. "As a broad generalisation, taxes on property are used internationally to support expenditure by local government" (Dixon, 2000:4). This is supported by Overchuk (2001) in his study of European valuation systems for tax purposes, also by Bird and Slack (2002:36,43) in their study for the World Bank. However in most countries "the valuation arrangements are centralised" (Dixon, 2000:5).

Since its introduction in 1601, English (and Welsh) rating has been a tax on "the value of the occupation of property" (Dixon, 2000:5). The importance of ensuring equity as between taxpayers has always been recognised but only since 1950 has a national public agency been responsible for valuations: the Valuation Office Agency (VOA), now an Executive Agency of HM Treasury. Unlike valuations for other purposes, rating valuations operate on an area-wide basis, with relative accuracy as between taxable entities (known as 'hereditaments') as important as absolute accuracy: "the valuation officer ... will aim to get a consistent view of the rents achieved for all classes of property in the area" (*op cit.* p.15).

Since property market conditions vary over time as well as geographically and between sectors, it is general practice with property taxation to normalise the valuations to a common 'antecedent valuation' date (AVD) "to ensure fairness and equity" (*op cit.* p.65). Periodic revaluation is also normal to property tax systems: Dixon (*op cit.* p.6) suggests a maximum interval of "in the region of five years" between revaluations, based on international experience. Overchuk (2001:8) notes that:

> It is common for revaluations to occur every four or five years. In recent years some [European tax] jurisdictions have introduced more frequent revaluations. It has mainly become possible due to development of information technologies.

Heard (2005), a former President of IRRV, suggests that "we should now be looking seriously at the concept of annual revaluations" for non-domestic rating "with the advent of modern computer technology and information systems". He

believes this could be achieved by 2015. Government appears to accept the argument (Bassam, 2003).

Banding and Council Tax

The current British domestic property tax, Council Tax (CT), uses bands of capital value. Plimmer *et al* (2000) have explained the history behind the CT system and provided a critique of its operation. Banding, they noted, is defined in the New Oxford Dictionary as "the division of something into a series of ranges or categories (used especially in financial contexts)" but they found "there is no other recorded system of using banded values for property taxation purposes anywhere else in the world" (*op cit*, p.2). Banding obscures the actual market value of individual properties and limits the scope for Value Mapping residential areas using published property tax data.

CT was introduced in 1993 in haste. Unlike the Uniform Business Rate (UBR) introduced a few years earlier alongside Community Charge, no statutory provision was made for revaluations or adjustments to the CT bands. Consequently neither the AVD (1 April 1991) nor the bands have been changed since then. It has several administrative advantages, summarised by Plimmer *et al* (2000:3). One "apparent" advantage, they surmised, is "lack of public criticism" (relative to its predecessor Community Charge), which supports Plimmer's research showing surprisingly low numbers of justifiable appeals (*op cit,* p.10). Bird and Slack (2002:72) suggest that CT "has been widely accepted by taxpayers because it is well understood, predictable and stable". However, to "informed commentators" such as RICS and IRRV, Plimmer *et al* (2000) ascribe criticism that CT suffers from "absence of revaluation" and "limitations of existing band values" (*op cit,* p.4). Problems arise with properties adjudged to have values close to a band boundary, because the potential for inequity is great. CT has eight bands, denoted A to H, hence seven band boundaries. Lyons (2007) has published research for the Government which his Inquiry's final report says shows that "3.7 million households (17%) ... are arguably paying too much council tax" because of the lack of revaluation (Lyons, 2007:23).

For the purpose of this research, it is of concern that the only publicly held nation-wide definitive valuation dataset for domestic properties, potentially useful as a basis for Value Maps, is severely degraded. Also the existence of an entirely

different kind of dataset to that used for non-domestic rating (UBR) makes the formation of a single national dataset problematic. No commentators appear to have expressed concern about this, however in the absence of any debate about national land valuation there is no reason why they should.

The prospects for reform of a banded CT – let alone its abandonment – are slim. It would appear that Government (DETR, 2000) believes that "valuation cannot be an exact science" and hence that banding improves "stability" of the tax base and might even be extended to non-domestic rating in future. However DETR accepted that crude bands are "less fair than more numerous, narrower bands", the implication being that discrete valuations for tax are the most fair (there being no bands at all).

Lyons (2007), following a lengthy independent review of local government finance, concluded that there was no need for major reform of CT. In his 2005 Interim Report, Lyons had found no significant benefits would result from revised, increased or otherwise reformed CT. However in his final report Lyons (2007:23) stressed the importance of revaluation, pointing out that "the technology now exists to go ahead with a revaluation relatively cost effectively". However he also said revaluation was "not the most urgent priority", although when it happened "Government should reform Council Tax by adding new bands" (*op cit*, p.24).

Plimmer *et al* (2000:18) suggest bands that "could be locally or regionally determined" (Britain has three national banding structures, one for each of Scotland, England and Wales) and contrast the banded CT with the use of discrete values and with "the use of value zones defined by floor area, location or land use" (*op cit,* p.17). They conclude that banded systems like CT could suit developing or transitional countries where data is poor or lacking, or trained assessors are in short supply. However there appears to be no move by any other country to adopt banded property tax.

Rental and Capital Value

Since any calculation of financial value should be based on evidence of financial transactions, the nature of the property market is important to tax administrators seeking to maximise tax transparency. If most properties are bought and sold for owner occupation, most transactions will be expressed in terms of capital value. If properties are usually leased by investors and transactions are by way of

leases and tenancies, then market evidence will be in terms of rental value and/or yield.

Another reason to use rental values for property tax assessment, cited by Bird and Slack (2002:49) is that taxes are paid out of income: rent is “income (a flow)”, market value represents “wealth (a stock)”. Since British property taxes are normally paid by occupiers, a rental basis of value is more appropriate for business rates. The capital basis for CT arose from the need to rapidly acquire crude market data when the tax was established: British domestic property is normally traded freehold, hence the market deals in capital prices.

When land undergoes redevelopment, it is the underlying capital value of land that is subject to a transaction – whether compulsorily purchased or via the free market. Hence property transaction taxes (described below) are usually based on capital value.

In order to produce a common ‘value surface’ (i.e. a cartographic expression of the mathematically derived value) of land – Landvaluescape – values must first be normalised: either capital values converted to rental value equivalent or *vice versa*. This is especially important if the results of this normalisation are to be used in a property tax system.

There is a well established triangular relationship between capital value, rental value and yield from property. IVSC (2005:163) describes the “income capitalisation approach” to valuation, explaining that the resulting derived present capital value is based on “the expectation of future benefits (income streams)”. The guidance from IVSC (Guidance Note 9) defines the “yield rate” as “the opportunity cost of capital, i.e. the rate of return the capital can earn if put to other uses having similar risk” (IVSC, 2005:245). Prospective purchasers of property calculate the expected rate of return from net rental income and convert that into net present value (NPV), which becomes the basis of any capital sum they are prepared to pay. If any two of capital value, rental value and yield rate are known, then the third can be calculated.

However estimates of yield rate are bound to be speculative, because the future cannot be known in the same way that actual transaction prices can be known. Hence all capital values are also to a large extent speculative, which is why many economists who favour *ad valorem* property taxes (e.g. Banks, 1989; Robertson,

1994; Land Value Taxation Campaign, 2008) prefer them to be based on rental values. The current rental income from property is the least speculative basis upon which to levy a tax and less liable than capital value to fluctuations, caused by changes to forecasts of future yield rates.

As Robertson (1994:25) explains, whereas a “land-rent tax” will “clearly reduce the capital value of land for landowners”, because “the annual worth of the land will drop by the amount of the tax”, users will still need the land and “will be prepared to continue to pay rental charges in accordance with the level of profit or benefit they can get” from it. Although rental values will fall to some extent, because the tax (being an ongoing holding charge) “will bring more land onto the market” and the law of supply and demand will apply, they will not be eroded nearly as much as capital values. The fixed nature of overall land supply sets a floor to rental values, assuming demand to be constant. However the expectation of **future** lower levels of rent will bring down capital values faster.

The Land Value Taxation Campaign (2008) group argues that there is “no shortage” of rental evidence in most kinds of property market in Britain. They point to the tendency of capital valuations to factor in several speculative elements that can lead to the “classic bubble” of borrowing and lending based on values that bear little relationship to actual current rents (Land Value Taxation Campaign, 2008:2). This, according to the Land Value Taxation Campaign (LVTC), is one reason why LVT based on capital values (e.g. in Denmark) has sometimes proved unpopular: the tax was based on unrealistically high values that cannot be paid from current income, i.e. not related to ‘ability to pay’.

Nevertheless there is an argument that the best method of expressing value of any commodity is that which is understandable to most market players. Residential property taxpayers generally understand capital values better than rental values, hence most property taxes worldwide are now based on capital values of land and buildings. In some countries (e.g. Sweden, see chapter six below), the unpopularity of the property tax is reduced by making the taxable value a percentage (there 75%) of the capital value, so that taxpayers think they are being treated generously and are less likely to appeal the valuation.

Previous attempts to introduce LVT into Britain have had a mixture of capital and annual rental bases (Connellan, 2004:52-3). However most modern *ad valorem*

property taxes, whether based on site values only or gross property values, use capital values (Brown and Hepworth, 2003; Bird and Slack, 2002).

Other Statutory Property Taxes

Connellan (2004:83-86) describes several attempts by UK governments to capture windfall gains in value by means of transaction taxes. Apart from Capital Gains Tax (CGT), which was introduced in 1965, these all depended on the requirement institutionalised in 1947 (through the Town and Country Planning Act of that year) to obtain permission for development, which was at first (until 1953) subject to a charge of 100% of the land value uplift arising from permission. Although potential uplift value (MV minus EUV) continues to be expressed in property transactions and can generally be recovered via CGT, this 'hope value' cannot be fully realised by owners without planning permission.

The Betterment Levy (1967) and Development Land Tax (1976), like the earlier development charge all Labour Government measures, failed to produce either the expected revenue or development and were withdrawn by the Conservative Governments that followed. Although based on a similar principle, the continuing 'developers contributions' or Planning Agreement payments to local government that openly and legally accompany most major planning permissions (Connellan, 2004:95-99), do not require formal statutory valuation of the windfall that arises. However the proposal by Barker (2004) for a Planning Gain Supplement and (it is widely expected) that by the present government for a Community Infrastructure Levy would, like the earlier twentieth century measures, require statutory valuation. The debate about this "implicit land taxation" continues (e.g. Oxley, 2008) but without the benefit of land value visualisation.

Another purpose for property valuation, defined by statute, is compulsory purchase of land by Compulsory Purchase Order (CPO). Because the value of 'improvements' is (in broad terms) discounted, CPO value approximates to land value, which will be shown later to have particular relevance to value mapping.

Here the owner is entitled to compensation based upon an assessment of MV carried out under guidelines established by Acts of Parliament, primarily the Land Compensation Act of 1961. Clearly the market is, by definition, artificially constrained in such circumstances.

In English law a fundamental concept for such valuation is the No Scheme World, which “involves estimating what the site would have been worth if the scheme the CPO is enabling had never existed” (Asher, 2004). Asher (a valuer and past president of the Compulsory Purchase Association) was discussing work by the Law Commission (2003) to develop the concept so as to avoid some of the arguments about what a site might have been worth if alternative redevelopment strategies besides the one behind the CPO had been adopted. Instead of assuming that the “statutory project” (that for which the authority wishes to acquire the land) had never existed for the purpose of valuing the sum in compensation, the Commission proposed that it be assumed that it existed but was cancelled on the date of valuation.

Government decided not to accept the Law Commission proposals but debate continues among specialist valuers and lawyers as to what planning permissions and valuation date should be the basis of CPO valuations (Compulsory Purchase Association, 2006). Because the acquiring authority generally has no use for buildings that exist on the site to be acquired for re-development, CPO value approximates to HABU value prior to the scheme that led to the CPO.

The Law Commission (2003) proposals expanded on the existing “appropriate alternative development” certificate under Section 17 of the Land Compensation Act of 1961(Planning Inspectorate, 2003). A similar idea for a Certificate of Development Potential (CDP) was proposed by Hudson (1976) as a means of assisting the definition of HABU for a property tax based on site values alone: Site Value Rating (SVR). Such certificates would have no status in planning law other than for statutory valuation purposes.

Conclusion

From the aforegoing discussion of valuation theories and purposes, several conclusions can be drawn that relate to the hypothesis.

Firstly, before considering what values to map it is necessary to be clear what the purpose and “particular definition” of basis of value was obtained by those producing the values to be mapped. There must a normalisation of the data before any sense can be made of the resulting Landvaluescape, as defined in the introductory chapter.

Secondly, British value data are heterogenous in respect of type of land use. The statutory basis of taxable value for residential land is very different to that for commercial land and there are large parts of the country for which no regular statutory valuations are carried out and which may not have been valued for decades. In the absence of market transactions on that type of land in many neighbourhoods, there is no readily available data from which value maps could be produced.

Thirdly, British valuation standards are undergoing change in response to globalisation of certain property markets and developments in European and global accounting standards and financial risk regulations. The trend is for more market-based and less business model valuation to be required in Britain, as elsewhere. Absence of a land-use zoning system and the fact that occupiers rather than owners pay British property taxes together make HABU valuations both difficult and inequitable for tax purposes. There is uncertainty as to how far and fast the trend to more frequent and HABU valuations will go, particularly with regard to smoothed long-term but market-based valuation practices such as is normal in much of Europe.

Fourthly, the literature gives little indication that Britain is likely to undergo property tax reform, which is the most common trigger for widespread use of hedonic modelling and mass valuation, as will be seen in the next section.

2.4 Valuation Methods: Manual and Automated

This section briefly discusses valuation methods, before considering in more detail the extent, nature and implications of the use of computers in valuation. Howes (1980:135) foresaw that computers would have the potential to make value maps much easier to produce. Gilbertson and Preston (2004:9) confirm "valuers are seeing a progressive shift towards automated processes" and "there is no way back from evolutions in technology" (*op cit*, p.10).

Methods of Land Valuation

Irrespective of the purpose of valuation, there are several methods of obtaining real property valuations. IVSC (2005:162) states that many countries recognise three approaches: "sales comparison, income capitalisation, and cost", each "reasonable for the valuer to consider". The outcome in all three approaches is a capital valuation.

The purpose of valuation in this study is to arrive at 'Landvaluescape', assuming that the concept of Value Mapping in Britain is worth developing. Therefore only those methods of property valuation from which consistent estimates of land value across an entire territory can be obtained will be discussed. German *et al* (2000) considered all three of the above valuation approaches when addressing "the single greatest challenge to any type of land value taxation system" in a seminar at Lincoln Institute where officials of Toledo County Ohio met experts in various fields interested in LVT. The 'challenge' is to achieve "accurate valuation of land on a large scale". The authors of the article point out that this only becomes an issue when land values are taxed more highly than values of "building components" and the accuracy of the split valuation can affect tax payments. Otherwise, as Batt (2008:8) says, "assessors ... have no incentive to accurately value land" separate from buildings on it.

In densely urbanised tax jurisdictions, sales of "comparable unimproved land" sites are rare. Whereas sales comparison is "the most direct and systematic" approach in normal property valuation, "when data are insufficient, the applicability [of the approach] may be limited" (IVSC, 2005:162) and "difficult to apply" to land valuation (German *et al*, 2000). "If sales of improved land are followed soon after by demolition of the buildings", according to German *et al* (2000), the unimproved land value can be arrived at by deducting the costs of

demolition from the purchase price. Even so, they say “such sales ... do not exist in sufficient numbers over a varied enough geographic range to serve as the sole basis for assessment”.

According to German *et al* (2000), the “land residual method” closely relates to income capitalisation/analysis. This is described by Gwartney (1999) and in IVSC (2005:171) as “a technique for land valuation” whereby HABU is assumed and “all operating expenses and the return attributable to other [non-land] agents of production are deducted, and the net income imputed to the land is capitalised to derive an estimate of land value” (Gwartney, 1999:10). German *et al* (2000) point out that the robustness of this method is vulnerable to poor assessment of depreciation of buildings and any deviation from HABU. It is therefore more suitable for “income producing properties and .... newer properties for which fewer assumptions are required” (IVSC, 2005:171), i.e. recently developed sites. It also forms the basis of most development appraisals, where the current use and existing buildings are discounted, although German *et al* (2000) treat this “full-scale market appraisal of potential development alternatives” as a separate approach: “cost of development”. IVSC (2005:170) calls this the “subdivision development technique”.

With the cost appraisal method, to arrive at land value it is assumed “that structures can be worth no more than their cost of construction”, with “all remaining value in the improved parcel” assigned to the land (German *et al*, 2000). Whilst this may be true for newly developed sites, “the financial effects of various forms of obsolescence can only be measured accurately through examination of sales data, which will almost never be available for the building alone” (*op cit*). Gwartney (1999) does not include cost appraisal among his seven suggested “land value indication” procedures.

IVSC (2005:170-171) and Gwartney (1999:20) cite “ground rent capitalisation” as a further approach to land valuation.

Mass Appraisal

Almy (2002:15) defines mass appraisal as “the systematic appraisal of groups of properties as of a common date using standardised procedures and statistical testing”. Note that the purpose of appraisal does not form part of this definition. No definition of ‘appraisal’ is offered by IVSC, nor is any distinction made

between ‘professional valuer’ and ‘appraiser’, although the latter word is seldom used to describe a valuer in Britain. Dale, in his 2005 report for UNECE, uses the term “mass valuation” interchangeably with “mass appraisal”, pointing out that it is:

> in principle … undertaken for the purposes of taxation but, once established, it provides a basis for analysing the performance of the land market, assessing trends in the price indices, supporting strategic decisions at the State and local levels, or assessing the level of compensation in a proposed development project (Dale, 2005:40).

The term Automated Valuation Model (AVM) implies that valuation is conducted by computerised methods, with little human input. It also does not suggest that valuation is for tax purposes. On the other hand, the term computer-**assisted** mass appraisal (CAMA), which is associated with taxation, implies that the computer is in a supporting role.

IVSC (2005:271) introduces its Guidance Note 13 on “Mass Appraisal for Property Taxation”, saying that it “may be utilised … for statistical and economic studies” but nowhere else in International Valuation Standards are computers mentioned. Overchuk (2001:7) also states that “the need for mass valuation has evolved when governments started to apply property tax that has required a large number of properties to be valued at the same time”, noting that all European countries that responded to his enquiries about the status of their “mass valuation” systems had introduced them for tax purposes.

After outlining their four methods of discrete land site value appraisal, German *et al* (2000) conclude that only by using computer-assisted mass appraisal (CAMA) and GIS can “a response surface that represents the effect of location on land value” be developed. This “location value variable” is analysed alongside numerous other variables available to Lucas County assessors for properties in their database, to “produce a total estimated value for the parcel” in two parts: land and buildings.

The CAMA/GIS approach can be regarded as a form of hedonic pricing (see previous section) and uses “beacon” properties to achieve robust results, as recently carried out for Northern Ireland’s domestic property tax revaluation (Gloudemans and Montgomery, 2008). These beacons can have their discrete

values assessed, prior to CAMA/GIS modelling, by any of the above four valuation methods described above.

This “new approach to land valuation” (German *et al*, 2000) “still relies on an element of [human] appraisal and economic judgment in determining neighbourhood boundaries for location effects” but can be tested empirically by refining “breaklines” and by making the resulting assessment data available widely to taxpayers, who can “create customised maps” from either online or CD-ROM datasets, with viewing software. Gwartney (1999:21) also expounds on the benefits of CAMA and GIS for land valuation, citing among the advantages, the ability to: “facilitate frequent updating ... improve the assessor’s productivity ...[and] eliminate arithmetic errors”.

The Northern Ireland (NI) Domestic Revaluation (DR) of 2006-7 achieved significantly better (lower) levels of appeal than had been expected in the first year (LPSNI, 2008:12): 92% of only 600 appeals submitted were found to be within 10% of assessed value, against a target of 90%. If the level of pre-appeal informal inquiries and value reviews is taken as a barometer of public acceptance, the initial NI DR figures are even better: only 8% of ratepayers (compared to an expected 20%) used the inquiry process and only about half of these required manual value review (Gloudemans and Montgomery, 2008:28-9). However although GIS was employed for the DR CAMA, from Gloudemans and Montgomery (2008) it is unclear whether value maps were used for any aspect. LPSNI (2009) confirm that they “expect to use GIS as one tool towards … explaining and enhancing general understanding of the system”. They also state that there is no legislation in place or planned that would trigger another revaluation.

IVSC (2005) states that mass valuation does not require computers or automation, however Kathmann and Kuijper (2006) claimed that when the Netherlands introduced annual revaluations for tax in 2007 “it is obvious that automated valuation models are used”. The saving in skilled valuers’ time can be very considerable: when Denmark automated its four-yearly mass revaluations in 1981 (Müller, 2000:11), the municipal tax authorities expected to be able to shed four-fifths of the staff engaged in valuation (Jensen, 1998). However instead of immediately commencing lay-offs, they decided to work

towards increasing the frequency of revaluations. From 1998 there were annual revaluations in Denmark, with the result that levels of appeal by 2000 had reduced by a factor of three (Müller, 2000:13). Although the revaluations then became biannual, the number of valuation committee members had been reduced from 3840 (before introduction of computerised valuation systems) to just 672.

For the NI DR, the first use of CAMA in the UK, non-CAMA methods were never considered. After no revaluation for thirty years, revaluation by CAMA and GIS was the obvious solution. All but about 80,000 of the Province's 680,000 domestic properties were assessed with the aid of MRA and *spatialest* GIS software (Gloudemans and Montgomery, 2008). The authors conclude:-

> In effect, a complete, new valuation system and supporting software, methodologies, training, and culture were required. Happily, despite some considerable struggles, the project was completed effectively, on schedule, and with excellent results in terms of accepted professional standards. Public acceptance was also positive. (Gloudemans and Montgomery, 2008:30)

They also state: "MRA is a highly effective and efficient mass appraisal technique." However manual "value review" by LPSNI resulted in almost half of the modelled capital values being changed.

The superior efficiency of CAMA and MRA generally is mainly attributed by Müller (2000) to the increased accuracy and transparency of more frequent revaluation involving "a vast number of calculations". Neither Gloudemans and Montgomery (2008) nor the official LPSNI (2008) annual report and accounts reveal whether skilled staff were released as a result of modernisation, probably because the period since the last rating valuation had been so long (e.g. compared to Denmark, cited above) as to make any comparison of staff numbers meaningless. However they point out that "prior to the DR project, professional valuers within [NI's valuation service] had neither a background in statistics nor any practical CAMA experience" (Gloudemans and Montgomery, 2008:19). A dozen valuers and other staff had to undertake the Royal Statistical Society Basic Statistics course before the project could commence.

Automated Valuation Models

The AVM has been defined as:-

> a mathematically based computer software program that produces an estimate of market value based on market analysis of location, market conditions, and real estate characteristics that was previously and separately collected. (Clark, 2007)

This definition, by a CAMA practitioner working in a US County Appraiser's office, writing "a primer for individuals who are new to valuation modelling" in a journal for commercial (non-tax) valuers, makes it clear that to him the AVM is merely a component of the CAMA system: "the credibility of an AVM is dependent on the skills of the modeller".

AVMs are generally proprietary algorithms incorporated into computer software programs aimed specifically at the real estate industry, including both private and public sectors. They include CAMA products but need not have GIS nor use spatial algorithms.

Hitherto most CAMA and AVMs have used the statistical technique of multiple regression analysis (MRA) for deriving hedonic models and producing discrete values for properties within them. ARM *et al* (2003:24) point out, in their study for TfL of the Croydon Tramlink (see above) that such techniques are "not … necessarily well suited to analysing geographical data", as MRA "typically assumes that the observations used in the regression are independent of one another". The values of factors/attributes that might influence property values are solved independently of one another in a typical MRA, for each of many neighbourhoods that are assessed manually (or sometimes with the aid of the software) to have similar market characteristics. However, because "spatial autocorrelation [is] often present within geographical data" (i.e. variations in one attribute have a spatial mathematical relationship with one or more other variable attribute), a "geographically weighted regression" (GWR) technique, such as that developed at the University of Newcastle and used for the Tramlink study, should be used.

In both MRA and GWR, many iterations of the calculations are normally carried out on the entire hedonic model of data to produce different values of all or most variables and a 'best fit' empirically between predicted and actual prices, before

final assessments of value are published. The skill lies in identifying both the attributes (physical and spatial) of significance and the boundaries of the (more or less) distinct neighbourhoods. From the literature, the quality of the final result depends on the quality of market data (both in terms of richness of attribution and openness of the market), the definition of neighbourhoods, the robustness of the algorithms used in the modelling and the skill of the statistically trained valuers. The NI DR project describes how each of these affected the results (Gloudemans and Montgomery, 2008). Other examples in the literature, all of which deal with property tax systems, are: Ward *et al* (2002), which discusses both MRA and GWR; Almy (2002), describing how to plan for tax modernisation in a former communist country; and Gloudemans (2002), which specifically looks at MRA as a means of deriving land value from a mass of property market data where values of land and buildings/improvements are not separately available.

Because it is the mapping of land values specifically that this thesis is concerned with, Gloudemans' conclusions are important:-

> Mass appraisal models are remarkably robust in capturing neighborhood and location influences for improved properties. As long as the proper variables are included, almost any reasonable model formulation will succeed in incorporating proper adjustments… Location affects both land and buildings, but in percentage terms the impact on land is much greater. (Gloudemans, 2002:7).

Gloudemans goes on to remark that "in dollar terms, the impact [of location on land values] can be similar". However his research was in parts of North America where the land value represents a much smaller proportion of total property value (typically under 20%) than in most of urban Britain. Hence his conclusions are more significant for Britain and contradict the views of British valuers such as Hart and Johnson (2005:3.30), who state that "underlying land value is not simply the residue left once a building is stripped away by using a depreciated replacement cost calculation" and that "the use of computer modelling and computer based valuation techniques would be complex, expensive and relatively difficult to maintain" (*op cit*: 3.33). The NI DR experience indicates this might not be so. Hart and Johnson (2005) offer no evidence in support of their views, which are widely held among RICS valuers: RICS were content to use

their report as the Institution's response to Barker (2004). Yet (RICS ex-President) Gilbertson and Preston (2004:18) appear to expect automation to be a means by which "larger firms [of valuers] may look to … cut their costs", not least because "competition…is stimulating greater use of technology" in valuation services (*op cit*, p.9).

Clark (2007) points out that, whereas "virtually all public sector users" of AVMs are seeking "a point estimate of market value as of a given date", usually for tax purposes, in the private sector AVMs might be used to produce "a range of possibilities [for value] at a given level of confidence". Examples given are "a lending institution [wanting to know] the lowest amount the property might bring in a given market" and a "real estate agent, investor or property owner [wanting to know] the highest price for which the property might sell".

According to research for the British Council of Mortgage Lenders (CML), only 2% of valuations carried out for their members used AVMs in 2004, yet by 2012 – within five years of the introduction of compulsory Home Information Packs (HIPs), with valuations – they expect 40% to use AVMs (Pannell and Wagstaff, 2006). Gilbertson and Preston (2004:9) report that AVMs were being used "in approximately 10% of all mortgage originations in the US" in 2003. Lenders use AVMs for a purpose that could be regarded as falling within Almy's definition of 'mass appraisal' above, although usually not to produce a mass of values but one at a time from a mass of data records.

A CML Senior Policy Adviser has suggested that Basel II's emphasis on monitoring values of portfolios on a frequent basis could lead to greater use of statistical methods for individual domestic mortgage lending (Thomas, 2006). The aggregate value of lending of most companies holding – or lending against - property assets in the UK is above the threshold at which compliance with the Capital Adequacy Directive (CAD – EC, 2006) is compulsory, hence Thomas stated that "Basel will accelerate the development of AVMs through their use in revaluation". The Joint Industry Response (JTA, 2005) to the Financial Services Agency's 2005 consultation paper on Basel II implementation CP05/3 (FSA, 2005) refers to a CML member survey on current and future practice:

> It would seem likely that updating will be done more frequently… the granularity of the AVM is seen as its strength … AVMs will be used more

> widely, possibly in conjunction with or as a replacement for the [house prices] index. (JTA, 2005:122).

The growth in extent of use of computers by members of CML is evidenced by what happened when ODPM introduced its monthly house price index using a Survey of Mortgage Lenders (ODPM, 2004). Although ODPM only asked for a 5% sample of records of mortgage completions from lenders, most lenders found it as easy to supply 100%, because their records are held on computers and a simple data transfer is all that is required. As the use of HIPs grows and the national property database is populated, CML believes it is likely that more lenders will rely on AVMs to approve loans, rather than insist on individual valuations.

As Clark (2007) points out, resistance to use of AVMs arises out of suspicion that there is "potential lack of human intervention" in what can be a very sensitive and value-laden process, upon which large sums of money depend. In fact, in AVMs used properly "trained persons verify and input the raw data, others develop and refine the mathematical models and the output is reviewed according to locally developed standard procedures", if appropriate by skilled humans. The operations which are automated are those "that are repetitive and may be accomplished following standard rules and procedures" more quickly and cost effectively by computers than by people. As Gilbertson and Preston (2004:11) put it: "If properly understood and used, [AVMs] will become a valuable part of the valuation process rather than the process or the result itself".

The American experience of AVMs as compared to valuations produced without them, in the circumstance of class actions before the courts, is revealing. Kilpatrick (2004), cites numerous academic and legal references in support of his assertion that "techniques which value large numbers of properties together are more statistically valid than" those which use prescribed alternative valuation procedures for individual property appraisals. However he notes that "public officials" in key roles "throughout the United States are required to continuously maintain data bases of real estate values": a situation which does not exist in Britain.

CAMA in Property Tax Systems

Although Almy's definition of mass appraisal does not specify its use in property tax systems, nor does IVSC's Guidance Note 13 (Mass Appraisal for Property Taxation) limit the term to computer assisted methods, CAMA is invariably used in support of modern property tax administrations. Almy (2002) was writing background materials for a workshop of national tax administration officials in a former communist country wishing to modernise its property markets and its tax system. The system Almy describes is typical of what the UNECE's 2000 survey (Overchuk, 2001) found was happening in such countries and draws on his own North American experience. Batt (1998) describes a similar proposal for New York State.

Almy's description of mass appraisal is just part of an overview of how to plan, design, implement and maintain a modern property tax system. Almy (2002:3) states that "at the process level, the main external linkages" of a modern property tax system are "taxpayers, the land title system, building permit issuing authorities, and real estate professionals". Since all these are either sources or potential users of data within the system, by implication Almy here identifies stakeholders in value mapping, as a by-product of the tax system.

In Britain, politicians (and the British Property Federation) would claim to represent property taxpayers. Local planning authorities approximate to 'building permit issuing authorities'. The 'land title system' involves Land Registry (for England and Wales), Registers of Scotland and Ordnance Survey (OS) on account of its copyright in map data (see next section). 'Real estate professionals' are proxy for their clients in the property industry: investors, occupiers, buyers and sellers.

In planning for the system, an important strategic aspect is estimation of the resource requirements. Almy says that "the costs of maintaining the data in the fiscal cadastre" - which he defines as "the totality of maps and files containing data relevant to property taxation" (Almy, 2002:11) – is "generally the largest component" of the costs of administering a property tax (*op cit* p.6). Almy goes on to say that "data in the fiscal cadastre are valuable if they are kept current" and he suggests that cost recovery from other non-tax uses of the data can be significant: "data needs of others in the public and private sector users also

should be taken into account" in designing the mass appraisal system (*op cit p.*12). Dale (2005:iv) notes a trend in UNECE countries for "operation of the land cadastre and register system to be partly or fully based on the principle of cost recovery", implying a significant commercial value in such databases (see also Guandin and Manthorpe, 1998; UNECE, 2005).

Within the fiscal cadastre, Almy states that "building and maintaining the property inventory and attribute database are the most labor-intensive and hence most expensive aspects". Components of this database are listed (Almy, 2002:11-12): "cadastral maps and assignment of parcel identifiers; land and building attribute records; sales records and other evidence of market values; records of taxpayers (usually owners)". In Britain, sales records involve Land Registry and Registers of Scotland but retrospective capture of title holders would require secondary legislation in England and Wales, although local authorities maintain registers of occupiers of property for tax billing purposes. VOA compiles other evidence of market values besides sales. Land Registry maps contain OS copyright but the assignment of parcel numbers is a task divided between several public bodies, although the National Land and Property Gazetteer (NLPG) appears to offer a good solution (Sayce *et al*, 2008). The NLPG is a "comprehensively and continually updated database, created by … those with legal responsibility for street naming and numbering" in local authorities" (NLPG, 2008). It is working rapidly towards daily updates.

What Gilbertson and Preston (2004:17) say of "former communist states" is also true of Britain: "the move to mass land taxation is unlikely to happen until sufficient information has been collected". The current Director of IRRV has privately stated his view that Britain does have 'sufficient' property information for 'mass land taxation' (Magor, 2007) but that the inventory of data lacks coordination and direction. Existence of sufficient data is however not the only precondition for tax modernisation.

There are currently no plans for a comprehensive British national database of property attributes, although ODPM (2004:3) refers to "the proposed development of a National Property Databank (by the Valuation Office)". VOA itself, in its 2003 Forward Plan, mentions "improvements to public sector property information" that were under discussion with Land Registry, OS and IDeA (VOA,

2002), while claiming that current property tax systems were to an extent already automated (Leggo, 2002). These discussions are analysed in a later section on geo-information polity. Meanwhile it is noted that HIPs, introduced in 2007, are regarded by some as offering technical potential for routinely and systematically populating such a database with domestic building attributes as homes are placed on the market (Magor, 2007). The NI DR database is being maintained routinely with such information (Gloudemans and Montgomery, 2008:30), although no further revaluations are planned, nor other uses for the data (LPSNI, 2009).

Almy (2002:15-16) describes the stages in carrying out mass appraisal for taxation and the main features of valuation modelling. A valuation model is "the mathematical representation of the effects of property supply and demand factors on market prices" (op cit *p.*17). The more factors there are recorded in the cadastre about properties (e.g. type of construction, number of bedrooms, distance from railway station), the more accurately the model will reflect market conditions. Gloudemans (2002) states that some tax jurisdictions in North America have fiscal cadastres containing over 100 data elements or factors about properties. However Ward (2001) describes how valuation modelling can proceed initially with very few data elements in property records (perhaps only location and house size), which may be necessary in some countries where the property market and/or administrative systems are poorly developed.

Preliminary activities in any implementation of mass appraisal include "stratification" (dividing properties into groups such as types and market areas). "Provided there are adequate market data in each group" statistical analysis will be improved by "stratification ... into more homogenous groups" (Almy, 2002:16). In the NI DR, census output areas were found to be good building blocks for the "neighbourhoods" that in turn formed 25 "market areas" for model formation (Gloudemans and Montgomery, 2008:19). DR NI used the same four types of domestic property as HR Land Registry use in their database, although "apartments" were excluded from the model (*op cit*, p.20).

Within each property type group, according to Almy (2002) "a profile describes the range of properties" found "and the characteristics of typical properties". "Price level patterns and trends" must be analysed by valuers before initiating the

mass appraisal model, using a map: “a GIS can automate the process”. Depreciation studies need to be carried out on samples of transaction records. This is so that the “CAMA system should have an acceptable means of identifying comparable sales and comparable properties” by assigning each record to the correct group and adjusting its value. DR NI used *spatialest* GIS software, developed in the Province, after an initial CAMA MRA modelling using SPSS (Gloudemans and Montgomery, 2008:21). *Spatialest* “can work with SPSS to produce value estimates rooted in both an underlying MRA model and the most comparable sales (or beacons) identified for each subject property” (*op cit*, p.23).

Almy (2002) goes on to assert that the system “comprises separate models for major types of property and for each approach to value”. One of these models will be for land values (Almy, 2002:17). Almy advises the use of zones, each with a separate “base rate” value per unit area with “adjustments to reflect micro-locational factors”. However Batt (1998:2) believed that by use of standard GIS algorithms (see below) “which have the capacity to identify land value configurations with far greater facility and accuracy”, the model zones can be dispensed with. In practice, most existing property tax systems have hitherto used zones. Denmark did not use GIS until very recently (Müller, 2002:19). Dale (2005:40) says CAMA “can be strengthened” with spatial data and GIS, implying that GIS is not an essential part of CAMA.

Batt (1998:9) asserts that without GIS, CAMA methods have crudely treated the “value of the land component ... as a residual”. Gloudemans (2002) does indeed treat land as a residual in MRA without GIS algorithms. However Gloudemans’ property databases, in his studies for Lincoln Institute, had the benefit of very richly populated attribute datasets, whereby the impact of all value factors on market prices could be robustly calculated, leaving the residual value as a good approximation for land/location value. According to Batt:

> underassessment of the land component is a frequent failing of assessors, explained largely by the failure to take into account the depreciation of structures. Yet ironically it is now far easier to assess land than improvements. (Batt, 1998:10)

The reason for this ease, according to Batt, is “state-of-the-art [use of] GIS to draw the equivalent of ‘contours’”, “somewhat comparable to a topographical survey map” (*op cit*, p.7). In other words, iso-line value maps are a significant aid to CAMA. The significance of using iso-line value maps, as opposed to zonal maps, is explained below.

In his recent study of the history of land value maps, Batt (2008:4) quotes from a 1926 textbook on American municipal tax assessment (Upson, 1926:83), which stated that “it is the equivalent assessment of land values that raises the greatest difficulties for the taxation authorities”. It therefore appears that Batt believes that computers have transformed the situation: from land values being of ‘greatest difficulty’ to calculate without them, it has become ‘far easier to assess land than improvements’.

In framing his proposal for New York State (NYS) in 1998, Batt was aware that there was no immediate prospect of LVT. However, like some 20 US states, NYS requires values on tax lists to be recorded separately for land and total property value. “Recognising the differential dynamics of the two components of a real property parcel’s value [land and improvements] is the first step toward understanding how a [valuation] model might be developed” (Batt, 1998:9). “Land values typically fluctuate, very much in response to regional factors, and usually without reference to whatever any titleholder does or does not do” (*op cit*, p.5). On the other hand, “improvements, both individually and collectively, typically depreciate in value whether through physical deterioration, structural obsolescence, or identifiable damage [and are therefore] less relevant for trend analysis”. In other words, irrespective of whether there is a separate tax on land values, a CAMA valuation model needs to first account for the dynamics of land values, the Landvaluescape depicted in value maps. Batt (2008:6) illustrates the validity of German land economist Von Thunen’s (1826) formula for land value with respect to “distance to market” for goods with a graph from a 1920s study (McKenzie, 1933) of land value gradients for NYC, Detroit, Cleveland and Chicago.

Conclusion

Several conclusions relevant to this thesis can be drawn from the above:-

1. CAMA now produces more robust, objective and defensible valuations than individual methods, especially where there is some homogeneity in property characteristics.

2. Whereas a separate land value assessment was regarded as very problematic before computers were used, it is now regarded by those with an understanding of both CAMA and GIS as easier to derive from mass appraisal processes than a discrete gross property value, where the data in the model is good.

3. CAMA is very much associated with property tax systems but AVMs more generally are very likely to become more widely used as global financial regulation demands more frequent and standardised valuations.

4. Data availability is a major issue. Lack of sufficient good quality property market data in the public domain is an obstacle to AVM/CAMA implementation in many countries, including Britain.

5. Unless property tax administrators and assessors are obliged to take account of the data needs of others, there is rarely any incentive for them to use CAMA to value land accurately, if at all. The value of data in a CAMA-derived tax system is not generally recognised. The NI DR is an example of a recent UK implementation of CAMA where the opportunity to derive land values was missed.

6. GIS is becoming a standard component in any CAMA implementation. However that does not mean value maps are used. Possible reasons for this are discussed in section 2/6.

Meanwhile the next section looks at the literature on techniques for spatial analysis and display that might derive from CAMA applications and thus define the characteristics and potential for value maps.

2.5 Spatial analysis and displays from CAMA

Batt (1998:2) observed that CAMA evolved during the last decade by employing GIS "algorithms of spatial relationships developed in the disciplines of meteorology and geology". These take records of physical phenomena at specific "known points", randomly spread across a geographic area of interest and then triangulate "to interpolate values at points in between" (*op cit*, p.17). Triangulated irregular networks (TINs) "are used to represent surfaces by displaying data values at known points in the form of non-overlapping, contiguous triangular facets". TINs "got much attention in the early 1980s" (Laurini and Thompson, 1992:254) when digitising devices were much cheaper than scanners for capturing spatial data from maps. They continue to be used in physical sciences for modelling, especially where data are captured in the field.

The interpolation uses a variety of assumptions, expressed in mathematical formulae which are now very well tried and tested in a range of applications across both physical and socio-economic sciences (e.g. Okabe, 2006:302). The four main interpolation methods are: Inverse Distance Weighting (IDW); Spline; Kriging; and Trend (Batt, 1998:17). Some or all of these are incorporated in several standard GIS software packages, or their extensions (e.g. ArcView and ArcGIS from ESRI). By this means, the resulting 'response surface' formed by TIN facets can be displayed in various cartographic forms, analogous to the display of topographic surfaces in maps, with other topographic features displayed as overlays to aid visual interpretation: roads, railways, and other property value influence factors such as water bodies and land use designation zones.

The difference between spatial analysis and other forms of statistical data analysis is that spatial analysis involves data items that have a geographic component and uses the spatial relationships, in terms of both topology and distance, between data records to analyse aspects of the dataset. Without the analytical dimension provided by geomatics (Laurini and Thompson, 1992: 21-3), human cognitive understanding of real world phenomena through visualisation is incomplete. A geographic data model is "a representation of the real world that can be used in a GIS to produce maps, perform interactive queries and execute

analysis" (Zeiler, 1999). Maps are anthropocentric; query and analysis processes also imply human purpose. According to a recent study of spatial databases for the US Government, one of the three main trends in their use over the three decades since Howes (1980) is for "effective visualisation" (Gandhi *et al*, 2007:4). This study also points out that a characteristic of spatial data that makes it different from other kinds of data is "the implicit spatial relationships among variables". This is known as topology.

Orford *et al* (1998) note that "examples of visualisation research in politics, economics and sociology" are few, compared to those in other non-physical science disciplines such as geography and planning. They explain this "through a combination of traditional resistance to graphic techniques mixed with a relatively lower level of computer literacy in these subjects" (*op cit,* p.11). They go on to claim that "when integrated with advanced visualisation tools" GIS can be just as useful "in the analysis and presentation of complex data" in, among others branches of social sciences "planning and resource management" (*op cit*, p.19). No mention is made by them of valuers or real property valuation. However the relative absence of examples of value maps may be attributed to the same reasons given for economists' failure to exploit visualisation techniques.

Absence of visualisation does not mean absence of spatially referenced data. Often there is non-spatial analysis of data records that have a geographic component which is not being used in that analysis, for example the ODPM House Price Index (HPI) previously mentioned. With this, each record supplied contains full postcode address. However the HPI compilation process does not use the address in spatial analysis but merely assigns each property to a local authority area (ODPM, 2004).

On the other hand, a GIS can perform spatial analysis without involving the production of a visual display of any kind. The production of a TIN, for example, may be carried out internally by a GIS to interpolate, derive and store estimated values for points in real space for which no value was recorded in the initial dataset. This automated process does not require human intervention, hence may not involve any 'map' or other graphic display. The NI DS described above used GIS in data model analysis but does not to use map displays of the results.

Maps are merely a useful adjunct to geography, not the totality of the discipline. However it is generally agreed that map inspection will improve the quality and acceptability of the resulting derived dataset, because the human eye picks out blunders and other anomalies more readily from a map than from inspecting tables of data. This is especially true when a property value response surface is displayed in a map referenced to other geographic features. Laurini and Thompson (1992) is a detailed pedagogic exposition of this human-machine "problem solving" relationship involving GIS and a variety of users of maps and related graphics, which applies to Landvaluescape visualisation as much as to any other field.

Choropleth Mapping and the Modifiable Areal Unit Problem

The history of visualisation in social sciences shows that choice of cartographic display is important inasmuch as maps can conceal as well as reveal – and can also mislead (Orford *et al*, 1998). However Batt (2008:12) notes that "there is no necessary agreed-upon style or standard format to display land value" and little discussion in the literature on property taxation or CAMA/GIS as to the relative merits of different possible types of map display.

At one extreme, a value map can depict discrete parcel values. Alternatively, parcels may be combined and their values aggregated or (more likely) averaged, perhaps to deliberately obscure confidential market transaction information. For this reason, Land Registry will not publish house price statistics of postcode sectors in England and Wales where only one transaction has occurred in the reporting period, so as not to reveal that transaction price. Similarly Danish tax map zones (see chapter 6) always contain more than one parcel. Value data may be combined in a model, as described above, from which a response surface is directly represented using TINs where each node represents a land parcel. The surface may then undergo smoothing by application of mathematical algorithm.

These different displays can have different effects on users and the decisions they make. Zeiler (1999:25-37) describes a typology of map displays in a generic context, with examples none of which relate to value mapping. Among these are several that can be used for value mapping. However it is not the purpose of this research to achieve the basis for any recommendation on standard style or

format, only to point out some features inherent in GIS that can lead to problems in how the utility of value maps might be perceived.

Whichever of the types of value map is used, unless they are displayed with other topographic or cadastral information overlaid (e.g. roads, zone boundaries), they make it difficult for the user to relate value to location. Colour coding also greatly aids cognitive interpretation by humans.

Choropleth maps are “maps in which areas sharing similar geographical features are represented by the same colour” (Chambers, 2003:270). It is in the definition of those areas – both in terms of what features to use as boundaries and what ranges of value to represent in a particular colour – that the Modifiable Areal Unit Problem (MAUP) arises. MAUP is the geographic sub-set of the larger statistical problem of “the ecological fallacy” of “interpreting aggregated data at the individual level” or *vice versa* (Hox, 2002:3; after Robinson, 1950).

In a GIS, MAUP arises whenever a boundary between zones is defined. It is “the variation which can occur when data from one scale of areal units is aggregated into more or less areal units” (Ratcliffe and McCullagh, 1999). If care is not exercised when defining zone boundaries for assignment of value to fiscal factors (prior to mass appraisal in a GIS-enhanced CAMA) or in post-CAMA displays, either false results may be produced by the CAMA or misleading conclusions may be drawn by users of the value maps. An example of the MAUP using property value data is illustrated in ARW *et al* (2003:16), where the authors go on to recommend a value surface approach instead of zones (or at least the automatic adoption for land valuation purposes of zone boundaries that exist for another purpose).

Whether or not to use zones and, if they are used, how to define zone boundaries in value maps, is a question that must ultimately be faced by sponsors and designers of a mass valuation system. Since it has been shown that such a system will most probably be designed as part of a reformed property tax – or at least of a reformed land management information system (Dale, 2005) – the next section considers what has been written about property tax and land management information system reform, specifically in a British context.

Conclusions

This section shows that there is very little in the literature on the design of value maps and no apparent attempt among property tax authorities to standardise them. Among the conclusions relevant to this thesis are:-

1. Since value maps are intended for human use, their purposes should influence the design of the CAMA system within which they sit, especially if a main purpose of the maps is to help the tax authorities improve the quality of assessments.

2. Maps have traditionally been of marginal use to many tax authorities, including those in Britain. The absence of their use in modern property tax systems, such as the NI DR, may be largely due to the traditional absence of graphic and computing skills among valuers.

3. Where value maps are used, the choice of any zone and of the method of depicting values within zones can significantly affect their potential utility.

4. There are benefits to integrating property tax and other land management information systems, so that value maps can reflect changes in the underlying human geography and as far as possible avoid misinterpretations due to MAUP while aiding wider understanding of the local Landvaluescape.

2.6 Geolformation Policy and Polity

So far in this chapter, it has been shown that Britain does possess many elements of what the literature says a modern fiscal cadastre needs. However the relevant datasets are not being developed or used in a coordinated way, such as might facilitate either the reform of property taxes or improved efficiency in property markets. The expectations of 10-15 years ago that completion of these datasets would lead to a multi-purpose NLIS, for example, from which property value maps were seen as one possible application, have not been fulfilled.

This section looks at the evidence in academic and other literature as to what influences 'geoinformation polity', in particular relating to land ownership, use and value information in Britain. Moves towards what is now called a Location Strategy are outlined, as are developments in sustainable land management policy, which place demands on such a strategy. In the introductory chapter this was given as the first of three reasons why the subject of this thesis could be important, yet it has so far not featured in this chapter.

The British Fiscal Cadastre in a wider context

Generically property tax systems are a sub-set of land administration systems (Dale *et al*, 2002, 2006). Bird and Slack (2002:74), in a summary of their report for the World Bank reviewing such systems in 25 countries, state that "property tax reform is seldom easy, usually difficult technically, and often not too rewarding in either revenue or political terms". Reform is "as much or more a political as it is a technical exercise" (*op cit*, p.73), hence the polity of a country at the time reform is under discussion is relevant to any analysis of the geo-information requirements and issues in Britain.

'Polity' is defined as "a body of people organised under a system of government" (Chambers, 2003) and is used in Pollard (2006) extensively to refer to the environment in which policy is formed. The polity for property tax, traditionally formed within a wider fiscal and macro-economic context, is relatively remote from the polity in which environmental management, information policy and sustainability issues are discussed (Jackson *et al*, 2009).

Some commentators have linked the potential for British Value Maps with property taxes or markets (Wyatt, 1995; Gallimore *et al*, 1995; KPMG in NLIS, 1997). However they have noted that this potential fails to be exploited, although production of relevant datasets continues. Meanwhile studies of the practicality or desirability of property tax reform in Britain point out that better land information is a prerequisite (Barker, 2004; Connellan, 2004).

The government sponsored National Land Information Service (NLIS) project was said by Pollard (2006:97) to have included “insurance location risk analysis” as one of its “potential applications which have commercial value” at full feasibility study stage in 1997. This particular application might appear to have value mapping relevance, however it has never been taken up. Stakeholders had been led to expect that NLIS would “integrate comprehensive, up to date and accurate information on property ownership, use, development control and planning information, values and prices” (Smith and Wyatt, 1996:9). The 1997 KPMG report (referred to here by Pollard) setting out “The Business Case and Market Demand for NLIS” identified around “seven initial applications” having “greatest commercial value”, including a “multi-sector, online property enquiry service” providing “access to owner, value and use of land and property” (NLIS, 1997).

In draft doctorial research awaiting publication, Pollard (2006) carried out a “longitudinal in-depth case study utilising an actor-centred account of the development of spatial addressing datasets”, involving personal interviews with ‘actors’ in the British geo-information industry over some 15 years. Her sources were to an extent overlapping with those used here but her approach was different. Her study set out to shed light on the mechanisms shaping public policy relating to GI in Britain, following the analytical framework of “governing in the information age” (Bellamy and Taylor, 1998). Her emerging conclusions are far-reaching, raising concerns about the “commodification” of address datasets that have an echo in Gilbertson and Preston (2007), where similar concerns are raised about valuations becoming commodified. Pollard’s key point is that information policy making is not a rational process but a political one, in which the policy actors are mainly public bodies whose geospatial systems are failing to reshape the institutions entrusted with them (Pollard, 2006:271) in the way that

"transformational government" might be expected to do (Porter, 1990; Cabinet Office, 2005).

Status of British Fiscal Cadastre

Probert (2002) reported on the status of and responsibilities for elements of the UK's fiscal cadastre, although he began by saying "There is no UK Cadastre" in the sense that other EU member states understand the word. "The development of land administration systems has taken place in a different way from the rest of Europe".

There is no single organisation responsible for the datasets that a fiscal cadastre for Britain would comprise. Table 2/1 lists the components of a target British fiscal cadastre, with the agencies and Government Departments responsible for each, illustrating the diffusion of those responsibilities. It draws on Probert (2002), Vickers (2000b) and others, updated to March 2009 names of agencies and ministries.

Component Dataset	British Name [target]	Producer Agency (England & Wales)	Government Department Responsible
Base mapping	MasterMap™	Ordnance Survey	CLG
Land ownership	Land Registers	Land Registry	Justice
Land use (actual)	NLUD	N/A (?OS)	CLG
Property addresses	NLPG	Local government	CLG
Valuations	Tax lists (?)	VOA	HM Treasury
Building permits	N/A	Local government	?CLG

Table 2/1. Responsibilities for British Fiscal Cadastre

OS maintains large-scale topographic mapping for all of Britain and completed full national coverage in digital form in 1995. The development of the concept of a Digital National Framework (DNF) for integrated geospatial reference datasets (Ordnance Survey, 2004a) was led by OS from before the decision by its new Director General in 1999 to implement it as a product known as MasterMap™. The digital topographic databank in unstructured form, known as LandLine, was structured into nearly half a million polygons for MasterMap™ within only 14 months of that decision, on 30 November 2001 becoming the first – and still the only - national large-scale structured mapping dataset anywhere in the world (Barr, 2004). Surveys are entirely electronic, the database is continuously and

seamlessly updated (ignoring map 'sheets') and OS guarantees change on the ground in urban areas will be reflected in the database within six months (Ordnance Survey, 2007).

All other components of the fiscal cadastre depend to some extent on that topographic OS framework, which has implications for overall GI Strategy and for the business of all OS' partners, as will be discussed. OS also has control of the reference dataset on administrative boundaries for all of Britain.

The land title registers of England and Wales were 50% digitized by 2004 (Munday, 2004), using an OS LandLine base and costing under £1 per title. This was seen by HMLR (now Land Registry) as a contribution to NLIS and to *e-government*. Registers of Scotland was by then also developing automated registration of land title and throughout Britain online access to property price statistics down to postcode sector level was available (Probert, 2002). However the aspiration then for a complete Land Register for England and Wales had been downgraded to a "comprehensive" one by 2007 (Land Registry, 2007), in which some 10% of titles (possibly half the country by area) will remain unregistered and hence not available to online users after 2012 unless legislation changes. Changes made to the Land Registers are immediately available to users.

Probert (2002) correctly assigns responsibility for definitive "land and property valuation" in Britain to VOA and (in Scotland) Boards of Assessors, not mentioning that the former come under HM Treasury (the latter under Scottish Government, administered by Scottish local authorities). That 'responsibility' is limited, in fiscal terms, by the absence of any property taxation on vacant or agricultural land.

Probert (2002:279) mentions two other "significant developments": NLUD and NLIS. Neither has since developed in a way that would significantly aid value mapping. "NLUD-Baseline", as a "comprehensive and up-to-date land use map", remains a mere concept. One-off non-governmental attempts during the last century to assemble comprehensive land use information failed to persuade Government to act (Stamp, 1962; Coleman, 1961; Walford, 1997). A database of only "previously developed land (PDL)" has an entirely different purpose in

support of urban renewal but may soon have its scope extended, by enhancing the NLPG (Sayce *et al*, 2008).

NLIS has also changed from when KPMG recommended a multi-application service (NLIS, 1997). The conveyancing application, which was then estimated to offer more than three-quarters of the almost £100m forecast annual revenue from NLIS, is still the only one to have been taken forward.

Whilst NLIS does link all agencies that would need to contribute to a value mapping system, the project in its current form is now independent of Government, managed by Community Interest Company Land-Data (NLIS, 2008), broadly as recommended by KPMG, although they suggested “a new agency” formed from (or by) a number of public sector data providers with “a PFI approach”, to attract “private capital ... different management skills... and market knowledge”. According to the NLIS project website, it has now handled over 14 million property searches and currently has 30% of the market share for British residential house sales. Virtually all local authorities participate in the online service, which uses NLPG data.

Probert (2002) makes no mention of one of what Almy (2002) states is a “main external linkage” of a property tax system. By this he means British “building permit issuing authorities”. Potentially HIPs could have provided these, through local authorities, as part of their LLPGs. Each record includes a full postcode, hence offers potential for detailed spatial analysis. However in their existing form there is no prospect of HIPs becoming useful other than for parties to domestic house sales. Research carried out at Portsmouth University before HIPs were introduced concluded that the benefits to the consumer of HIPs without HCRs “will be marginal” (Dixon, 2007). According to a Director of the Association of Mortgage Intermediaries, who assist buyers in financing purchases, HIPs should include a valuation (Griffiths, 2006). There is no other source of property attribute information existing or planned at national level in Britain. NLIS can support HIPs but they add nothing to its service. Furthermore the officials in charge of developing HIPs have not considered making them available other than to parties to the particular property transaction (CLG, 2006). According to RICS, the superiors of these officials unjustifiably think that data supplied by lenders will, in turn, be able to “feed into lenders’ AVMs” (Manning Stainton, 2007).

As Sayce *et al* (2008) reaffirmed in their NLUD Scoping Study by means of a questionnaire to all LPAs, local government GIS is a key component in any national fiscal cadastre. By the start of this research, according to ESRI UK (2004), 59% of LAs had already "deployed suitable GIS" whilst 47% had "corporate GIS in place". The ESRI survey showed the most common reason for not having a GIS yet was said by Authorities to be "lack of awareness of what the technology can offer" (63%) with cost being cited by 35% (the next most common reason). By 2007, Sayce *et al* (2008) found that local government's contract with itself to improve and maintain the NLPG, requiring online updating, had led to 100% use of GIS in LAs.

GI Strategy to 'Place Matters'

The Chorley Report (Department of Environment, 1987) was possibly the first attempt at a strategic approach to the UK's geo-information infrastructure. Lord Chorley's Committee of Enquiry had carried out a thorough review into how GI was being – and could in future be – handled for public benefit. His report contained 64 recommendations, only some of which could be regarded as 'strategic'. 24 were specific to OS. Only one referred to value data. This called for "open access" to "details of land and property transactions held by the Valuation Office". Government did not accept this.

Significantly, Chorley did not recommend further strategic studies but instead (Rec. 64) called for "a central body, independent of Government" to be set up to cover all interests "in the GI area". Among the duties of this body, he advised, should be to "review progress and submit proposals for developing national policy". The Association for Geographic Information (AGI) was formed in 1989 and came near to satisfying this recommendation, however it was never given core public funding or any statutory powers or a duty to "produce a strategic plan" for GI as Chorley intended (Pollard, 2006:74). Meanwhile the Director General of OS (DGOS) remained *ex officio* the principal source of expert advice to Ministers on GI matters both detailed and strategic, even after acquiring Executive Agency status and becoming a trading fund.

Pollard (2006:73) says that Chorley's most significant recommendations "related to the coordinating role [of] government". Unfortunately the list of

recommendations that relate to this is itself un-coordinated and the key point (according to Pollard) in Chorley's main report was lost:

> The government inevitably has a major role to play. It is the major supplier and user of geographic information and many actions and activities can be carried out only by government. Moreover, a firm lead by government would, more than anything else, provide a powerful impetus to the more effective use of geographic information. (Department of Environment, 1987:114)

Pollard (2006) traces the subsequent 20-year saga of friction between elements of the British GI industry, especially the private sector value added resellers (VARs) and local government, and OS. This has also surfaced in the technology pages of the Guardian, as the "Free Our Data" debate (Arthur and Cross, 2006).

With DGOS acting as both Chief Executive of the dominant commercial player in the industry and the sole Adviser to Government and Board member of its Department responsible for implementing policy, friction has been at its worst during the tenure of the current DGOS: the first to come from a private sector background, in 1999. British GI Strategy has been inextricably bound up with OS' own Framework Document (Ordnance Survey, 2004b), which OS largely writes for itself without reference even to Parliament. A House of Commons Select Committee scrutinised OS in 2001, while its Framework Document was undergoing its quinquennial review, in which consultants were at first recommending OS "move to government owned company status which ministers were minded to accept", according to Pollard (2006:128). AGI's evidence to the Select Committee expressed the view that OS' position "placed it in conflict with customers, commercial partners and competitiors" (Pollard, 2006:131) and that "it should withdraw from activities that can be carried out by [others]" (House of Commons, 2002:11). The behaviour of OS accords with that described by Williams and Edge (1996) in a review of companies operating in the IT industry: "Dominant players may seek to destabilise solutions and erode industry standards, to monopolise their links with users". The Committee report strongly opposed OS becoming a company and called for Government to define clearly the boundaries of its public task. However OS was allowed to define its own public task in its new Framework Document to include the very activity that had

caused most controversy (Ordnance Survey, 2004b), without reference to Parliament.

Calls for a separate independent body with a more formal strategic advisory role on GI than the AGI were partially met in 2005, when the GI Panel was created "to consider medium and long term strategic and policy issues" (Cooper, 2004) and to "complement" advice which would continue to also come *ex officio* from DGOS. AGI had been foremost in calling for such a Panel but its Director had said "OS should not have a special place" on it (Linehan, 2004). However AGI's Council did not demur when the Government asked DGOS not only to Chair the Panel but to advise who should be its members. The GI Panel's main (and almost only) task in the two and a half years of its existence was to prepare a GI Strategy for the UK, which Government then took over a year to publish (GI Panel, 2008).

While Government gestated over the GI Strategy, it became a "Location Strategy" and accommodated the requirements emanating from the EU via the INSPIRE Directive (EU, 2007). Entitled "Place Matters", the published Location Strategy has been broadly welcomed, although it is much briefer than expected and may undergo changes when responsibility for its implementation transfers early in 2009 to the Department for Food and Rural Affairs (Defra), which leads on INSPIRE for the UK Government. A "Location Panel", entirely made up of public sector members (GI Panel, 2008:25), took over from the GI Panel in early 2009 to advise Ministers on implementation of the Strategy.

Although the INSPIRE Directive does not include property or land value among its 33 'themes' for coordinated EU-wide integration, all the components of a fiscal cadastre are provided for (EU, 2007; GI Panel, 2008:35). Therefore any British Value Mapping ought to develop in conformance with EU GI infrastructure.

Encouragingly, the Location Strategy makes explicit mention of "the need to go beyond INSPIRE...to underpin legislative arrangements for the like of...land registration [and] property valuation" (GI Panel, 2008:15). Also "land and property ownership" and "addresses" are listed as part of "a recommended initial set of Core Reference Geographies to be implemented by the Location Strategy" (*op cit,* p.36).

PSI & PPP: data sharing, re-use and business models

Public Sector Information (PSI) is a key component of the Knowledge Economy, which the EU believes to be Europe's future (EC, 2000). At the EU's Lisbon Summit in 2000, it was resolved at the highest level that "making available PSI at no more than the cost of dissemination for private sector re-use" was crucial to prosperity (Pollard, 2006:115). A study for the EC that year showed that the value of the EU's information industry was €68bn/yr (Pira International Ltd., 2000). However the potential of this industry was much greater, according to EC's consultants: whereas the ratio between the equivalent figure and public investment in PSI in the USA was 40:1, in the EU it was only 6.5:1 (Pollard, 2006:117). The argument was that increased economic activity, knowledge and tax revenues resulting from less restrictive governance and copyright arrangements would more than offset any loss of direct revenue from PSI to agencies like OS.

Studies elsewhere appear to show strongly positive economies in the American approach: "the cost of data requirements is outweighed by the informational advantages of the procedure" [for assessing land use impact of transportation projects] (Vadali and Sohn, 2001). HM Treasury itself appeared to support a move towards marginal cost pricing of PSI, as recommended by the Lisbon Treaty text and PSI Directive, in a study it commissioned at the time:

> The current policy of average cost pricing creates a significant barrier to the re-use of information because it requires parts of government, where this is not core business, to make assessments and attributions of relevant costs and negotiate individual contracts in an area in which many departments and agencies are ill-placed to operate. Marginal cost pricing would remove this burden from both the department concerned and the private sector. (HM Treasury 2000, para 1.15 – in Craglia & Masser (2001:15))

The re-use of PSI was the subject of an EU Directive (EC, 2003) intended "to promote the re-use of information held in public sector organisations" (HMSO, 2004). The Office of Public Sector Information (OPSI, formerly Her Majesty's Stationery Office (HMSO)), in whom is vested data ownership rights (Crown Copyright), exercises UK's regulatory duties of compliance with the PSI Directive.

Straddling the period when the PSI Directive was being introduced, there has been a long running dispute, tracked by Pollard (2006), between OS and local government's address dataset contractor, Intelligent Addressing (IA). Addressing is germane to property data more generally, hence the outcome of this dispute is relevant to British Value Mapping. The Office of Fair Trading (OFT) became involved in 2005 and undertook a study of the commercial use of public information (the CUPI Study - OFT, 2006). This followed a long-drawn-out negotiation between OS and the Local Government Information House Ltd (LGIH) over the terms of the Mapping Services Agreement (MSA) in which LGIH was seeking to obtain contracts for GI supplies and services on behalf of local government in Britain. IA eventually won the contract for addressing in competition with OS, which won 7/9 uncompeted 'lots' in the MSA.

In early 2006 IA lodged a complaint with OPSI against OS. OPSI concluded after six months that OS was "using its position as the official mapping and geospatial data producer to compete unfairly" (OPSI, 2006:15) and stated that under the Information Fair Trader Scheme (IFTS) provisions which enable OS to have delegated authority on copyright matters it must act in compliance and amend its practices within six months, i.e. by January 2007. This ruling appeared to be reinforced by the wider OFT (2006) CUPI Study.

Both OS and IA appealed to the Advisory Panel on Public Sector Information (APPSI), whose members are mainly not public officials. APPSI's response took over nine months, then was equivocal and inconclusive (APPSI, 2007). The Government's response to the CUPI Study was published three months late (DTI, 2007). Another review by Parliament of OS' activities took place in the intervening period but was also published some months later (House of Commons, 2008). This also drew attention to the confusion in the PSI market – even among other public sector GI users, such as MOD.

In an effort to resolve the underlying issue of how best to design a business model for PSI trading, a review by Cambridge academics on the subject was commissioned by Cabinet Office in June 2007. This was an unusually swift response to an independent report by experts in the information business on "The Power of Information" (Steinberg and Mayo, 2007). The Cambridge University study (Newberry *et al,* 2008) was published in under a year. However

it was not the end of the policy process. Government's Shareholder Executive followed up with its own wide-ranging Trading Fund Assessment, by management consultants KPMG (Shareholder Executive, 2008). OS and Land Registry are among a "priority group" of trading funds studied in this Assessment, as they account for most of the revenue from UK PSI. It appears the Assessment will not be published but will remain private advice to ministers (Afriyie, 2009), which is likely to lead to continuing uncertainty for potential PSI applications and may bring the issue into party politics.

The Land Registry's attitude towards marketing the data it holds has been less commercially aggressive than that of OS. It pioneered the use of Public Private Partnerships (PPP) in promoting NLIS in the 1990s. However the data that it holds is of limited value until Land Registers are complete. It has no remit from Government to retrospectively require land titles to be registered, which is necessary to achieve completion. Instead certain 'trigger' events, to be defined by secondary legislation, are required by the Land Registration Act 2001 to be registered. Meanwhile registration of title is voluntary.

According to the Chief Land Registrar (Hollis, 2004), registers could in theory be complete within ten years. In the 2005 annual refresh of its 10-year Strategic Plan (HMLR, 2005), The Land Registry included objectives that could alter its market role as a PSI holder:

- E-business Strategy: "1.3 Develop a strategy for implementation of Wider Market activities into Land Registry – by July 2005" (HMLR, 2005:13)
- Geographic Information Strategy: "5.2 Scope the possibilities for marketing of map data …" (HMLR, 2005:27)
- Registration Change Strategy: "2.8 Investigate feasibility of introducing legislative changes to give further triggers to extend compulsory registration – [start date] 2/2005, [due date] 2008; (HMLR, 2005:43)
- "3.6 Review with Department of Constitutional Affairs what measures, if any, are needed to complete Land Registers – due date Spring 2009; and
- "3.7 Consult widely with the aim of bringing remaining land onto Land Registers within the following three years – due date Autumn 2009." (HMLR, 2005:47)

However the 2007-08 Land Registry Business Plan appeared to rein back the agency from these ambitions. There is no mention of “marketing map data”, “wider market activities”, or “completion of land registers”. Instead “Create a comprehensive land register” is now “Strategic Objective 3” with “Register at least 70% of land in England and Wales falling within the comprehensive land register definition*”* (Land Registry, 2007:46) as “Action Point 61” for completion by October 2009.

There is a significant component of OS data within Land Registry’s ‘map data’ and that of Registers of Scotland. It is unclear what the attitude of OS would be towards re-use by HMLR or others, for Value Mapping related commercial purposes, of that data. It is likely that OS would expect a substantial share of any revenue earned by Land Registry from re-use of its data, just as OS demands a very large share of NLPG revenue from commercial sales (NLPG, 2008b). This may have led Land Registry to abandon its commercial aspirations, pending resolution of the trading funds issue.

Prior to transfer of Location Strategy responsibilities to Defra, some of the key potential private sector partners for a Value Mapping implementation saw its effect as likely to “reinforce the OS monopoly” because its civil service management “confuse their own interests with that of the ‘Public Interest’” (Nicholson, 2006). Data sharing is still often seen within Government as about inter-department data sharing and not about sharing with – and re-use by - the private sector. The composition of the GI Panel and the Location Panel reflect this: the former was ¾ public sector; the latter 100%.

The consequence of this dominance by public bodies of PSI and its re-use combined with lack of clear strategic ministerial oversight, according to AGI’s response to the Cabinet Office Strategy Paper “Transformational Government: Enabled by Technology” (Cabinet Office, 2005:2) has been:

> lack of leadership [i.e. no single Cabinet level post to ensure compliance and champion the strategy]; ….lack of sanctions if changes which benefit users are not implemented because they do not benefit the owners of data or technology; ….systems designs not meeting the needs of users because they are not involved. (Schmid *et al* 2006, 3)

It remains to be seen whether the attitude of the UK Government towards the business model of OS, which has a knock-on effect on the business models of all users of its data, will change now that the Location Panel has succeeded the GI Panel and Defra has the lead role in GI/Location Strategy matters.

Theories of Behaviour in Governance

Booth (2005) has summed up the importance of cultural influences on the way societies respond to technological change: “Before people understand the power of IT the Playstation generation will have to come of age”. During the course of this research, the process of generational ‘coming of age’ among decision makers has been happening. A landmark event was perhaps The Power of Information Report for Cabinet Office in mid-2007, referred to above (Mayo and Steinberg, 2007), to which Government responded remarkably within six weeks of its publication. Its authors were referred to by Government as respectively “a leading social entrepreneur and consumer activist” and “one of the world’s leading practitioners of online re-use of government information” (Cabinet Office, 2007:4). These are unusual members of polity and an indication of the need to depart from traditional theories of governance in the internet age.

In Pollard (2006:14), theories of “IS development within an organisational context” were explored, in an attempt to understand the difficulties experienced in Government adapting to IT. Pollard herself surmised, in the introduction to her thesis, that Government needs to decide whether GI is a commodity, an asset or infrastructure (*op cit*, p.20). A different strategy will follow depending on what decision is made. If GI is an asset, Government needs to take a coordinating role, much as Chorley recommended. In comparing US and UK experience, Pollard (2006:24) identified “decision making about re-use of GI as one of the key issues” facing all Governments.

Among the literature on “inter-organisational theory” cited by Pollard is Nedovic-Budic and Pinto (1999), which includes a comprehensive GI-specific bibliography but is biased towards North American sources and partnerships. They conclude: “Both technological and organisational difficulties are more likely to be encountered in building inter-organisational GIS and databases.” In Pollard’s view, “technological difficulties were observed but they were becoming alleviated by moves towards interoperability, open systems and the web” (Pollard,

2006:27). Meanwhile Pollard alludes to the temptation for Trading Funds to behave like commercial entities rather than public bodies, regarding partners as potential threats to their revenue in accordance with Michael Porter's "SWOT Analysis" (*op cit*, p.28; Porter, 1990).

Pollard (2006:30) cites the work of Walsham, which "suggests that information system linkages have implications for the power relationships between the partners that do not automatically lead to trust relationships"; also "a tradition of research that has been characterised as "social informatics" (Rosenbaum *et al*, 2006) which "sees the introduction of IS into organisations as embedded in social institutions limiting and shaping the radical potential of technology" (Pollard, 2006:30). Walsham, she says, is "critical of the perception of organisational change as management of uncomplicated, rational processes" (*op cit*, p.31).

Stern (2006), in his report for HM Treasury on the implications of climate change, refers to the work of Simon (1959) and the limitations of neoclassical economic theory in explaining decisions by actors both private and public sector. In complex matters such as adaptation to climate change impacts, Stern believes that "bounded rationality" applies to decision making, whereby uncertainty about the future and the cost of acquiring information together lead to "satisficing" (Stern, 2006:381): choosing actions more out of hope that they work out than through pure rationality. Governments as well as companies and individuals have to work within the limitations of their mindsets and existing knowledge.

Specifically with regard to public policy, Pollard cites Vickers (1965), a civil servant and "policy practitioner" whom she acknowledged as conceiving of "an appreciative system", in which (*op cit,* p.32) "civil servants make judgements about what events and relations they will regard as relevant to them". Pollard says this "is both enabling and limiting" because "action judgments leading to change and innovation are therefore dependent on this readiness of individuals within institutions rather than on concepts of bounded rationality."

Coming forward to the modern computer systems era, Pollard (2006:33-5) looks at the impact on the British civil service of New Public Management (NPM), which is associated with the "new right" of the 1970s, perceived by Hood (1991), she says, as one of three "models of public administration: lean and purposeful [NPM - control by output]; "honest and fair" [traditional – control by process];

"robust and resilient", the last of which might be the model for the future, with control by both output and process. NPM is characterised by "the doctrine of targets and performance management" (*op cit*, p.35).

A similar model but focusing on the contrasting "mechanism for coordination" between partner organisations is given in Pollard (2006:36) by Rhodes *et al* (2003). Whereas markets use price, hierarchies use command authority and networks use trust. Pollard believes NPM has led to "a hollowing out [of government which] erodes the capacity of the state to steer and plan" and must lead to Government relying on a combination of markets and networks to achieve control indirectly, operating much like the web.

Pollard concludes that what Bellamy and Taylor (1998) call "information age government" will be characterised by "change which is inherently evolutionary and incremental in nature", although the technologies "may appear revolutionary" (Pollard, 2006:38). "Information domains", in Bellamy and Taylor (1998) are important to define. Pollard says they:

> conclude that researchers must look at the flow, distribution and control of information and the relationship of information to the strategic behaviour of actors in networks as they manage resources and uncertainties. (Pollard, 2006:40)

What these insights into organisational behaviour show, in the context of the future prospects for British Value Maps, is discussed in the final part of this chapter.

Climate change as a policy driver

The Stern Review has been mentioned, significantly its author recognising the need to depart from pure neoclassical theory when deciding how governments and others should act in the face of climate change. Although Stern mainly deals with the economics of carbon reduction, he touches on the significance of climate change to land use planning and information needs more generally.

In his Executive Summary, he states that "providing better information and improved planning and climate-resilient infrastructure" are core functions of governments, acting internationally (Stern, 2006:vii). "Action to …inform, educate and persuade individuals about what they can do to respond" to the need to

adapt to climate change is one of three “required elements of policy”. “Quantitative information on the costs and benefits of economy-wide adaptation is currently limited” (*op cit,* p.xxi). Land-use planning is one of four key areas where “governments have a role in providing a policy framework”: …“land use zonal strategies (including congestion charging), have the potential to support integrated public transport to reduce the use of private motor vehicles” and thereby cut carbon emissions (*op cit*, p.384).

Although commissioned by the UK Government, The Stern Review is aimed mainly at a global audience. Other global detailed studies for the IPCC Fourth Assessment Report, especially Nicholls *et al* (2007) endorse and underpin Stern. The IPCC assessment “shows that the level of knowledge is not consistent with the potential severity of the problem of climate change” (*op cit*, p.345), specifically in coastal zones – where they conclude “with very high confidence” that “coasts will be exposed to increasing risks, including coastal erosion, over coming decades due to climate change and sea level rise”. Their studies are more from a natural science perspective than Stern. Their four scenarios for coastal zones assume different socio-economic responses and climate trends affecting population movement and dry-land conditions, with between ten and 500 million people (out of between 300 and 550 million worldwide living in coastal floodplains) (*op cit,* p.334) affected every year by flooding by 2050. They cite “data exchange and integration hampered by divergent information management systems” and “fragmented and ineffective institutional arrangements and weak governance” as “major impediments” to the success of adaptation measures (*op cit*, p.341) pointing out that “uncertainty increases as we move from the natural sub-system to the human sub-system” (*op cit,* p.345).

At the EU level, the INSPIRE Directive addresses many of these issues, in that it aims to ensure geospatial information (datasets and infrastructure) supports decision making by governments at all levels in Europe in relation to the environment in the broadest sense. INSPIRE has specific themes for land use, land cover and many other themes where changes caused by climate change will occur over coming decades, over and above those that would have occurred without it. The Eurosion (2004) study specifically addresses the issue of sea level rise around Europe – just one effect of global warming - and its potential impacts.

A European level study of the implications of public policy in member states on the ability of citizens to engage with decision making depicted UK “in policy terms, at the antipodes of US Federal policy” in respect of the latter’s open approach to re-use of PSI and gave as one of eleven key “research issues”:

> The impacts of government geographic information policies and strategies on organisational change within both the public and private sectors needs to be explored in greater depth. (Craglia and Masser, 2001:22)

This attitude appears to challenge the ability of the British government to “inform educate and persuade” as called upon by Stern.

Earlier in this section the status of British land use datasets was mentioned, as a key component of any fiscal cadastre is land use information. The challenge of adapting to climate change does not create a new requirement in this respect but does increase the urgency and need for a comprehensive, as opposed to partial, NLUD – which is all that Government is at present committed to (Sayce *et al,* 2008). Sustainable redevelopment will become a critical priority for all Governments, rather than just a significant factor in a number of areas of government. Information about all possible uses for all land and the comparative costs and benefits of these potentially competing uses, looked at holistically and informed by skilled valuations, will be needed. Studies elsewhere (e.g. Zellner *et* al, 2009) indicate the potential for using complex modelling and game theory to aid decision making, given sufficient data.

The UK Government Foresight Programme commissioned a study of Land Use Futures in April 2008, the findings of which are due to be published in January 2010. It recognises that “climate change will affect patterns of agriculture and biodiversity whilst changing demographics will create further demands for housing and infrastructure” (Foresight, 2009).

The aim of the Foresight Land Use Futures Project is to “explore how land use in the UK could change over the next 50 years”. During the evidence gathering phase (June 2008 – May 2009) some forty “state of science” research review topic papers by leading academics have been commissioned, which will be published in the Land Use Policy Journal (expected November 2009). Many of these would seem to require some reference to land values. Recent issues of this Journal do not indicate that either urban land use or economic value of land

feature strongly in the editorial content, nor does the list of topic papers include reference to geospatial data as a land use policy tool. The list of disciplines involved in writing the topic papers is “planners, environmental scientists, economists, geographers, ecologists and transport experts”.

Conclusions

From this brief review of the literature on geoinformation policy and polity certain conclusions can be drawn:-

1. There is considerable diffusion of responsibility for land and geoinformation policy in Britain, with no clear central strategic direction for the entire period in which technology has developed the capability to map land values. Such strategic oversight as there has been was until very recently dominated overwhelmingly by one public body with an increasingly commercial remit: OS.

2. Geoinformation polity is beginning to change. Recent involvement of leading independent non-government academics and knowledge industry figures in strategic studies, with transfer of lead responsibility for INSPIRE from OS/CLG to Defra, offers the prospect of a more joined-up approach. However the policy process is currently somewhat opaque, especially regarding the key issue of Trading Funds’ business model, which makes predictions regarding the future of Value Mapping difficult.

3. No specific moves by Government towards Value Mapping can be deduced either from official publications or British academia, which seems largely uninterested in the subject, were it not for the long-term conceptual topic papers for Foresight’s Land Use Futures project.

4. Key agencies seem unwilling, unable or prevented from acting alone to meet the needs of climate change, largely by a commodity approach by Treasury towards PSI products. Despite there being increased quantities of PSI, many data products are limited in function (e.g. HIPs) and the successes (e.g. NLPG) have been achieved largely despite lack of, rather than because of, strong central Government leadership.

5. PSI rules are over-restrictive and holding back innovation in the GI industry and the achievement of the aims of the Lisbon Treaty and PSI Directive.

2.7 Overall significance for British Value Mapping

The hypothesis in this research is that the concept of Visualising Landvaluescape offers discernable public and commercial benefits for Britain, sufficient to justify immediate and coherent steps to be taken to overcome any institutional, technical and policy (including tax policy) barriers that might be exposed. This chapter has reviewed the literature on relevant subjects, firstly in order to see what had already been written before choosing a research method and focus for testing the hypothesis, latterly to check how that hypothesis stood up in the light of the most recent developments in relevant policy areas.

It seems that there is a gradual, perhaps accelerating, trend towards convergence in property valuation methods and systems for designing and operating property tax assessment. The use of AVMs and specifically CAMA with GIS is set to grow rapidly worldwide, at least where property markets are mature or being developed. The technology is mature and markets for the CAMA/GIS systems themselves are global. Value maps are however only sometimes seen as beneficial in the tax assessment process itself, although GIS is now a standard element of any modernisation of property tax systems, as in NI DR.

The characteristics of fiscal cadastres are well understood but necessarily develop in different ways, according to the history and culture of countries. In this respect Britain is unique in having a highly advanced topographic mapping infrastructure but no cadastral land administration system. This has affected the levels of awareness and understanding among property professionals of the potential of CAMA and GIS to improve the operation of British property markets and tax systems. It has left the national mapping agency, OS, in a dominant position with respect to development of a Location Strategy.

Nevertheless most of the key components of a British fiscal cadastre do exist. Given a rational structure for national decision making in this area and ignoring the natural resistance to change in relevant organisations, there is enough evidence from studies (e.g. KPMG for NLIS) that property information systems fully exploiting the capabilities of modern IT – with or without property tax reform – could be implemented without technical or budgetary difficulty.

Howes concluded thirty years ago that non-availability of value data and lack of "demonstrable demand" for value maps were reasons why the maps were not produced. He expected them to become useful in ensuring more "effective operation of the property market". Today there is much more – probably enough – data for value maps but there is as yet no purposefully designed structure for land information: it is the wrong kind of data. There remains an absence of "demonstrable demand" for value maps which is largely caused by low levels of awareness among mainstream British valuation practitioners of the potential for AVMs using GIS to improve the efficiency and objectiveness of much of their work – not just in relation to tax systems. "Bounded rationality" affects the entire spectrum of policy decision making in this area, compounded by the dispersion of responsibility for different components of the fiscal cadastre and sustainable spatial planning.

In outline after analysis of recent literature, the case for British Value Mapping to be adopted is as follows. Global commerce and financial institutions, with which Britain's economy is vitally connected, depend increasingly on accurate, frequent and up-to-date market-based valuations of the real property assets of listed companies. These include banks and others which invest in, lend against or insure property. Such valuations can be done most efficiently by making increasing use of AVMs. A similar argument applies to the public sector, especially for infrastructure investment projects, in which private finance has become a vital component. Governments at all levels, not excluding those in Britain, need comprehensive up-to-date information on the ownership, potential uses for and value of land and natural resources, in order to plan and manage sustainable spatial development and long-term measures to combat and mitigate effects of climate change.

A hiatus in British GI Strategy has taken some years to resolve but now it appears that a new structure for decision making is about to be put in place. Meanwhile the literature has been deficient in addressing the potential of computer visualisation as a tool to support modernisation of valuation for commercial and public purposes. This is not surprising, since there has been an absence of central direction or interest from Government and the major professional bodies. The work of Pollard in tracking policy-making in respect of

property address datasets indicates how poor are the links between the various elements of geo-information polity. Nevertheless the new Location Panel could find the idea of a National Property Database appealing, with Value Maps as a spin-off application to help enable better informed public and commercial decision making about “the value of place”.

The remainder of this paper will describe empirical work to discover what barriers exist, especially in the minds of relevant experts, to prevent the potential of Value Mapping being realised in Britain, in order to test the original hypothesis.