# THE DEVELOPMENT OF A FULLY INTEGRATED INFORMATION TECHNOLOGY SOLUTION TO THE RESIDENTIAL PROPERTY VALUATION PROCESS.

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A submission presented in partial fulfilment of the requirements of the University of Glamorgan/Prifysgol Morgannwg for the degree of Master of Philosophy

This research programme was carried out in collaboration with The Centre for Research into the Built Environment

October 1997

## ABSTRACT

The objective of this research is to provide assistance to the beleagured residential valuation surveyor by helping to facilitate the development of an information technology product to support the valuation process. After first explaining the reasons for the need for such a product the research investigates three areas.

The first area investigated is the Direct Capital Comparison method of valuation as applied to residential properties. This is a much under researched field given the vast number of valuations for mortgage that are completed each year. The thesis will provide a summary of the best practice to be adopted, including a recommendation for the key attributes to be used. This will be drawing from academic texts, practical experiences and knowledge elicited from practising valuers.

The second area then considers and evaluates the possibilities offered by statistical methods of comparable analysis (artificial neural networks, genetic algorithms, multiple regression analysis, expert systems) and information technology applications that can aid the valuation process such as geographic information systems. Proposals will be made for the optimum solution.

These first two areas of research are in essence a follow up to, and were prompted by, the experiences of the writer as a result of his involvement in the development of a computerised property inspection module. The third part of this thesis evaluates this development work from inception through to prototype production and field testing.

To the best knowledge of the writer there does not yet exist a specification (detailed or draft) for the production of a fully integrated information technology solution to the residential valuation process. This thesis will provide a draft specification together with guidance on software and hardware considerations. In this respect it is considered to be unique.

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## LIST OF ABBREVIATIONS

| Abbreviation | Description in full | Page of First Occurrence |
|---|---|---|
| ANN | Artificial Neural Networks | 74 |
| BUG | Bottom Up Group | 164 |
| CAD | Computer Aided Drafting | 128 |
| DCC | Direct Capital Comparison | 11 |
| DDE | Dynamic Data Exchange | 132 |
| ERP | Estimated Realisation Price | 59 |
| GIS | Geographic Information System | 90 |
| GPS | Global Positioning System | 93 |
| GUI | Graphical User Interface | 107 |
| HPC | Hand Held Personal Computer | 219 |
| HVS | Halifax Valuation Surveyors | 149 |
| ISVA | Incorporated Society of Valuers and Auctioneers | 15 |
| MIRAS | Mortgage Interest Relief at Source | 20 |
| MRA | Multiple Regression Analysis | 69 |
| NLIS | National Land Information Service | 217 |
| OLE | Object Linking and Embedding | 127 |
| OMV | Open Market Value | 59 |
| OS | Ordnance Survey | 97 |
| OSAPR | Ordnance Survey Address Point Reference | 168 |
| PAF | Postcode Address File | 94 |
| PDA | Personal Digital Assistant | 136 |
| RICS | Royal Institution of Chartered Surveyors | 12 |
| TDG | Top Down Group | 163 |
| TIS | Tree Identification System | 11 |
| UGDT | University of Glamorgan Development Team | 164 |
| UPRN | Unique Property Reference Number | 97 |

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## OTHER MATERIAL

Run time Version of Tree Identification System.

System Requirements. P.C. with 8MB RAM. 5KB Hard Disk Space

## ACKNOWLEDGEMENT

This research has been undertaken to further the research and development work initiated by Project Dragon, a collaborative venture between the Halifax and the University of Glamorgan/Prifysgol Morgannwg.

The assistance provided by Halifax Plc in funding the research is acknowledged together with the assistance provided by members of staff at the Centre for Research into the Built Environment, University of Glamorgan.

This thesis would not have been possible without the support and encouragement of David Jenkins to whom the writer is very grateful.

## DECLARATIONS

This is to certify that neither this thesis or any part of it has been presented or is being currently submitted in candidature for any degree other than the degree of Master of Philosophy of the University of Glamorgan.

Candidate .....

## CERTIFICATE OF RESEARCH

This is to certify that, except where specific reference is made, the work presented in this thesis is the result of investigation undertaken by the candidate.

Candidate .....

Director of Studies .....

# THE DEVELOPMENT OF A FULLY INTEGRATED INFORMATION TECHNOLOGY SOLUTION TO THE RESIDENTIAL PROPERTY VALUATION PROCESS.

## PART ONE

## ANALYSIS OF THE RESIDENTIAL VALUATION PROCESS AND THE NEED FOR CHANGE

CHAPTER ONE

# 1.00 INTRODUCTION

## 1.01 Hypotheses and Objectives

The Author is a practising Chartered Surveyor who has been involved in the valuation of residential properties since 1972. He has become increasingly concerned at the lack of sophistication/rigour in the residential valuation process and the poor image of his sector of the profession.

This he believes is a consequence of poor guidance to the valuation surveyor. He also believes that information technology can provide solutions to support the residential valuation process, develop it as a science, and thereby enhance the status of its practitioners.

The objectives of this thesis therefore, are to:

1. Investigate the reasons, and prove the need for change.
2. Analyse the residential valuation process and provide guidance to the valuer.
3. Research the options available for the development of a fully integrated information technology solution.
4. Consider the experiences and findings of Project Dragon (an attempt to develop an information technology solution).
5. Provide a blueprint for an application that can assist residential valuation surveyors.

## 1.02 Structure of this Thesis

Part One will explore the background to the residential valuation process and look at the reasons for a need to change. It will look in detail at the Comparative Method of Valuation or Direct Capital Comparison (DCC - the most widely used basis of valuation for residential properties) and attempt to distil the formula for successful valuations using this method.

Byrom (1979)

*"Almost all valuations with which the building society valuer is likely to be involved will be open market vacant possession valuations of private dwellings using the comparative method."*

Part Two will investigate the current position within the property profession with regard to the use of modern technology, expert systems and mathematical valuation techniques such as artificial neural networks and multiple regression analysis.

As part of this MPhil submission the Author has developed a tree identification application to show how expert systems can be of benefit to property professionals. The Tree Identification System (TIS) will be examined in detail in this section together with a review of the hardware and software considerations.

Part Three will examine the first steps taken by the country's largest residential mortgage provider, the Halifax Building Society, towards the development of an integrated residential valuation system. It will look at the strategic issues and the piloting of an inspection module for residential valuations.

Part Four drawing from the findings and conclusions of the earlier sections will provide a specification for an information technology solution to the residential valuation process. The section will finish with recommendations for future research.

## 1.03 Scope within the Context of the Residential Valuation Process

There may be many reasons for valuing a residential property, be it for sale, mortgage, divorce, probate, etc. Mackmin (1989)

*"A valuation may be required to assess reinstatement cost for insurance purposes, to assess value for council tax, to determine 'fair' rental value when a house or flat is let under the Rent Acts or market rental value when a house or flat is to be let on an assured shorthold tenancy, to assess the price to be paid by a tenant purchasing the landlord's interest by agreement or as a right under the Leasehold Reform Act 1967 or, in due course to assess the price to be paid where a leaseholder exercises the right to buy a flat or maisonette."*

Millington, (1994 )

*"There can be a wide variety of reasons for requiring a valuation, and it is possible to have a whole range of different values for one property at one particular moment in time, dependent upon the purpose for the valuation."*

This thesis concentrates on valuations for mortgage purposes, using the definition for Open Market Value provided in Section PS9 of the RICS Appraisal and Valuation Manual (RICS 1995), as these numerically and in terms of media attention are by far the most significant.

In 1993, 993,000 loans were approved for house purchase, in 1994 this increased to 1,014,000 rising to 1,085,000 in 1996. Each loan would have required a valuation and loans not approved would account for many more valuations (Source: Bank of England, 1997). The figures for Housing Transactions (England and Wales) obtained from the Inland Revenue show for 1993 - 1,195,000 transactions, 1994 -1,275,000, 1995 - 1,134,000 and 1996 - 1,243,000.

The residential mortgage valuation has the highest surveying/valuation profile with the general public as generally it is their main point of contact with the valuation profession.

Richards (1995)

*"most people choose to rely on the very limited valuation report from a mortgage lender,.....potential house purchasers quite reasonably place heavy reliance on the contents of the report which they receive."*

The other main area where property professionals come into contact with the general public is in the field of estate agency. Some would argue that the process of valuing a property for sale is very similar to that for mortgage, and to a certain extent, this is true. The estate agent, however, is often more concerned with securing the instruction to sell than determining a precise value for the property. He will be content for market forces to do this once the property has been offered for sale.

Clarke et al, (1994)

*"There is no difference then, in many instances between a 'professional' valuation and a 'market appraisal' or 'listing advice' as regards the techniques used and the time taken, albeit that a professional valuer is likely to be more experienced."*

*"Some agents, particularly the corporates are reluctant to call them valuations and terms such as listing are applied."*

The estate agent advises the vendor and apart from time delays this provides very few opportunities for allegations of negligence. The residential valuation surveyor on the other hand advises, directly, the mortgage lender and, indirectly, the purchaser. Both can rely on his report. Errors in judgement can and do lead to negligence claims. It is therefore in the area of mortgage valuations where the need for an information technology solution most exists.

In practice there are two levels of inspection and report on residential properties involving a valuation: the first being the aforementioned valuations, the other is entitled The Home Buyers Survey and Valuation. The latter is a more detailed inspection and report provided to the purchaser as opposed to the mortgage finance company. It is provided on a form of report supplied by the Royal Institution of Chartered Surveyors and the Incorporated Society of Valuers and Auctioneers. The basis of valuation is very much the same as for a mortgage valuation but

the report is more detailed in its description of the property and the defects encountered.

It is intended that eventually any information technology solution will be extended to this level of inspection and reporting. However this research will concentrate on valuations for mortgage purposes.

## 1.04 The U.K. Property Market - General

The U.K. is unusual in Western Europe in that owner occupation, reported by Miles (1995) as currently running at 68%, is one of the highest rates. Housing plays a significant part in the economy of the country, Miles (Ibid)

*"In the U.K. housing stock is the single most important component of national wealth - half the nations assets are its houses."*

This has not always been the case but it is a feature of post war U.K. Miles, (Ibid) reports that the value of real owner-occupied housing wealth increased twelve-fold between 1939 and 1991. Levels of home ownership have grown steadily since the war but most rapidly in the period 1981 to 1991. Forrest et al (1995)

*"Between 1971 and 1981 the proportion of households in home-ownership grew by about 5 percentage points from 49% to 54%, but in the subsequent decade ownership grew more rapidly by a further 12 percentage points to encompass 67% of households."*

This growth was due to many factors, the most significant of which being the Conservative government's policy on the sale of council houses, which accounted for half of the increase. Forest et al. (Ibid).

In parallel with the increase in home-ownership, housing in the U.K. saw an increase in its value and prices.

Miles (op. cit.).

*"The value of real owner-occupied housing wealth increased twelve fold between 1939 & 1991."*

*"In the past 50 years the annual average rate of increase of house prices has been 2%."*

## 1.05 The residential valuation process

The residential valuation process consists of three main activities as defined in the "RICS/ISVA Specification for the Valuation and Inspection of Residential Property for Mortgage Purposes on Behalf of Building Societies, Banks and Other Lenders", these are:

- Inspection
- Report
- Valuation

This research investigates ways in which modern technology in the form of computer systems can assist in all three areas.

The inspection is of a visual nature of so much of the exterior and interior of the property as is accessible to the Valuer without undue difficulty. Measurements are taken to ascertain the size of the property for comparable and insurance assessment calculations and when necessary to assist in identification of the form of construction. Dampness readings are taken. No other tests are made. Legible notes must be taken to record the aforementioned measurements and readings, to record the nature and condition of the property sufficient to enable a report to be prepared, to specify the limits of the inspection and conditions in which it was carried out.

The report must primarily advise the Lender as to the Open Market Value, the nature of the property and any factors likely to materially affect its value. It should also include, among other things, advice on

further investigations required (should hidden defects be suspected) restrictions to the inspection, evidence of serious disrepair or obvious potential hazard, the existence of significant alterations or extensions, the form of construction and assumptions made in arriving at the valuation.

The valuation is to provide the Valuer's opinion of the best price (RICS, 1995) at which a sale of an interest in the property would have been completed unconditionally for cash consideration at the date of the valuation. Various assumptions are implicit in this opinion and they include proper marketing of the property for a willing seller who with his purchaser has acted knowledgeably, prudently and without compulsion. The Valuer must keep a record of the comparable transactions which have been used in arriving at the opinion of value (RICS, Ibid).

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CHAPTER TWO

## 2.00 THE NEED FOR CHANGE

### 2.01 The Valuer's Image / Reputation

This chapter will consider the low ebb that the image of the Residential Valuation Surveyor has reached and the factors that have led to this situation. Griffiths, (1989).

*"Surely it is work at the lower end of the surveyor's field of professional expertise."*

These were the words of Lord Griffiths when commenting on the limited nature of the inspection of a property for mortgage purposes in his summing up in one of the most significant judgements from the House of Lords to affect the property profession in recent years. Griffiths, ( Ibid.).

*"I cannot see that it places an unreasonable burden on the valuer to require him to accept responsibility for the fairly elementary degree of skill and care involved in observing, following up and reporting on such defects. Surely it is work at the lower end of the surveyor's field of professional expertise."*

These comments made by a professional person involved, albeit indirectly, in the property business sum up the opinions of the public in general of the surveying profession. If the task of inspecting a property, identifying defects (or potential defects), determining the impact on value of those defects, considering all other factors likely to materially affect value, assessing market evidence and establishing value is so straightforward then why was Lord Griffiths involved in the matter ?

To those involved in the process of valuing residential properties these perceptions are considered to be ill conceived. A consultant surveyor to RICS Insurance Services summed it up thus:

Moreton, (1989)

*"The Guidance Notes for Valuers and many other court cases of note, clearly indicate that our professional expertise at this level requires experience and knowledge in recognising subsidence, settlement, floor slab failure, wall tie failure, dry rot, drainage problems, defects in building materials and dampness to name but a few problem areas. Work at the lower end starts from a fairly high level."*

Valuers are professional people performing a complex task and providing a service to people at the time of perhaps their greatest financial commitment.

So why has the image of valuers reached such an all time low? A look at recent events in the U.K. property market and changes in the structure of the profession may provide some clues.

**2.02 The U.K. Property Market - The Property Market Crash**

During the eighties the inflation in house prices increased steadily to unsustainable levels. This was due to a combination of factors including a rise in disposable incomes (a consequence of strong economic growth) and substantial tax cuts.

The Halifax House Price Index, which is considered to be the leading source on House Price trends, commenced in 1983. The figures below taken from this Index illustrate this point graphically. The U.K. figures are included but it was in East Anglia where the greatest rises occurred.

| | UK | | East Anglia | |
|---|---|---|---|---|
| | Index | Annual % | Index | Annual % |
| 1983 | 100.0 | - | 100.0 | - |
| 1984 | 107.2 | 7.2 | 108.4 | 8.4 |
| 1985 | 117.0 | 9.1 | 121.2 | 11.8 |
| 1986 | 129.9 | 11.0 | 138.9 | 14.6 |
| 1987 | 149.9 | 15.4 | 174.1 | 25.3 |
| 1988 | 184.8 | 23.3 | 248.9 | 43.0 |
| 1989 | 223.1 | 20.8 | 255.5 | 2.6 |

**Figure 1. Extract from the U.K. House Price Index 1984 -1989 . Source: Halifax Plc**

Whilst these figures appear to be dramatic the situation for specific property types and some geographic locations were even more so.

This overheating of the market culminated in a mad rush for properties between the March 1988 budget presented by N. Lawson and his August deadline for double MIRAS relief. (Mortgage Interest Relief At Source). House Price inflation soared through the roof.

Everybody was chasing mortgage business, not just the traditional avenue, the Building Societies, but the banks and a rash of new lenders who had entered the market. All lenders were relaxing their lending criteria. Income multiples increased from a prudent 2.5 times annual salary to commonly 4 times the main income plus 1 times the second income (Mackmin, 1994) and occasionally as high as seven times. Price to income ratios increased as did the percentage of loan against value.

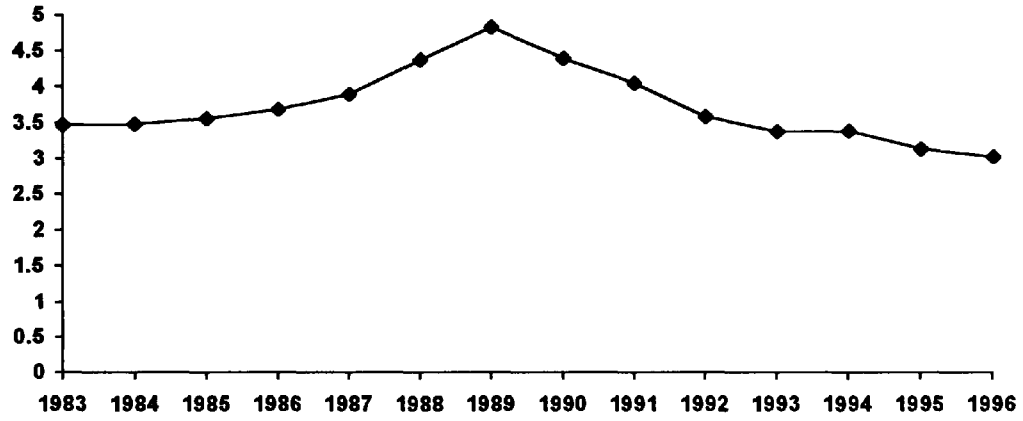


**Figure 2. Price to Earnings Ratio U.K. Housing. Source: Halifax Plc**

Loans of 100% of value were common. Pannell, (1995)

*"In 1989, 22% of first time buyers obtained loans of 100% of the purchase price."*

This made lending very risky. The ability of buyers to service their loans was put under strain. Many buyers had little or no equity stake in their property and thereby little commitment to make repayments when financial conditions worsened.

Valuers found themselves in an invidious position under two conflicting pressures. The first was to facilitate the ever growing business. Instructions would not be issued to Valuers who frequently created obstacles to lending. Gronow et. al. (1997)

*"Lenders control the market for valuation advice. In a deregulated market where the competition to lend is strong, there may be a presumption that the lender instructing the valuer wishes to secure the business."*

The second was to fulfil their professional obligations to purchasers who it had been ruled in the courts, for example Yianni, (1981), Smith v Bush, (1987), could rely on the 'complimentary' copy of the mortgage valuation report that they receive.

Richards, (1995)

*"The only way for housebuyers to protect their interests is to have quality checked by an independent expert before purchase. But most people choose to rely on the very limited valuation report from a mortgage lender.....Whatever level of inspection is carried out, potential house purchasers quite reasonably place heavy reliance on the contents of the report which they receive."*

For those residential mortgage valuers who succumbed to the business pressures the inflation in prices was hiding their errors and misjudgements.

Matters became worse as brokers began to dominate the market and lenders, blind to their business practices were happy to take packaged cases. A packaged case is where the application papers are completed by the broker and submitted to the lending institution together with a completed valuation report. The report is commissioned and the fee paid by the broker.

Mortgage fraud and valuation abuse were rife (as evidenced by the numerous legal actions brought against valuers in recent years). The ensuing crash in property values exposed many of these crimes/errors in judgement and the reputation of the surveying profession began to suffer. Gronow, (1991)

*"Valuation abuse can occur in situations where the packaged mortgages come through a broker especially where borrowers essentially nominate the valuer."*

This situation began to tarnish the image and reputation of the residential valuation surveyor to the point where even the staff valuer (acting without the external business pressures) came under scrutiny.

Gronow (*Ibid.*).

*"..in the case of the staff valuer, considerations of career prospects within the organisation....."*

Gronow went on to suggest ways in which these poor perceptions could be overcome and, as will be seen in Part Three, some of these suggestions were (towards the end of this research) being incorporated into the standard procedures of many of the leading organisations.

Gronow ( Ibid. )

*"To avoid accusations of fraud, valuers will need to provide evidence of as much consistency and accuracy in valuation as is possible.*

*Allied to this comparable transactions should be recorded and analysis undertaken using computerised databases and even expert system technology."*

Gronow and Scott (1988) In an earlier paper expressed the opinion:

*" it is clear that the selection of good comparable information on which to base the valuation is crucial to the satisfactory performance of the valuer."*

As the market fell, challenged valuations became the norm and it was not sufficient for the valuer to just show that he had accumulated a number of comparable transactions as evidence. Mortgage Valuation Guidance Notes, (1992)

*"6.2 The Valuer is advised to keep a record of the comparable transactions and/or valuations to which he/she has regard in arriving at his/her valuation."*

The basis of analysis came under scrutiny by a more sophisticated market. Agents, developers, purchasers and vendors all felt qualified to challenge the valuer's art. The simple comparative method of valuation (See Chapter 3) was open to challenge and misinterpretation. Swift,(1992)

*"It is by our performance that we are judged and there is no doubt that it is our performance which is at the root of the low esteem in which we are held. The public perception is that our margins of error are too large."*

*"our inability to justify the basis of our decisions in detail is grounds for doubting our competence."*

The falling market not only exposed the inadequacies and errors of valuations in the heady days prior to the crash but created new problems for the besieged valuer. The dearth of transactions meant fewer comparables and often for many property types there were no comparables at all.

Adair and McGreal (1986) pointed out the problem that had faced valuers for years.

*"Many valuers will face the problem of lack of good comparable evidence, a situation which undermines the rationale of valuing by direct comparison."*

The level of values fell over a period of five years with a number of false dawns. The experience of the Author was that it was not a steady decline but tended to be a series of steps. A valuation prepared on the "nosing" so to speak was very soon exposed. The ability of a valuer to be able to forecast the market was coming into consideration.

As the market tumbled the aforementioned new lenders disappeared and most of the banks withdrew from residential lending. The fall in values left many purchasers of the late eighties in negative equity (their mortgage debt exceeding the value of the property against which it was secured). Miles, (1995)

*"There are still about one million households suffering negative equity."*

A substantial number of home buyers unable to service their loans entered into voluntary repossessions and the underwriters of their mortgage loans revised their underwriting criteria. This last point, together with lenders wishing to see applicants having a financial stake in their purchase, affected the level of finance available.

Pannell, ( op. cit. )

*"In 1989, 22% of first time buyers obtained loans of 100% of the purchase price, this has been reduced to 11% in 1993."*

## 2.03 The Property Market - Trends for the Future

By April 1997 a resurgence in market activity has become apparent with increases in house prices particularly in the South of the country.

| | UK | | East Anglia | |
|---|---|---|---|---|
| | Index | Annual % | Index | Annual % |
| 1990 | 223.2 | 0.0 | 225.8 | -11.6 |
| 1991 | 220.5 | -1.2 | 214.4 | -5.0 |
| 1992 | 208.1 | -5.6 | 198.5 | -7.4 |
| 1993 | 202.1 | -2.9 | 193.2 | -2.7 |
| 1994 | 203.1 | 0.5 | 195.8 | 1.3 |
| 1995 | 199.6 | -1.7 | 193.5 | -1.1 |
| 1996 | 208.6 | 4.5 | 197.7 | 2.1 |

**Figure 3. Extract from the U.K. House Price Index 1990 -1996 . Source: Halifax Plc**

This is borne out by the house price statistics (Figure 3) which show an upturn in 1996. Market commentators are now more optimistic than they were at the commencement of this thesis (1995) when their forecasts were very gloomy. Wood, (1995)

*"Over the next 20 years we are going to see a continued erosion in the real price of houses, of the order of 20 or 30 percent."*

Miles, ( op. cit. ),

*"Demographic factors are likely to reduce the rate of new household formation over the next thirty years."*

Forrest et al, (1995) held the view that the change in demography of the country is likely to lead to a long term impact on housing in the U.K. When examining the trends in Home Ownership they concluded:

*"there are grounds for arguing that the pressures boosting growth of home-ownership in the 1990's and beyond will be less strong than in the 1980's."*

Now, in less than two years, the same commentators are very much more optimistic. Nuki and Smith (1997) reporting on research by Miles stated:

*"Bricks and Mortar are back. Houses in Britain are massively undervalued, will more than double in the next ten years and represent a better investment than stocks and shares according to a new forecast.....it now suggests that British house prices are trading at 20% below their true value."*

Miles has constructed a sophisticated model of the British housing market which suggests that house prices reached an overvaluation of 32% in 1989, compared to an undervaluation of 25% in the second quarter of 1996. It is on this model that his projections are based. There are however concerns within the residential valuation profession that this resurgence may be short lived and this view is shared by Graeme Leach senior economist with the Henley Centre for Forecasting.

Eade (1997)

*"Graeme Leach argues that the Government's household projections - the basis for many optimistic assessments of the housing market's long term future - could be too high."*

In 1995 there was evidence to suggest that the business pressures on valuers mentioned earlier had reduced, they are beginning to creep back.

Property Week (1997)

*"Some property lenders are pressurising valuers into making higher valuations in today's highly competitive lending market a director of the Bank of England warned last week."*

Cundell (1997)

*"The problem according to observers, is that in a fiercely competitive lending market, banks which want to increase their exposure to the property market are falling foul of their own lending rules."*

This is all against the background of valuers being sued by lenders for their valuations of the late eighties / early nineties and complaints, from ever increasingly consumer-rights conscious purchasers, about perceived omissions in 'their' mortgage report. Property professionals have

become understandably cautious and have found themselves under attack from the media and others.

McGhie , (1995)

*"YOU MAY LOVE IT BUT WILL THE SURVEYOR - Nit-picking surveys are putting the market's recovery at risk,*

*Then as the market dived a second problem emerged over the question of mortgage valuations. This time it was mortgage lenders who began to sue for valuations on properties which then dropped in price..... the valuers then responded by under valuing or trying to second guess the movements in the market. Up and down the country agents began to complain that agreed prices between seller and buyer were being sabotaged by valuers who were in effect sucking down the market."*

Richards, ( op. cit. )

*"Unlawful exclusion clauses, muddled complaint schemes, blinkered judicial decisions which ignore the realities of life....Surveyor's customers get a raw deal from a system which is biased against them..... The type and extent of defects which go unnoticed by surveyors is astonishing."*

Articles such as these in the media abound, serving to reinforce the public's poor perception of the valuation surveyor. The issues noted above are not however the only factors contributing to the Valuer's poor image. The changing structure of the profession has played its part, as will be considered in the next section.

## 2.04 The Structure of the Valuation Profession

The property profession has grown organically over the years to service local needs. Even into the 1970's the valuation profession was mainly organised into a large number of small local, independent practices, partnerships or sole traders often multidisciplinary with estate agency being a major element. This gave them comprehensive knowledge of their local property market and with the estate agency operations a finger on its pulse.

Pendered (1995)

*" Because they were involved with the local market, and knew the local agents, these surveyors and valuers were able to interpret the moods of the market and react in their valuations accordingly, anticipating rises and falls in demand."*

As the major financial institutions began to acquire estate agency practices, to capture the fast expanding mortgage business, they also quite unintentionally acquired professional valuers. Work by researchers at Sheffield City Polytechnic, Henneberry and Khan, (1990) showed that in 1982 the twenty largest estate agencies were all independent comprising 589 offices. By 1989 the situation had changed to the extent that the twenty largest estate agents had 5,889 offices. Only five remained independent accounting, for only 365 of the offices.

Run by accountants and managers these large corporate organisations rationalised and reorganised what they had acquired. The property generalists disappeared, the professionals were directed into surveys and valuations and salespeople were recruited into the estate agency business. To be fully occupied the valuers were forced to cover larger and larger geographical areas and they lost that all important local knowledge. Pendered ( op. cit. )

*"these valuers think nothing of travelling 30 to 40 miles to do a valuation in an area where they cannot possibly have an adequate knowledge."*

Byrom, (1979)

*" To value successfully by the comparative method requires good up-to-date office records preferably coupled with good local knowledge, for it often remains a mystery to the outsider as to why one district is so much more sought after than another apparently similar district only a short distance away."*

Rees,(1988)

*"Whether a property is saleable and the price it will achieve is a matter for local knowledge. An outside valuer must take extreme care when visiting an area of which he has no intimate knowledge."*

Lenders in an attempt to gain greater control over the source of their mortgage business, and thereby reduce the occurrence of valuation fraud, further compounded the situation by reducing the numbers of valuers on their panels together with the number of small locally based independent valuation firms. Clarke et al, (1994)

*"In a well published example the Household Mortgage Corporation reduced its valuation panel to 13 for the whole of England and Wales thereby making it inevitable that many valuations would have to be undertaken 'out of area' where valuers lacked local knowledge."*

Valuers were being required to cover larger areas at a time when the acquisition of comparable evidence to support valuations became more difficult due to a reduction in the number of transactions.

| | |
|---|---|
| 1988 | 2,149,000 |
| 1989 | 1,593,000 |
| 1990 | 1,401,000 |
| 1991 | 1,304,000 |
| 1992 | 1,128,000 |
| 1993 | 1,195,000 |
| 1994 | 1,275,000 |
| 1995 | 1,134,000 |
| 1996 | 1,243,000 |

**Figure 4. Housing Transactions England and Wales. Source: Inland Revenue**

Professional valuers operating outside their comfort zone were forced to rely on the salespeople for information which was often sketchy and unreliable.

The accuracy of valuations suffered and with it the image and reputation of the valuation profession. The need for support, possibly utilising an information technology solution was being established. Other solutions have been suggested and these will be considered in Chapter 4.

Kirkwood, (1984)

*"Valuers certainly need all the help they can get when it comes to forecasting the changing events that influence present value. One way of improving the valuers chances of survival is to encourage greater use of statistical methods as an aid to professional judgment. Such methods include trend analysis, correlation and regression, sensitivity analysis and risk simulation."*

**2.05 Quality and Consistency .**

As will be seen from the following chapter, technical literature giving guidance on the residential valuation process is limited and very little has been readily accessible to the average valuer. Scott, (1988)

*"The comparative method of valuation is poorly defined and under researched."*

Over the past twenty years it has become apparent to the Author through discussions with colleagues and reviewing job application forms that significant numbers of the valuers practising today were not formally trained in the residential valuation process. Many of the younger valuers who obtained their qualifications through colleges and universities sat courses that concentrated on commercial and taxation valuations. The older valuers may have received no formal training at all, (entering the profession without examination). Furthermore a considerable number have transferred from other disciplines, such as building surveying.

Any training that has been received has been on an apprenticeship basis and as such relies heavily on the ability and skills of the trainer. This piecemeal approach to the training of valuers has done nothing to develop the profession as a whole. Swift ( op. cit. )

*" The valuation of houses is almost the only field of human endeavour which has never made any progress. As things stand there is no prospect of any change."*

As a consequence, within the larger valuation organisations, many different methods are being used. This leads to inconsistencies which further damage the valuers' reputation. There exists a need for valuers to adopt a more consistent approach to the process of inspection, reporting and valuation. (Chapter 3 looks in detail at some of the approaches adopted by the In-House valuation department of the Halifax.) New technology offers the possibility for a consistent approach to be adopted by all valuers across the country which will benefit all of their customers and hence their reputation. Richards ( op. cit. )

*" The valuer knows full well that failure on his part to exercise reasonable skill and care may be disastrous to the purchaser."*

The need for an improvement to the present situation has been established. It is the belief of the Author that one possible answer will be found in the development of an Information Technology Solution.

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CHAPTER THREE

# 3.00 THE RESIDENTIAL VALUATION PROCESS - THE PRESENT POSITION

## 3.01 Introduction

Moreton, (1995) when defending the professional valuer as outlined in Chapter 2, only referred to physical factors which are matters of fact. Undoubtedly the most difficult aspect of a valuers work is in establishing the value, which is, a matter of opinion. RICS Guidance to Clients and Model Conditions of Engagement , (1992)

*"A Valuation is the individual opinion of a Valuer based on the relevant facts available"*

When the valuer looks for help in performing his/her role he/she has access to numerous books, manuals, guidance notes even videos to assist with the physical aspects of the inspection. In addition, an array of equipment, such as damp meters, crack gauges and endoscopes, is also available. Whilst this is a crucial aspect of the valuation process, Mackmin, (1984) when concerning himself/herself with the valuation itself noted that the valuer receives very little guidance on the process of arriving at an opinion of value. A review of products on offer to the residential valuation surveyor at the Property Computer Show in 1995 discovered that technological assistance is very basic with only rudimentary database programmes being available.

Mackmin,( Ibid. )

*" The mainstream of residential property valuation is under-researched and poorly represented in valuation and property publications."*

*"Why, if it is so important, do we allocate such little teaching time to it , so little research, so little professional time and so little space in our trade journals."*

A review of the present situation with regards to the valuation of residential properties will be of value in developing an information technology solution. Therefore, this chapter will consider the various methods of valuation and their application in practice.

### 3.02 Methods of Valuation

There are five basic methods of valuation that can be used, (Millington,1994)

- The Comparative Method
- The Contractors Method
- The Residual Method
- The Profits Method
- The Investment Method

The Comparative Method will be considered in the next section.

The Contractors Method is based loosely on the theory that the cost of the site plus the cost of the buildings gives the value of the property. This may be appropriate for properties for which few transactions take place such as libraries, doctors clinics etc. In these circumstances it may be reasonable to assume that cost and value are not unrelated. However, for residential properties where there is a large and diverse market, and where factors other than cost come into the supply and demand equation, this is not so. In practice, the cost of the site has to be obtained by reference to other transactions and this is achieved by comparison.

With the Residual Method, the potential future value of the property is estimated (by comparison with similar completed properties!) and the estimated cost of development deducted to give the present condition value. This method relies heavily on estimating but can be useful where a latent value exists. This method is most often used in residential property for establishing the value of land with development potential. Mackmin,(1994)

*" The residual method of valuation is used to assess the value of land in an undeveloped state with development potential."*

The Profits Method works on the assumption that the value of some properties will be related to the profits which can be made from their use. It is generally used where some degree of monopoly exists in its use such as a remotely located hotel. As such this method is not really appropriate for private residential properties and was excluded by Mackmin ( Ibid. ). when considering the methods available for these properties.

The Investment Method is based on the principle that annual values and capital values are related. Like the other methods referred to above (with the exception of the Profits Method) this method relies heavily on comparison.Millington,(1994)

*" Although a property may not be let it is possible to predict what its rental value is by comparing it with similar properties."*

The ability of valuers to be able to compare properties, whether it is for assessment of capital or rental value, is therefore essential. This thesis will now consider the guidance that is available to the valuers in this respect.

**3.03 The Comparative Method - textbook approaches.**

A review of the leading textbooks on the subject of residential valuations provides little assistance. So little has been written that it is possible to include extracts referring to the comparative method in their entirety. Rees, (1988)

*"When he has sufficiently informed himself as to the size, nature and condition of the property he can select the various methods of valuation by which he will guide and check his opinion. For example he may be able to value by the comparison method if he has sufficient knowledge of recent sales of sufficiently comparable properties."*

Whilst this statement is correct it provides no indication as to what degree of evidence is sufficient nor what makes another property sufficiently comparable.

Byrom, (1979)

*"So far as a standard property such as a two/three bedroomed semi-detached house with a single garage and central heating, situated on an estate of perhaps 200 virtually identical houses, is concerned, it should be possible for the valuer to get the price right within a few percent, merely by comparison with office records and with prices recently achieved for other properties on the estate.*

*However when one comes to more individual properties and particularly in the case of properties that are "one off's" both in accommodation and location, it is far from easy and it is here that the valuer's experience and local knowledge do really come into play. One method sometimes adopted by valuers when dealing with unusual properties is to assess the maximum for which they think the property could sell and the minimum figure which it could be guaranteed to bring and to split the two figures to give a middle market valuation."*

The implication here is that for difficult properties the valuer can only rely on his experience and local knowledge but no guidance is given as to how that may be used. Reference is made to a 'middle market' valuation but no clue is given as to how the maximum and minimum values are assessed.

Millington, ( op. cit. )

*"The comparative method entails making a valuation by directly comparing the property under consideration with similar properties that have been sold in the past, and using the evidence of those transactions to assess the value of the property under consideration. ..... In using this method it is desirable that the comparison should be made with similar properties situated in the same area, and with transactions which have taken place in the recent past. The less the comparable property complies with these requirements the less valid will be the comparison."*

Here more specific advise is given as to what properties make the best comparables but again little indication is provided as to how the analysis of those comparables should be undertaken. Furthermore, no guidance is provided as to how a valuer should proceed if suitable comparables are lacking.

Britton et al, (1989)

*" It is necessary to make various allowances for the differences in quality between houses. The level of allowance is subjective and depends on the experience and knowledge of the valuer. This method is simple in its approach but is dependent on considerable valuation judgment for its application."*

Britton points the way to the need for allowances to be made but then falls back to the weak proposition that this subjective judgment depends on the experience and knowledge of the valuer!

Richmond, (1994)

*" This procedure is widely adopted in practice, but requires the keeping of adequate records of transactions."*

What is adequate ?

Ring, (1970)

*" The greater the number and more recent the sales of comparable properties the greater the accuracy and the more convincing are the results obtained via the market approach to value. Ready access to the market transaction source data is therefore of first importance ."*

*"To achieve comparability and to adjust for price differences caused by variations in type, size, features, age and condition of the improvements, most appraising practitioners rather than using "better, poorer, same" judgment analysis apply percentage ratings to reflect superior or inferior market factor relationships. The use of a series of percentage adjustments has serious pitfalls and limitations. A jury or even an investor might get the impression that the appraiser is playing a number game that borders on "guestimating" rather than professional estimating."*

This vague approach to the valuation of residential properties has many critics and the perceptions they have of the process do little to help enhance the image of the valuer.

Clarke et al, (1994)

*"Two questions immediately arise here: first how is such a judgment of value arrived at, and second, what are the clients' views of value? The first of these is easily answered: comparability and gut feeling. Market valuation is based almost entirely on comparability, with gut feeling compensating for those areas where comparison is impossible, and frequently being used as a leading basis for valuation. Nor is this confined to valuations for sale. We have observed mortgage valuations by qualified surveyors reached on the basis of a drive-past, even if subsequently confirmed by a tour of inspection for form's sake. ..... There is nothing esoteric about valuation and nothing the lay client cannot do unaided and indeed a good many of them do so."*

Byrom ( op. cit. )

*" Valuation is an inexact science. Send half a dozen valuers to the same property and you will get half a dozen different figures with the highest probably 20% above the lowest on a standard property and with a much greater discrepancy on an unusual one for which there are few comparables."*

The profession can no longer be seen to be relying on 'gut feeling' to value residential properties, to do so will further damage its image and reputation.

The aforementioned extracts from leading texts do nothing to dispel the views that valuation is a somewhat inaccurate art rather than a science. They refer to 'similar properties', 'market transactions' and 'adequate records' but give no guidance on how to compare properties, how to validate the evidence and how to make adjustments if the properties are not identical or transactions are not contemporary. Such guidance and a move to a more scientific approach to valuation is required to enhance the image and improve consistency.

Mackmin ( op. cit. ), breaks the valuation process down into four stages:

1. Select Comparables
2. Extract, confirm and analyse comparable sales prices
3. Adjust sale prices for noted differences
4. Formulate an opinion of open market value for the subject property.

Mackmin goes on to explain how valuers are usually employed by firms which are also involved in estate agency and therefore have access to the salient details of residential sales. However, as has been discussed earlier, as the profession has restructured, this is not now the case. Valuers must obtain their evidence from other sources and the validity of that evidence assessed. This will be considered later.

Once obtained the evidence has to be searched for comparability and adjustments made for those comparables that are less than perfect.

Mackmin, ( Ibid. )

*"The aim of the search is to find as far as possible matching pairs. In most cases the match will be less than perfect, and adjustments will have to be made to bring the comparable evidence into line with the subject property. The main adjustments have to be made for time, location, physical characteristics and conditions of sale."*

Certain attributes, factors that affect value, will have a greater significance than others and this will vary for different properties. Mackmin has referred to several categories of attributes. A wider range and their weighting will be considered later.

Rees, ( op. cit. )

*"Accessibility , accommodation, condition and location are the main factors affecting value together with the standard of construction and quality of finish."*

It is necessary to extend the search of literature on residential valuations to the United States of America to obtain more detailed guidance. Whilst a very different market exists there and some of the key attributes may be different the basic principles of valuation using the comparative method or the Market Data Approach as it is known there are similar.

Bloom and Harrison, (1978)

*"When carefully collected, analysed, verified and reconciled, market data usually provides the best indication of market value for a house."*

Bloom and Harrison ( Ibid.) identifies five steps in the residential valuation process:

1. Study the Market
2. Collect the Data
3. Verify the Data
4. Analyse and Compare the Data
5. Adjust the Comparables to give an Indicated Market Value.

Bloom and Harrison ( Ibid. ) recommend the collection of large quantities of data with most reliance being placed on recent sales of similar properties. They suggest that a computerised data retrieval system should be used to serve the appraiser's needs most effectively. Whilst guidance is provided on the numerous sources of market data in the

United States most of the sources referred to do not exist in the U.K. and these must therefore be considered later. The need to verify the data obtained is stressed but the suggestion that every property used as a comparable should be personally inspected, whilst desirable, is not practical. It does however emphasise the need for the source of data to be reliable, especially if a valuation is being made by reference to limited evidence rather than a broad range of properties.

The verification process should consider not only physical factors but also the motivation for the sale. Is it an 'arms length' transaction between a willing buyer and a willing seller? Is any other consideration passing other than cash? This aspect is particularly relevant today where builders are selling many new homes on a part exchange basis. Many properties today are being sold by mortgagees in possession on a forced sale basis, and if being used as comparables, these transactions will need to be treated with caution.

When considering the assembled evidence Bloom and Harrison ( Ibid. ) refer to elements of comparison which must be considered:

- Date of Sale
- Physical Characteristics
- Location
- Conditions of Sale

They refer to analysis in the past being based on nothing more than educated guesses but go on to say, Bloom and Harrison, ( Ibid. )

*"Good appraisal practice requires that adjustments be supported with data from the market. The best technique is to extract the amount of the adjustment from the market by the utilisation of 'matched pairs'. This is often the only acceptable technique to many sophisticated purchasers of appraisals."*

It has been demonstrated earlier that in this country the perception is that valuers are still 'guesstimating' but that the participants in the market are becoming more sophisticated. It is now necessary to develop a more intellectual approach.

The 'matched pair' approach tries to identify the difference in value attributable to a single attribute where that is the only difference

between two properties. This technique is generally reliable where only one difference exists but this is often not the case in practice. It should be possible however to establish the influence of different attributes over a period of time.

Research on this subject conducted by Natalie Stringer a student working for the Halifax Building Society during a year out from college will be considered in a following section of this chapter.

Attribute values established in this manner should be used with care as some attributes will have differing effects on value dependent on the property. For example a large garden may have a detrimental effect on the value of a small bungalow for which the likely market is pensioners but a positive effect on a family house.

Additionally the adjustment for one item of difference between comparables may include a partial adjustment for another item of difference. Wherever possible comparables should be chosen which require the fewest adjustments. The limitations of this approach to the analysis of comparables points to the use of other techniques such as Regression Analysis which will be considered in a later chapter.

### 3.04 The Comparative Method - Its operation in practice.

Faced with such little literature giving instruction in the 'art' of valuation many valuers have developed their own approach to the residential valuation process. The case studies which follow later in this chapter show how two valuers in different parts of the country and their colleagues have developed the comparative method to include an element of devaluation.

As Regional Valuation Surveyor the Author had the opportunity to study the techniques used by 11 valuers employed in the East Region of the Halifax Building Society. It has been possible to identify a common thread. No doubt there are many other local variations throughout the

U.K. The basic method in use by these valuers within the Halifax Building Society is as follows.

The process of data collection and verification is ongoing and not entered into as a separate process for each individual valuation prepared unless a subsequent search of the data reveals insufficient evidence and further enquiries are necessary.

Valuers employed by the Halifax are typically expected to inspect and prepare a valuation report on 5 to 6 properties daily. These are all located within fixed geographical areas but large enough to include many valuation areas. This provides a significant mass of data for comparable purposes which satisfies the criteria of Bloom and Harrison ,( Ibid. ).

*" Each sale used as a comparable in an appraisal report should be personally inspected and the data confirmed with the buyer, seller or broker."*

Data used for comparable analysis come from a variety of sources which can be ranked for reliability and significance. Staff valuers do not have ready access to sales transaction data as they are not employed by firms engaged directly in estate agency. It has been argued that the only reliable transaction data is data on sales which have been completed, as until a sale has completed the price does not take into account every factor that may come into play in the sale of a property ( for example the price may be renegotiated after the mortgage valuation report has been obtained or the sale could not proceed for other reasons,- change of mind, finance difficulties etc.).

In practice the staff valuer (for the majority of comparables), uses evidence of sales agreed (from instructions to value for mortgage) rather than sales completed. Whilst this evidence does not fulfill the criteria of a completed transaction it does provide confirmation that a prospective purchaser is happy with the price. This evidence does have the advantage that it is more contemporary with the market. Completions sometimes take place several months after the sale price has been agreed.

Millington, ( op. cit. )

*"There is a great danger in the use of comparable evidence that the valuer may place too much faith in it, forgetting that while such evidence reflects what happened in the past his current task is to determine what the current value of the property is."*

Gronow et al. (1997) observed:

*"Experienced valuers also appear to look for and remember transactions which are representative of a class of properties. Valuers are observed to use a 'good' comparable repeatedly."*

Such comparables can be considered as 'benchmark' evidence, favoured because they have been personally inspected and validated.

Through experience, practice and discussions with colleagues the Author has developed a categorisation of the sources of valuation comparable evidence and ranked them in order of validity, as shown in the following table. Table No.1.

Byrom, ( op. cit. )

*"Regular reference to local estate agents' lists, local newspapers and certain magazines will assist, subject to the caution that asking prices are sometimes well above prices actually achieved."*

| Evidence | Source | Validity |
|---|---|---|
| Completed Transactions | Estate Agents | May be historic due to length of sales process. Unless inspected personally the details of size, condition and quality of fittings may be vague. It may not be possible to verify fully the conditions of sale. |
| Mortgage Valuations | Personal | Not always aware of eventual sales price. Fully aware of details of size, condition and quality of fittings. Ability to verify conditions of sale. |
| Mortgage Valuations | Within own organisation. | Provided a degree of consistency exists within the organisation this source should be reliable for description of physical factors and sales conditions. |
| Mortgage Valuations | Other professional valuers sharing information. | This source should be reasonably reliable for description of physical factors and sales conditions. |
| Verbal Enquiries | Estate Agents | Valuable evidence of current market conditions but may not be admissible in court. Details of physical condition may be lacking as agents do not measure properties on the same basis and are not trained to identify defects. This would include enquiries from 'For Sale' boards erected on properties in the vicinity of the subject property. |
| Verbal Enquiries | Property Occupants | Not suitable as evidence but valuable in identifying leads for more detailed enquiries on property sales in the immediate vicinity. |
| Advertisements | Local Newspapers, Estate Agents Windows | Useful in identifying leads for more detailed enquiries but see below. |

**Table 1. Valuation Evidence, Sources and Validity. R. Dennett**

Data collected from the mortgage valuations referred to above is held on a computerised database recording approximately 30 attributes of each property. The completed reports of those inspections carried out within the organisation are held in a paper form for further reference.

The database can be searched on several criteria to select those properties on the database which are the most similar to the property being valued. The criteria are:

| | |
|---|---|
| Street | All or part name. |
| Postcode | Any part or all of the postcode |
| Unit Type | House, Flat or Bungalow |
| Property Style | Detached, Semi Detached, Terraced etc. |
| Number of Bedrooms | Single Integer |
| Price Range | From 1 to 5,000,000 |
| Date of Valuation | Valuations after the keyed date. |

**Table 2. Valuation Search Criteria - Halifax Valuation Surveyors Database**

From this selection which can be against any one, all or any combination of the above criteria, one of two reports showing the properties chosen by the system can be produced. These reports/printouts are shown following. Figure 5. is the full report of all criteria on the system and Figure 6. is a shortened report including those attributes most frequently used for comparison purposes.

*06-Jan-96*

# HALIFAX Valuation Surveyors - Property Report

## Property Details

| | | | |
|---|---|---|---|
| **Roll Number** | 8232291 | **Purchase Price** | £70,000 |
| **Value** | £70,000 | **Valuation Date** | 19/08/93 |
| **Unit Name** | | **Unit Type** | Semi-Det |
| **Plot No** | | **Description** | House |
| **Unit No** | 2 | **Age in Years** | 55 |
| **Street Name** | Pottersfield, | **Tenure** | 1 |
| **District or Village** | | **Builder** | |
| **Town or Borough** | | | |
| **Post Code** | CM17 9BY | | |
| **No of Beds** | 2 | **Chief Rent** | £0.00 |
| **No of Living Rooms** | | **Ground Rent** | £0.00 |
| **Main heating** | Gas | **ServiceCharge** | £0.00 |
| **Extent** | | **Unit Size** | 69 |
| **Garages/ Parking Spaces** | 1 | **Length Of Lease** | |
| **Orientation** | | **Length Remaining** | |
| **Condition Factor** | | **Local Authority** | No |
| **Quality** | Average | **Traditional** | Yes |
| **Single Overriding Factor** | | **Sought After** | No |
| **SourceM & M** | | **Firm** | |
| **Quality of Evidence** | | | |

## Remarks

**Figure 5. Full Comparable Listing - Halifax Valuation Surveyors Database**

Having obtained the narrowed down selection, the valuer uses his judgement to make any adjustments, (that may be necessary) to the comparables to enable them to be used in the valuation. In reality, for the majority of st. aightforward valuations, the valuers form an opinion of value based simply on judgment and experience and then search for comparables to support that judgment.

**HALIFAX Valuation Surveyors - Comparable Print**

**Search Criteria: Address N/A Postcode SG11 2NH Type of Property Detached**

| Postcode | Address | Unit Style Main Heating | Garages Beds | Age | Over Factor Condition Factor | Purchase Price Value | Floor Area Val/M2 | Date Valuer |
|---|---|---|---|---|---|---|---|---|
| SG11 2NH | 10a Friars Road, Braughing | Detached House Elec | 1 4 | 30 | Views 3 | £134000 £134000 | 134 £1000 | 1.1.95 RMD |

**Figure 6. Brief Comparable Listing - Halifax valuation Surveyors Database**

From the printout ( Figure 6. ) above it can be seen that the database produces a rate per square metre of floor area. This is a very simple devaluation where the valuation is divided by the gross external floor area. This approach was advocated by Millington (op. cit.)

*"An example is given of the crudest form of devaluation. Comparable properties in the same street but of different sizes are compared by establishing the value per square metre of usable space. This is done by dividing the purchase price by the floor area."*

Given that properties of the same type in the same valuation area have been chosen, this method can provide a general indication for value levels when a reasonable number of comparables have been produced. The valuer can make adjustments for the other attributes shown on the printout where they differ from the subject property. The adjustments are made on a fairly rough and ready basis again relying on the valuers judgment and experience.

It will be shown later that regression analysis and neural networks can be used to enhance this aspect of the valuation process.

### 3.05 Comparison or Property Ranking

It is worth considering briefly at this stage a variation on the comparative method which could be referred to as 'Property Value Ranking'. This technique is most commonly used by estate agents when assessing where a property should be placed in the market in relation to other properties currently available. It has also been used by valuers for properties for which there are few direct comparables and, as such, relies entirely on the ability of the valuer to weight the various different attributes of different properties in the market, or for which recent sales have been achieved. The following example illustrates the technique.

Sales have recently been completed on the following properties which are ordered in terms of price achieved.

| Property No. | Type | Size | Bed | Single Overriding Factor | Other Key Attribute | Price Achieved |
|---|---|---|---|---|---|---|
| 1 | Det Hse | 100 | 3 | 1 acre plot | Rural outlook | £105000 |
| 2 | Det Hse | 110 | 4 | Double garage | Estate Location | £103500 |
| 3 | Det Hse | 95 | 3 | Excellent Condition | Single garage | £97000 |
| 4 | Semi Hse | 100 | 3 | Adjoins Park | Very Good condition | £92000 |
| 5 | Semi Hse | 84 | 3 | None | Average Condition | £89000 |
| Subject | Det Bung | 80 | 2 | Bungalow | Well landscaped garden | ? |

**Table 3. Property Rating Schedule. R. Dennett**

From the list it can be seen that there are no direct comparables for the bungalow to be valued. The valuer knows from experience that bungalows are in short supply and pro rata to the accommodation being offered achieve premium prices. The valuer determines that the value of the property lies between that for property 2 and property 3, i.e. £103500

and £97000. After further deliberation and consideration of the lesser attributes the value is determined to be £100000.

### 3.06 Valuation Attributes

As part of Project Dragon and to assist in its development, a valuation student (Natalie Stringer) was recruited by the Halifax and under the Author's direction carried out research into the key attributes that affect value. This research had the objective of establishing the 'experts' opinion of those attributes that most affect value and applying a weighting to them. The findings of the research are summarised below to provide a basis for later consideration.

Primary information was collected from 100 'experts', Valuation Surveyors employed by the Halifax Building Society, by means of a questionnaire. Whilst it had its limitations ( it only considered physical attributes ) it was able to provide useful raw data for further development. Attributes were ranked using two methods. Firstly a straightforward number of times an attribute was ranked of prime importance. Secondly a weighted ranking which took account of second and lower choices.

**Location** was considered to be the most influential attribute affecting value from the primary factors offered for consideration, whichever method of analysis was chosen. On the weighted analysis **property type** ( House , Flat or Bungalow ), **size** and **state of repair** were ranked equally after location. These were followed by **construction type** (Traditional or Non-Traditional ), **property style** ( Detached, Semi, Terraced etc. ) and **age**.

Stringer, (1994)

*" 56% of respondents thought that the number of bedrooms should be classed as being of major importance."*

The **number of bedrooms** can be considered a factor of property size but the two are not wholly interdependent and, therefore, can be considered as separate attributes.

Availability of on-site **parking** was also considered to be of prime significance by a substantial proportion (24%) of the respondents.

In addition to factors that occur in virtually all properties, the concept of single overriding factors was explored. This concept is based on the premise that there are certain factors/attributes which when they occur are so powerful that they can outweigh all other attributes combined. For example, when a property is situated in an area affected by **land contamination** this can be so detrimental that despite the size, condition or style it could have no appreciable value. Other such factors ranked in order of importance by the respondents include, **coastal erosion, flooding, crime rate, adverse tenure, overhead pylons, rights of way and unusual plot size.**

It is worth noting that this last factor, unusual plot size, is only included as an exception and no suggestions were forthcoming that plot size should be included as a main attribute. It is not standard practice within the U.K. in residential valuations for the plot to be measured or to make specific reference to it unless it is unusually small or larger than a quarter of an acre. This is in direct contrast to the U.S.A where lot size is measured and included in Multiple Listing datasets.

Lenk et al. (1997)

*"Seven variables, which have been shown consistently in prior studies to be significant property attributes for determining value, were chosen as the independent, or input variables. These variables were the number of bedrooms, the age of the house, the lot size....."*

From the experience of the Author condition is another attribute that can have the effect of a single overriding factor. It was however, not included in the list of overriding factors chosen by the participating valuers.

Having identified the main factors that were considered to affect value the research then looked in more detail into each. For example, with age the respondents were of the opinion that the periods most likely to affect value beneficially are 'new' followed by pre-1900 with the period 1966-1975 least likely to. This can be seen on the following chart. Figure 7.

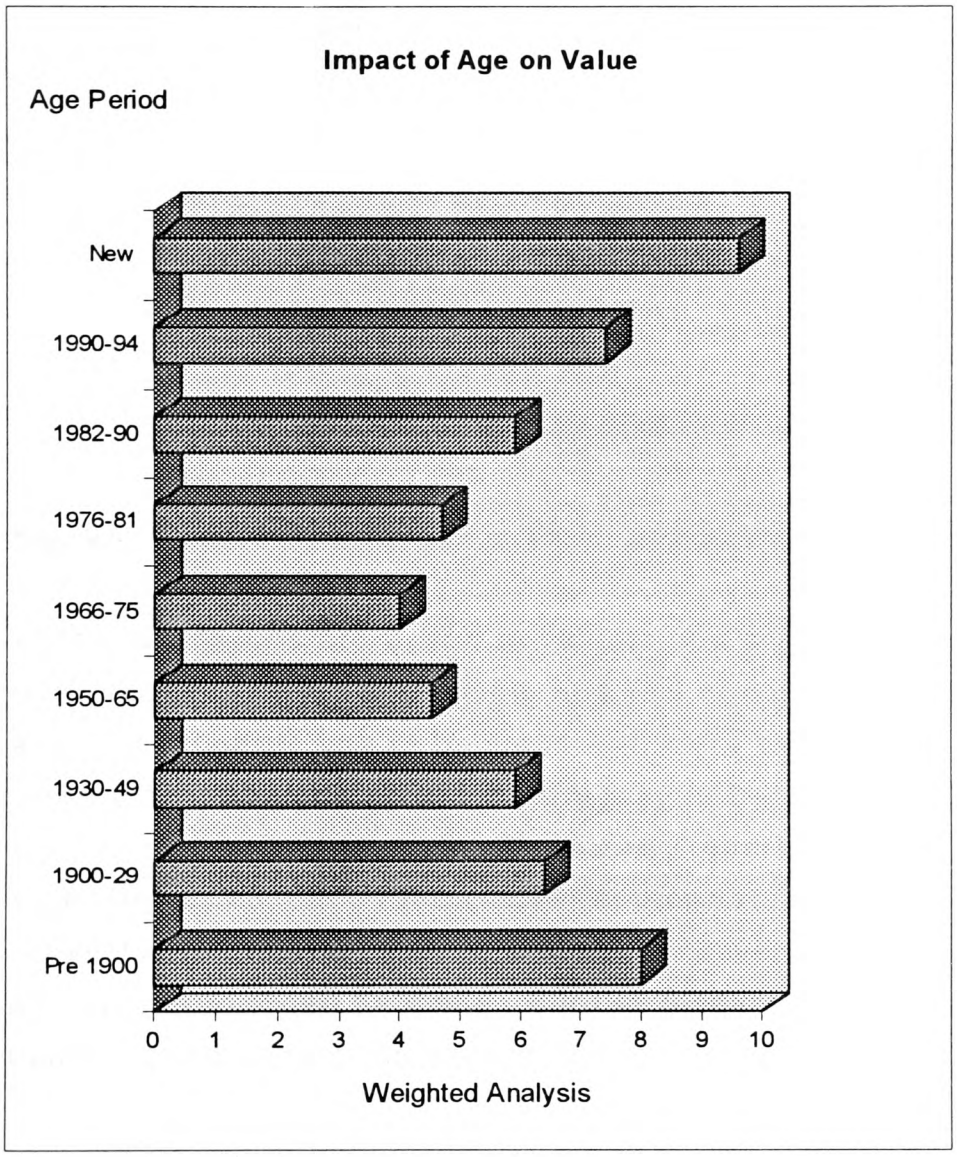


**Figure 7. Impact of Age on Value - Source: Research by N. Stringer (1994)**

When property style was considered a clear ranking of styles was established as shown in Figure 8 below.

| PROPERTY TYPE | Weighted Analysis |
|---|---|
| Detached Bungalow | 19.4 |
| Detached House | 18.9 |
| Semi Detached House | 18.6 |
| Semi Detached Bungalow | 17.1 |
| End Terrace House | 15.4 |
| Dormer Bungalow | 14.1 |
| End Terrace Bungalow | 13.9 |
| Mid Terrace House | 13.4 |
| Mid Terrace Bungalow | 12.3 |
| Purpose Built Flat Ground | 11.8 |
| Purpose Built Flat First | 11.6 |
| Purpose Built Flat Second + | 9.9 |
| Converted Flat Ground | 8.9 |
| Converted Flat Second + | 8.7 |
| Converted Flat First | 7.4 |
| Purpose Built Flat Basement | 6.4 |
| Converted Flat Basement | 2.2 |

**Figure 8. Impact of Property Type on Value - Source: Research by N. Stringer (1994)**

These two results are useful to valuers in a practical sense in that they reinforce views held and enable analysis of comparables in respect of age and property type to be made with more confidence. For example, when comparing a subject property (say, a Detached 1990-1994 House) with a comparable (say, a similar sized property in the same location but Semi-Detached 1982-1990 House) appropriate adjustments can be made. What this information fails to provide, however, is the degree of adjustment that can be made. Further research or analysis perhaps using statistical techniques is required.

Locational factors were ranked as follows, **Neighbourhood**, **Social Mix**, **Street Scene**, **Topography**, **Urban/Rural** and **Density**.

Ignoring extensions, improvements to a property that can affect value were ranked in importance thus: **Kitchen Fittings**, **Heating System**, **Bathroom Fittings**, **Double Glazing** and **Security Systems**.

It can be seen that there are a large number of attributes that need to be taken into consideration when assessing the value of a property. This research has provided some indications as to which attributes must be

considered. Some attributes such as location will have a major impact on value, others such as the quality of the bathroom fittings will have a less significant effect. Equally it will be easier to make adjustments for some attributes than others. The cost of fitting a good quality bathroom can be established by straightforward estimating but the impact of different locations will be more difficult to assess.

When selecting comparables therefore it can be seen that for the major attributes they should match the subject property as closely as possible and for the less important attributes adjustments which would tend to have a marginal effect on value can be made.

Whilst a number of the standard texts list the attributes that may need to be considered, Byrom ( op. cit. ) categorises attributes as follows: Type of Property, Tenure, Arrangement, Location, Outlook and Orientation, Character, Accommodation, Service Installations, Structural and Decorative Condition, Plot and Outbuildings, Provision for Motor Cars and Maintenance costs, few give guidance on priorities for selection.

Almond et al. (1997) have identified the need for the profession to agree a standard set of attributes for inclusion in a comparables database and whilst they have provided a possible classification they note:-
*"In its current form there is an incoherent structure, and disagreement amongst professionals as to the attributes that impact on value."*

### 3.07 The Comparative Method - Best Practice Distilled

The prime requisite of valuation using the comparative method is local knowledge. This knowledge is used to identify different valuation areas in order that appropriate comparables can be selected but, more importantly, to be able to collect relevant market data.
Scott and Gronow, (1988)
*"It is clear that the selection of good information on which to base the valuation is crucial to the satisfactory performance of the valuer."*

Ring, ( op. cit. )
*"Ready access to the market transaction source data is therefore of first importance."*

As data is collected it must be verified to ensure accuracy and validity (Bloom and Harrison, op. cit. ). The most useful data is that collected by the valuer personally (from physical inspection) as he will be able to collate information on all attributes and to ensure that the verification process is completed satisfactorily. Mackmin, ( op. cit. )

*" Each valuation adds to that data bank so it is essential to see that all the important information is recorded in a clear and accurate manner for subsequent users."*

The valuer will also importantly have first hand experience of attributes the detail of which it may be difficult to record in an easily retrievable manner. For example, the number of bedrooms or size of a property can be recorded numerically, and the search for properties of the same size or with the same number of bedrooms can be carried out easily. Decorative condition however could be anything from appalling to excellent. Average condition could include rooms in a range of conditions. It is possible to grade condition perhaps on a scale of 1 to 5 to allow easy retrieval but two properties of grade 2 could be very much different and only first hand knowledge would allow them to be differentiated.

Assessing and recording the valuation of the property in average condition for its age and type at the time the comparable data is collected allows a more consistent approach to the analysis of data when subsequent valuations are prepared. In effect the analysis takes place before the property to be valued is inspected.

Kirkwood, (1984)

*"A rigorous, methodical analysis of previous transactions in landed property has always formed an essential part of the valuer's methodology. This thoroughness reflects the inextricable bond between analysis and valuation, that is summarised in the aphorism 'As you analyse so shall you value'."*

This approach also has the advantage of overcoming some of the limitations of grading condition referred to above.

The following information should be collected as:

| ESSENTIAL | | OPTIONAL | |
|---|---|---|---|
| Attribute | Example | Attribute | Example |
| Date of Sale | | | |
| Location | Address<br>Postcode<br>Grid Reference | Location | Neighbourhood Type<br>Social Mix,<br>Street Scene, |
| Unit Type | House,<br>Flat,<br>Bungalow | | Topography<br>Urban/Rural<br>Density |
| Size | Gross External Floor Area | Plot Size | |
| Condition | External<br>Internal<br>Kitchen Fittings<br>Bathroom Fittings | Features | Double Glazing<br>Security Systems |
| Construction Type | Traditional<br>Non-Traditional - Name | | |
| Property Style | Detached, Semi,<br>Terrace, | | |
| Age | in years | | |
| Number of Bedrooms | | Number of receptions | |
| On site parking | No. of parking spaces<br>No. of garaging spaces | | |
| Heating Type/Extent | | | |
| Single Overriding Factor | Views,<br>Short Lease,<br>Local Authority<br>Large Plot. | | |
| Source | Firm name | | |
| Transaction Type | Open Market Sale<br>Possession Sale<br>Part Exchange<br>Remortgage<br>Right to Buy | | |
| Transaction Status | Contracted<br>Sale Agreed | | |
| Price | Contacted or agreed sale price. | Valuation | Present Condition<br>Average Condition |

**Table No. 4. Essential and Optional Attribute Data. R. Dennett**

When a property is inspected for valuation purposes it is necessary to collect the aforementioned information. Once this has been done a search for comparable properties can be made. Modern computer operated database packages can take the tedium out of this search process. This research will later consider how more sophisticated techniques can be used.

The search should attempt to find properties that match the subject property on as many of the aforementioned 'essential' attributes as possible. The valuer should use his knowledge of the property market to identify the locations which should be searched for comparable evidence. Research by Adair and McGreal (1986) on the statistical variability in house prices in the Northern Ireland Property Market concluded that within specific bands of property types it is possible to look over wider areas for comparable data. The valuer should be able to identify such properties and valuation areas.

Having identified a minimum of three comparables, adjustments should be made to them to make them equate to the subject property. As has been demonstrated earlier (Millington, op. cit. ), the fewer the adjustments the more accurate will be the valuation. Additionally the more adjustments that can be supported with evidence or can be made without subjective judgment the better.

Bloom and Harrison, ( op. cit. )

*"Unless aided by properly applied adjustment processes such as regression analysis, the appraiser should generally make the fewest adjustments possible."*

In the absence of regression models or other more sophisticated analysis techniques adjustments can be made in a number of ways including percentages of value or cash consideration. Different forms of adjustment will be appropriate for different attributes. Care should be taken to treat such adjustments with caution. The fewer the adjustments the more reliable the comparable becomes.

Ring, ( op. cit. )

*"The use of a series of percentage adjustments has serious pitfalls and limitations."*

Bloom and harrison ( op. cit. )

*" The appraiser should resist the temptation to use cost estimates as the basis for market adjustments. While relationships between cost and value contributions of components may exist, they may be supported only by market data."*

Four key 'Elements of Comparison' (areas of adjustment) have been identified by Mackmin, (1984), these are: time (date of sale), location, physical characteristics and conditions of sale.

Whilst Mackmin suggests that all physical characteristics are factually identifiable and measurable in value terms, this view is not wholly supportable. It is true that items such as a heating installation can be valued in cost terms, however attributes such as property type which cannot be measured may require some other form of adjustment.

The following is a suggestion as to how the various attributes should be treated.

| Attribute | Suggested Method of Adjustment |
|---|---|
| Date of Sale | Reference to House Price Index |
| Location | Percentage |
| Unit Type | Percentage |
| Size | Direct Mathematical but observing the law of diminishing utility |
| Condition | Cost |
| Construction Type | Percentage |
| Property Style | Percentage |
| Age | Percentage |
| Number of Bedrooms | Percentage |
| On site parking | Cost/Value |
| Heating Type/Extent | Cost |
| Single Overriding Factor | Various |

**Table No. 5. Suggested Methods of Adjustment for Attribute Data. R. Dennett**

Whatever method of adjustment is chosen it is very important to support adjustments with market evidence. Valuers must collect this evidence whenever it presents itself and build up a database for future use. One method of doing this is to use the 'matched pairs' approach.
Mackmin, (1984)

*" The theory of valuation by matching pairs can be stated simply as follows: if a matching pair of properties can be found which sold under similar conditions at the same time but displayed a single physical difference then any variation in price might reasonably be accounted for by that difference."*

The adjusted comparable data will provide an indication of value based on an empirical analysis of the market data. Of necessity this market data will be historic and the valuer will need to be aware of what is

happening in the market place at the time of the valuation to enable final adjustments to be made.

Millington, ( op. cit. )

*"The valuer must make every effort to determine who is looking for property of the relevant type, what their precise needs are, and what their purchasing power is. Such factors could have a great influence on how comparable evidence should be used and whether it is indeed a reliable indicator of the prices likely to be paid in the current market."*

When preparing a valuation for mortgage purposes the valuer will also have to have an eye to the future. Most loans secured on property are for periods of 25 years and mortgage lenders are keen to ensure that the they are adequately secured for the whole period. Whilst valuers are currently required to provide Open Market Value (OMV), consideration is being given to providing an Estimated Realisation Price (ERP).

Clarke et al, (op. cit.)

*"A property's mortgage valuation is not merely the price that it would be likely to fetch today, but which could prudently be assigned to it for the reasonably foreseeable future."*

Without reverting to an information technology solution this is the extent of the comparative method. To make significant advances in the process it will be necessary to make use of modern technology but there is a certain degree of inertia within the profession in this respect.

Kirkwood, ( op. cit. )

*"Valuers have in the past limited their analytical techniques to those that could be undertaken manually; in consequence, improvements in valuation methodology have been constrained."*

The following case studies consider two such manual approaches. Information on the case studies has been obtained by interviewing the two valuers who the writer has worked with in the past. The two persons concerned have different backgrounds in respect of their entry to the profession and value in different parts of the country.

## 3.08 Simple Devaluation Techniques - Case Study One

The first case study looks at the devaluation technique developed by R. C. Johns FRICS (Senior partner, retired of W. H. Lee & Co.) for the valuation of properties in the general area of Welwyn Garden City, Hertfordshire. This approach evolved from a card index system that had been in use since 1904 and was still in use well into the 1970's. This system relied on the retrieval of historic valuation reports and whilst it operated within well defined urban areas it had its limitations in rural areas. As inflation in property prices increased in the 70's a need arose for a system to be developed that drew primarily on current rather than historic information.

| Date | Address | Town | Description | Age | Gge | Plot | Htg | Price | GISF | Rate | Gar' | Htg | Plot |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 7.81 | 4 Bushey Gn | WGC | 2 Bed TH | 25 | 0 | Gd | F | 24995 | 840 | 19.6 | 0 | 1500 | 7000 |
| 7.81 | 10 Warren Way | WGC | 3 Bed Semi | 22 | 1 | Gd | F | 41750 | 932 | 22.8 | 2500 | 1500 | 16500 |
| 7.81 | 4 Queens Rd | WGC | 3 Bed Semi | 58 | 1 | Gd | Pt | 47000 | 1033 | 23.2 | 2500 | 500 | 20000 |

**Figure No.9 Extract from Comparables Crib Sheet . Source: R.C. Johns**

The above is an extract from the records kept using this approach. It can be seen that estimated sums are deducted from the sale price to reflect plot size, level of heating and garage to give a rate per square foot of the gross internal floor area for the house and location. Significantly at this time central heating was not installed in all properties and was considered to be a key attribute.

The system was amended in 1984 to exclude garage and heating from the devaluation calculations and to replace them with a sum for outbuildings.

This technique of devaluation whilst slightly more sophisticated than the straightforward price divided by size approach adopted by some Halifax Valuation Surveyors relies heavily on the judgement of the valuer to estimate the impact on value of plot size, garage and heating extent.

### 3.09 Simple Devaluation Techniques - Case Study Two

The second Case Study looks at the method that was developed by P. Watkins (Senior Asset Manager, Halifax plc.) in the town of Newton-le-Willows, Lancashire primarily for use in estate agency. On leaving college he found himself responsible for valuing properties for sale and in the absence of any practical training he developed this approach.

There existed many comparables for the valuation of terraced properties but evidence for detached and semi-detached houses was scarce. The need was perceived for some form of analysis to make use of the limited evidence available for these house types and to be able to take account of the variations in features and degree of modernisation.

Considering semi-detached houses for which the method was mainly used transactions were analysed for the predominant age groupings of modern and 1930's built. The prime attributes of, unit type, construction type, property style, age and often number of bedrooms having been accounted for the valuer was able to concern himself with less significant attributes and make adjustments on an estimated cost basis.

Sales prices achieved were first adjusted for location and plot size by deducting a lump sum and the remainder of the price adjusted to provide a base value by making monetary (primarily cost based) deductions for attributes such as double glazing, heating, garage and quality of kitchen/bathroom fittings.

The resultant sum was divided by the floor area to give a base rate per square foot. These rates were obtained for the property types referred to earlier. On receipt of instructions to value a property for sale the process was reversed taking care to add back the same cost based sums for features where appropriate.

The following is an illustration of how this method worked in practice. For this illustration all of the properties are privately built, three bedroomed semi-detached houses of traditional construction built in the 1930's. Sales took place in a period with no house price inflation.

| Property | Price Achieved | Reduced Price | Size sq./ft | Rate/sq. ft | | | |
|---|---|---|---|---|---|---|---|
| Adjustments | Plot/ Location | Central Heating | Double Glazing | Single Garage | Modern Kitchen | Modern Bathroom | Total Adjustment |
| Basic Adjustments | Variable | £1500 | £1000 | £6000 | £2000 | £1000 | |
| 1 | 65000 | 56500 | 900 | 62.8 | | | |
| | -6000 | -1500 | | | | -1000 | -8500 |
| | | | | | | | |
| 2 | 71000 | 52500 | 850 | 61.8 | | | |
| | -8000 | -1500 | -1000 | -6000 | | -2000 | -18500 |
| | | | | | | | |
| 3 | 66000 | 61000 | 984 | 62.5 | | | |
| | -5000 | | | | | | -5000 |
| | | | | | | | |
| 4 | 69500 | 61000 | 1000 | 61 | | | |
| | -6000 | -1500 | -1000 | | | | -8500 |

| Base Rate | 62 |
|---|---|

**Table No.6 Illustration of Comparable Analysis by P. Watkins.**

A property to be valued is of the same type and same location as properties 1 to 4. The valuation calculation would be as follows.

| | | | |
|---|---|---|---|
| Size | 850 sq. ft | | |
| Base rate | £62 / sq. ft | | |
| | | £52700 | |
| Additions | | | |
| Location/Plot | £6000 | | |
| Central Heating | £1500 | | |
| Double Glazing | £1000 | | |
| Single Garage | £6000 | | |
| Modern Kitchen | £2000 | | |
| Modern Bathroom | £1000 | | |
| | | £17500 | |
| Valuation | | | £70200 |

This is a simplification of the process as other adjustments would need to be made for condition, plot size etc. but it does illustrate one potential flaw in that where a series of adjustments are made each additional

attribute may have diminishing utility. This would not be accounted for by the formula but the final figure placed on the property would be determined by the valuer.

The efficiency of this approach relies on the accuracy and appropriateness of the essentially cost based adjustments and the homogeneity of the housing stock. Adjustments for Location/Plot relied on the judgment of the valuer but these judgments were tested against new evidence as it became available. Potential errors in establishing cost based adjustments were in part avoided by adding back the same sums that were extracted from the comparables.

Being used to establish asking prices for properties for sale it was possible to test this approach against prices achieved and it was found to be sufficiently robust to also be used for mortgage valuations.

This method has limitations in its application and would not be suitable for use over wider areas or for differing property types, without further development and perhaps the use of statistical methods such as regression analysis for establishing the magnitude of adjustments to be made.

Elements of this approach may however be usefully incorporated into an information technology solution.

### 3.10 Conclusion

It can be seen from the above that the comparative method and indeed most of the other methods of valuation of residential properties rely heavily on the judgment of the valuer. When valuations are in dispute it is this judgment that is brought into question. It is no longer possible for the valuer to rely on his experience and local knowledge alone when his valuations are challenged and, therefore, prepared.

Whilst it may never be possible to eliminate this element of judgment completely, and indeed it can be argued that this should not be the case, information technology solutions can be used to support and reinforce it.

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# THE DEVELOPMENT OF A FULLY INTEGRATED INFORMATION TECHNOLOGY SOLUTION TO THE RESIDENTIAL PROPERTY VALUATION PROCESS.

## PART TWO

## EVALUATION OF THE OPTIONS FOR AN INFORMATION TECHNOLOGY SOLUTION

CHAPTER FOUR

# 4.00 REVIEW OF THE OPTIONS FOR STATISTICAL OR COMPUTERISED SOLUTIONS TO THE RESIDENTIAL VALUATION PROCESS

## 4.01 Introduction

Kirkwood (1984) stated that the valuers task is a formidable one as it consists of making predictions about an uncertain future, he went on to comment,

*" one way of improving the valuer's chances of survival is to encourage the greater use of statistical methods as an aid to professional judgment."*

The need for an improvement in residential valuation methodology and the inadequacies of the direct method of comparison as currently practiced has been demonstrated. The problem facing anyone wishing to develop an information technology solution is which statistical method or computerised system to use. Various approaches are available. Whilst much has been written for example, on the application of expert systems to medicine, this chapter will consider the options from the perspective of their application to residential valuation and go on to suggest which options should be used.

Regression Analysis, Artificial Neural Networks and Genetic Algorithms would be confined in their application (by virtue of their nature) to use in analysis of accumulated comparable data for production of a valuation estimate. Expert systems and Geographic Information Systems, it will be seen can be used to assist in both the valuation and the broader problem solving aspects of the valuation process.

## 4.02 Regression Analysis

Whilst the use of regression analysis in the U.K. has been expounded by a number of people, Boyle (1984), Greaves (1984), and Baum (1982). It is reported by Adair and McGreal (1987) that its application in practice has been limited to rating/local taxation valuations. Alastair Adair and Stanley McGreal are the main exponents of the use of regression analysis in residential valuations. Their work has focused on the residential property market in Northern Ireland.

Regression analysis is essentially a statistical technique which attempts to determine a mathematical relationship between say the value of a property and the elements or attributes of the property which combine to produce that value. Adair and McGreal (1987)

*"It measures statistically the relative influence of several factors.....It objectively explains how price is dependent on independent variables."*

In its basic form regression analysis uses the simple equation:

$$Y = B_1X.$$

In residential valuation terms Y (the dependent variable) would represent the value of the property which would be obtained by multiplying X (an independent variable) such as floor area by $B_1$ (the regression coefficient) the value per square metre of floor area. In the last chapter the use of this simple approach in practice was shown. Bloom and Harrison (1978)

*"any use of a simple unit of comparison such as price per square metre is an application of simple linear regression analysis."*

There are two problems with this basic form. Firstly this equation would force the price per square meter through the zero intercept and in reality this would not happen. This is overcome by introducing a regression constant $B_0$. The second shortcoming is that it assumes only one independent variable and it has been demonstrated earlier that there are many.

This is accounted for by extending the equation thus:

$$Y = B_0 + B_1X_1 + B_nX_n. + e$$

Where the independent variables $X_1$ to $X_n$ have values $B_1$ to $B_n$, and 'e' is the unexplained component.

This extended equation enables the combined influence of several variables to be measured. There is however a danger in increasing the number of independent variables to increase the level of explanation, this leads to collinearity - the interdependence or interaction of many comparable elements a factor which as Bloom ( op. cit. ) states *"traditional comparison methods have generally overlooked."*

Kirkwood ( op. cit. ) explained it thus:
*"Correlation refers to the strength of the relationship between two variables."*

For example the number of bedrooms and the floor area of a house are very closely related (they represent the size of the property). To include both attributes would lead to a considerable degree of double counting. This is as opposed to two variables-such as number of garages and quality of location-which though to a certain extent are interdependent their inclusion would not involve double counting.

The double counting of collinearity can be overcome by multiple regression analysis. One of a number of MRA methods is 'Stepwise MRA' used by Fraser and Blackwell (1988)
*"It is a process in which the independent variables are programmed to enter or leave the equation in order of magnitude of their effect in improving the predictability of the dependent variable."*

Bloom and Harrison ( op. cit. )
*"Regression techniques ( particularly stepwise ) can serve to reduce the problem of collinearity and provide a means of measuring where significant dependence is present."*

Multiple regression analysis can be used either for explanatory or predictive purposes. Bloom goes on to state that it is important to recognise that the model used for the final application of market adjustments must also be used as the model for original explanation of

the adjustment factors (a relationship criteria identified by Watkins - see case study 2 above).

There are two main measures used to establish the precision of regression estimates, one is the standard error (Bloom and Harrison, op. cit. ) the other is the level of statistical explanation. Adair and McGreal (1988)

*"The 'best' model is one which combines a high level of statistical explanation as denoted by $R^2$ with a low degree of variability as measured by the Standard Error."*

When being used for prediction the success of MRA has been variable. Pendleton (1965) demonstrated that a statistical model could be constructed to predict average sales prices of houses in the District of Columbia within error limits of 6 to 7 percent.

Adair and McGreal (1987) however, stated that many other studies have been unable to achieve such accuracy and using data for one property type at a micro locational (street) level they were only able to achieve 13.7% standard error. Fraser and Blackwell ( op. cit. ) in Melbourne, Australia using stepwise MRA faired better with 10.66 percent. To be of value a statistical approach will need to have a standard error which is close to the 5% accuracy claimed by most valuers using a manual methodology, Mackmin, (1984).

To achieve an acceptable level of prediction or explanation using MRA it is necessary to have a sufficient amount of data,.....Shenkel (1978)

*" a database of 100 comparables using sales giving good information on size, location, physical and neighbourhood characteristics is a prerequisite of the use of MRA."*

segmented locationally (or by market area) .....Adair et al. (1994)

*"U.S. studies show that regression modeling works best and achieves the highest levels of explanation in well defined market areas."*

and by property type/style. Adair and McGreal (1987)

*"statistically based computer models for valuation should be developed for individual property types rather than attempting to construct hybrid models in which the ratings would simply be averaged out."*

The separation by property type also overcomes the problem of trying to quantify mathematically the difference between a terraced house and a detached house. Adair and McGreal ( Ibid. )

*" such an approach is consistent with valuation practice in that the valuer will normally be seeking comparable evidence from similar property, so why develop regression models on a different basis."*

*"if MRA is to be applied effectively by the valuer then models need to be generated for a 'homogenous' group of properties in a well defined geographical unit."*

Adair and McGreal ( Ibid. ) saw potential for the improvement of regression models lying with:

- better definition of property variables
- the need for larger database
- increased data, better scaling of property and socio economic variables

To summarise, to be effective MRA requires sufficient validated data segmented by market areas and property types. Identification of the market areas may not be easily achieved and may require some other form of analysis. These objectives may not be readily satisfied.

Adair et al ( op. cit. )

*"it is impossible to resolve the data problems satisfactorily - complete data may result in multi-collinearity among the variables whereas stratification may make the sample size too small for meaningful analysis."*

It is clear from the above that MRA can play a significant part in any information technology solution to the residential valuation process but it has its limitations and cannot be used alone to replace present manual systems. Its role may need to be confined to a search tool for key value attributes. That is from a large data set MRA could be used to identify those attributes that have the greatest impact on value. Alternatively having stratified the data utilising an expert system MRA could be used

to analyse the remaining attributes and provide a prediction of value.

Fraser and Blackwell ( op. cit. )

*"comparable selection has stood the test of time in the courts of law the world over. MRA on the other hand is a much more complex process. It is difficult to put in layman's terms and is thus not favoured in law nor by practitioners."*

Eckert (1985) recommends that if a valuer is limited to using linear regression, formulation of a multi-stage model employing both normal linear and log linear regression is advisable thereby producing a hybrid additive-multiplicative model which will more fully approximate the realities of the housing market.

### 4.03 Genetic Algorithms

Genetic algorithms are a form of regression model. Their form was prompted by the process of biological evolution where through continued refinement, rejection of defective products and mutation a viable entity can evolve. Cooley et al. (1994)

*" they require that potential or partial solutions to a problem can be encoded in such a way that improved or complete solutions can be generated by operations analogous to mutation and breeding in biological populations."*

The genetic algorithm uses a process which evaluates then modifies a randomly generated population of encodings so as to favour the more successful encodings. It does this in two ways, either randomly modifying segments of an encoding - mutation or by combining segments of two encodings to produce a new one - breeding.

Genetic algorithms are used where automation is preferred to judgment or where the appropriate expertise is lacking. Cooley et al.( Ibid. ) showed in an analysis of house prices in Canterbury, Kent that genetic algorithms can be successfully used to identify sub-areas within a tightly defined property market area. The study used data on 792 transactions over a ten year period on properties close to the city centre.

By comparison with the local expert the genetic algorithm achieved a level of statistical explanation $R^2$ of 0.839 as opposed to 0.819. Both of these however fall short of the level of explanation suggested by Adair and McGreal (1987), 0.95 $R^2$ and 1988, 0.90 $R^2$ as being acceptable for use in practice.

### 4.04 Artificial Neural Networks

Taking their lead once again from the forms of nature, neural networks have been inspired by the neural structures of the brain. They appear to offer a less rigid/more responsive approach to problem solving where data may be incomplete or contradictory.

In a study of prices conducted in San Diego it was argued that neural networks are superior to multiple regression models when estimating residential property values. Quang Do and Grudnitsky (1992),

*"This paper uses market transactions to provide evidence that a neural network's estimates of residential property values are nearly twice as accurate as those of a multiple regression model."*

Tay and Ho (1993) using a backpropagation model (this is a technique where if a discrepancy exists the software works backwards to adjust the hidden layer weights to reduce the prediction error) to value residential apartments in Singapore also considered that neural networks could be used successfully in property valuation,

*"backpropagation models have a place to play in valuation practice because records of property transactions contain latent valuation functions which backpropagation models can automatically detect, learn and apply to future valuations."*

and when comparing neural networks to multiple regression techniques found a distinct advantage in their application,

*"in multiple regression techniques there has to be a priori parametric knowledge of the form of the non-linear function to be tested.....but in neural networks no such priori information is presumed or required."*

A neural network comprises three layers, an input layer which receives data on a selected range of attributes and an output layer which in

residential property analysis would be the estimated price or valuation. Between the two is a hidden layer which feeds back and re-presents the attribute data to the network to enable it to adjust its weights such that the estimated price equates to the sale price provided with the test data. Tay and Ho ( Ibid. )

*"ANN deduce rules and adjust their connection weights from learning the patterns inherent in the input and output training set.... they learn to solve specific problems without the need for problem specific algorithms."*

The illustration below is a simplified form of artificial neural network as it would apply to the residential valuation process using a limited number of input nodes. In a practical application many more input nodes would be required.

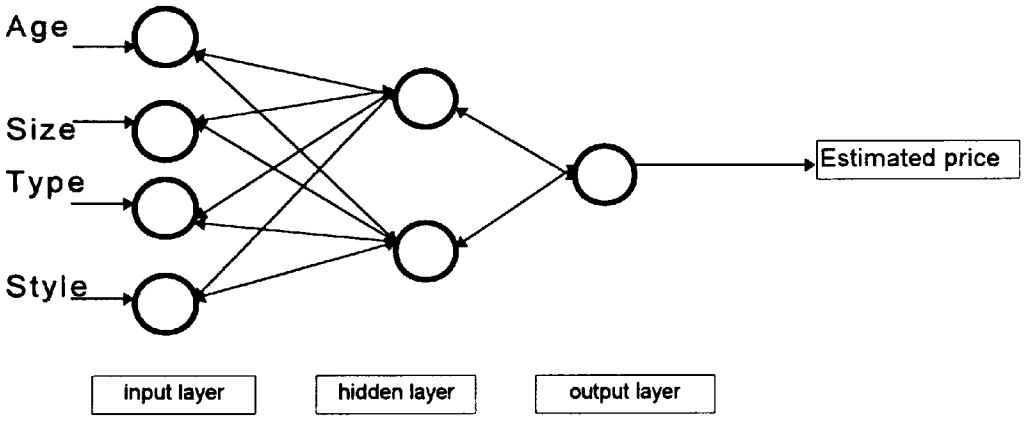


**Figure 10. Structure of a simple appraisal artificial neural network. R. Dennett**

Tay and Ho ( Ibid. )

*"neural networks employ a large number of interconnections to attain a high level of parallel processing."*

It is not necessary for the valuer to understand the mathematics which produce the neural network as a number of user friendly software packages are available and any solution developed would need to be structured such that the user did not require any programming skills (see Chapter 6) One of the criticisms of neural networks is the lack of confidence they promote purely from the lack of understanding.

Borst (1994)

*"Critics of ANN have suggested that it is a 'black box' with little ability for interpretation of the $W_{ji}$ *. This may have been true initially but advances in software have made the solutions offered by ANN much easier to interpret."*

*$W_{ji}$ ....the weights on the connections between the nodes

Artificial neural networks have a good deal to offer the valuation process, particularly in those areas where the factors affecting value are not clearly defined or identifiable, and in this respect have distinct advantage over expert systems. Tay and Ho ( op. cit. )

*"many situations exist where it is difficult to identify and represent the rules experts use to solve a problem."*

Quang Do and Grudnitsky ( op. cit. )

*"Neural networks seem particularly well suited to finding accurate solutions in an environment, such as residential appraisal, characterised by complex, noisy, irrelevant, or partial information or imprecisely defined functional models."*

They offer the possibility of analysing data to ascertain the impact of certain attributes on value. This has the effect of replacing the valuers 'feel' for hard statistical evidence. Evans et al.(1992) explained how an Artificial Neural Network achieved this:

*"The trained network allows not only the estimation of the value of unknown properties but also the analysis of the value effects of various attributes of the training set of properties. This can be achieved by repetitive testing with a notional property, during which a single parameter is varied over the desired range while the remainder are still fixed."*

Borst ( op. cit. ) was able to show that ANN performed well in establishing initial value estimates achieving an absolute error (prediction vs. Actual) of 7.5% and Quang Do and Grudnitsky ( op. cit. ) proved neural networks to be nearly twice as accurate as multiple regression models with a mean absolute error of 6.9% .

These levels of accuracy achieved with neural networks have only been possible where transactions in a very narrow domain (both in terms of time and space) have been used, they are however close to the error

rates achieved by experts ( see Chapter 3) and clearly offer potential for use in the residential valuation process.

Evans et al.( op. cit. ) using a data set of 34 (subsequently reduced to 33) properties in 14 streets in a single town in The Midlands were able eventually to achieve an average error rate of 5.03% with a maximum of 11.1%. This was achieved by reducing the number of attributes from 10 to 9. The omission of central heating improving the error average from 13.48%.

Evans et al.( op. cit. ) considered neural networks could be of benefit to valuers in one of at least three ways.

*"1. As an additional tool to speed the normal valuation process of gathering comparables and adjusting for differences in parameters such as location, floor area etc.*

*2. Checking for discrepancies in returned figures, obviating the need for inspection in many cases but also highlighting non-conforming figures for further investigation.*

*3. For preliminary so called desk top valuation. The valuer then has a suggested figure on which to work."*

As with the work on MRA there are limitations with neural networks. One of the most significant has been computing power. Tay and Ho (op. cit.) using a simplified backpropagation model with 10 items of data (input layer), 5 nodes in the hidden layer and 1 output node found that it took 205,858 iterations on a training set of 833 cases to train the model.

*"Highlighting the need for the backpropagation to run on powerful computers."*

Recent advances in computing power are overcoming this problem.

Whilst Artificial Neural Networks have the ability to identify rogue pieces of data, to provide levels of accuracy necessary for a practical application they must have a carefully selected data set.

Evans et al.(op. cit.)

*" Although the network is fairly robust and can cope with a certain amount of 'noise' inappropriate entries in the data set, like the single flat originally included in the trial will affect the level of error."*

It would not be feasible in practice to re-present data to a network to ascertain the degree of error and hence reliability of valuation prediction. Therefore if Artificial Neural Networks are to be incorporated into an application it would be necessary to develop a rigorous approach to the collection, validation and selection of data.

Lenk et al. (1997) when comparing ANN's to hedonic pricing models found little or no advantage to their use and concluded,

*"that caution be exercised and that more technical knowledge is needed before private and public confidence can be placed in these techniques for property valuation lending decisions."*

Further research however, by Lewis et al.(1997a), (1997b) has explored two ways of handling the location component of property data with some success. One of the key limitations of the studies mentioned above is that they were restricted to homogenous groups of properties in tightly defined geographical locations. In their first piece of research Lewis et al (1997a) used Kohonen feature maps both to identify groupings within the initial dataset and also to aid in the subsequent valuation analysis using an ANN.

*"It is evident from the results obtained, that the methodology proposed in this paper compares very favourably with the more conventional neural network approach. An average increase in prediction accuracy of 10% was achieved using the new method."*

In their other research Lewis et al, (1997b) have opened up the exciting possibility that Census data can be used to account for the location component of comparable data. Census data is available for the whole of the U.K. which can be analysed by postcode district.

*"This paper presents results indicating that features extracted from Census data can provide location surrogates that significantly improve prediction accuracy."*

Further work is required in this area but it does offer tremendous potential for the use of ANN's in the residential valuation process.

### 4.05 Expert Systems

Expert Systems attempt to replicate the behaviour and thought processes of human experts in any particular field of expertise. Experts accumulate knowledge or data relating to their particular field and then use that knowledge to solve problems or complete processes within the given parameters of rules and regulations that may exist. Expert systems are a computerised means of replicating human expertise, utilising knowledge acquisition and knowledge application techniques.

An expert system can be developed to be better than any single expert and therefore increase the levels of competence and ability of the users. Rychener (1985)

*"Expert systems are a good means for pooling the expertise of a number of specialists to provide a system that is more effective than any single specialist working alone."*

Gronow and Jenkins (1991) saw the expert system as having the level of expertise of a consultant and being a method of reproducing expertise rather than analysis of data.

Czernkowski (1989) considered one of the benefits of expert systems as being able to model complex non-linear and qualitative relationships and processes such as those which exist in the field of valuation and:

*"by mimicking an expert, the knowledge and reasoning capabilities may be applied to a problem without necessarily having the expert present."*

Expert systems unlike the mathematical models that have been considered earlier have the added benefit of being able to provide some explanation of the conclusions reached. Gronow and Scott(1987)

*"the user is usually able to question the system as to how it reached its particular recommendation."*

Czernkowski ( op. cit. ) felt that expert systems could go beyond the abilities of a human expert.

*"the human mind's inability to handle more than a limited number of information 'chunks' means that the human expert will inevitably resort to heuristics in analysing situations which require the simultaneous manipulation of many rules and data items. The ability of expert systems to investigate each avenue persistently and methodically means the problem of limited human information processing ability may be minimised."*

Gronow and Scott ( op. cit. ) described expert systems as differing from conventional systems in three ways:

- they offer advice when faced with incomplete information
- they utilise sophisticated knowledge storing and manipulating techniques
- their knowledge base is stored separately from the inference engine

Expert systems provide a structured model of expertise. Scott (1988) described expert systems as comprising of two parts.

*"Simplistically the expert system can be considered to consist of two parts, a knowledge base and an inference module. .....The inference module evaluates and interprets those rules for a given set of circumstances and is able to reason logically around the data that is presented."*

Wiltshaw (1986) considered the expert system to comprise of three parts:

- A knowledge base
- An inference engine
- An explanatory interface.

*"a knowledge base consists of the facts and relationships the expert thinks exist between the facts."*

*" an expert system possesses an 'inference' or 'reasoning' capability which processes knowledge."*

*"the inference engine handles two aspects of the experts expertise. The first is the manner in which the conclusion is drawn. The other is how the procedure should be controlled."*

Medsker (1996), produced a diagram which provided a very clear outline of the composition of an expert system. It is repeated below to aid in the understanding of the following sections.

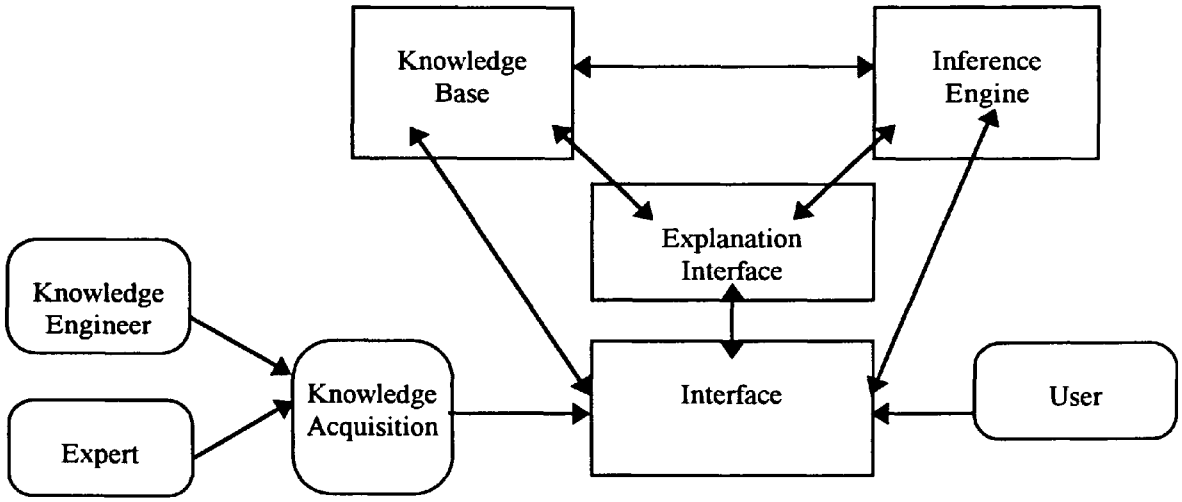


**Figure 11. The architecture of expert system development and operational environments. Source: Medsker (1996)**

The first step in the development of an expert system is to identify the expertise that needs to be built into the system to replicate the processes of an expert or experts in the particular domain. Gronow and Scott (1986) explored the various means of eliciting knowledge from building society valuers. Two basic approaches were identified. Rule induction (learning by example) and active methods.

With rule induction as with MRA a set of data on different properties would be required to form the training set. The 'expert' valuer would provide the initial guidance on those attributes that impact on value and an expert system that can induce rules and relationships would be applied to the data set to establish those rules and relationships by induction. These could then be applied to subsequent valuations.

There are however dangers in this approach. Scott and Gronow (1989)

*" a forceful personality in a given elicitation process may effectively produce a single expert system rather than the required multiple expert system."*

Scott ( op. cit. ) overcame this by developing a single valuer model before exposing it to the critical appraisal of multiple valuers. The same approach would need to be adopted with active methods which although they can take a number of forms, would still be susceptible to the influence of a single valuer.

Gronow and Scott (1986) described the most often used forms of active methods as observation, introspection, interviewing and model criticism.

Czernkowski ( op. cit. ), when considering the difficulties of developing a system, put forward the proposition that the appropriate approach may be elicitation of the valuer's decision model and parameter weights rather than the assumption of a model and statistical discovery of parameter weights. As such he expressed a preference for active methods over rule induction.

Kolodner (1984) suggests that knowledge is built incrementally:
*"By repetition, reasoning processes are refined and rigidity of rules learnt.... Experience turns unrelated facts into expert knowledge."*

It has been shown in the last chapter that the methodology of residential valuation (in particular the process of comparables analysis) is far from clear and therefore the elicitation of the valuer's decision model would not be straightforward.

Scott ( op. cit. ) described the problems of 'Knowledge Elicitation' thus:
*"The knowledge was not however easily available because most valuers are trained through a combination of academic study and practical experience to execute a task. They are not trained to explain the processes and reasoning involved in the execution of the task."*

Scott and Gronow ( op. cit. )
*" the sequence of activities used in residential valuation is poorly described."*

Gleaning knowledge from the expert is fundamental to the development of an expert system and is a stage through which every system must pass.

This process can delay development. Medsker ( op. cit. )

*"The knowledge acquisition process, which can be difficult and time consuming, has been identified as the bottleneck in the knowledge engineering process."*

Wiltshaw ( op. cit. ) identified the need for an explicit understanding of the expertise to be replicated.

*"Formally the expert may not be able to explain his analytical ability.....What the human expert would put down to 'judgement' has to be explicitly modeled."*

Gronow and Scott (1986) concluded that all approaches had their limitations and suggested a combined approach. This would consist of:

- an interview with a valuer to establish areas of importance and identify key concepts and relationships.
- observation of the valuer at work
- an opportunity for introspection by the valuer on his approach to the valuations observed.
- probing by the developer to provide sufficient material to develop a prototype
- evaluation of the prototype by the valuer.
- an iterative process of refinement until a workable application is developed.

It is clear that the more expertise and knowledge that is built into an expert system the more efficient it will reason and the more accurate will be the results it produces.

Expertise can be considered to be domain dependent, that is it usually comes in narrow specialised domains. Scott ( op. cit. )

*"for an expert system to function adequately it must have a detailed knowledge of its field of specialisation. If the 'grain' size is too large the system will reason crudely, the result an expert system which operates at the level of a superficially informed novice."*

Having elicited the knowledge the expert system developer has to select a method of representing that knowledge.

Gronow and Jenkins ( op. cit. ) identified various ways of doing this:

**Production Rule Reasoning** is a logical process that follows the premise that given A and B, C can be deduced using for example an IF - THEN function. This approach is suited for situations where there are clearly defined answers such as true or false. This approach has been used in the development of the Tree Identification database which is described in the next chapter. Gronow and Scott (1987)

*"a production rule method of knowledge representation would probably be the simplest to operate and build. However, it may not be suitable in all aspects of the valuation process. An ability to use the more complex, inference network type of representation would therefore be required."*

**Inference Networks** are built up with a system of 'Nodes' which represent objects that are connected by 'Arcs' which represent the relationships that exist between the nodes. The benefit of this approach is that items lower in the network can inherit features from items above. Inference networks are considered to be a psychological model of human memory.

**Frames** are data structures to which several types of information can be attached:

- How to use the frame
- What one can expect to happen next
- What to do if expectations continue.

Higher levels in the frame contain the general concepts whereas the lower levels are more specific.

Wiltshaw ( op. cit. ) envisaged the expert system as being able to

*"form an initial impression (based on macro data) and then revise it in the light of detailed evidence."*

The following (Figure 12) is an example of how a frame could be used to represent structural cracking diagnosis in domestic buildings.

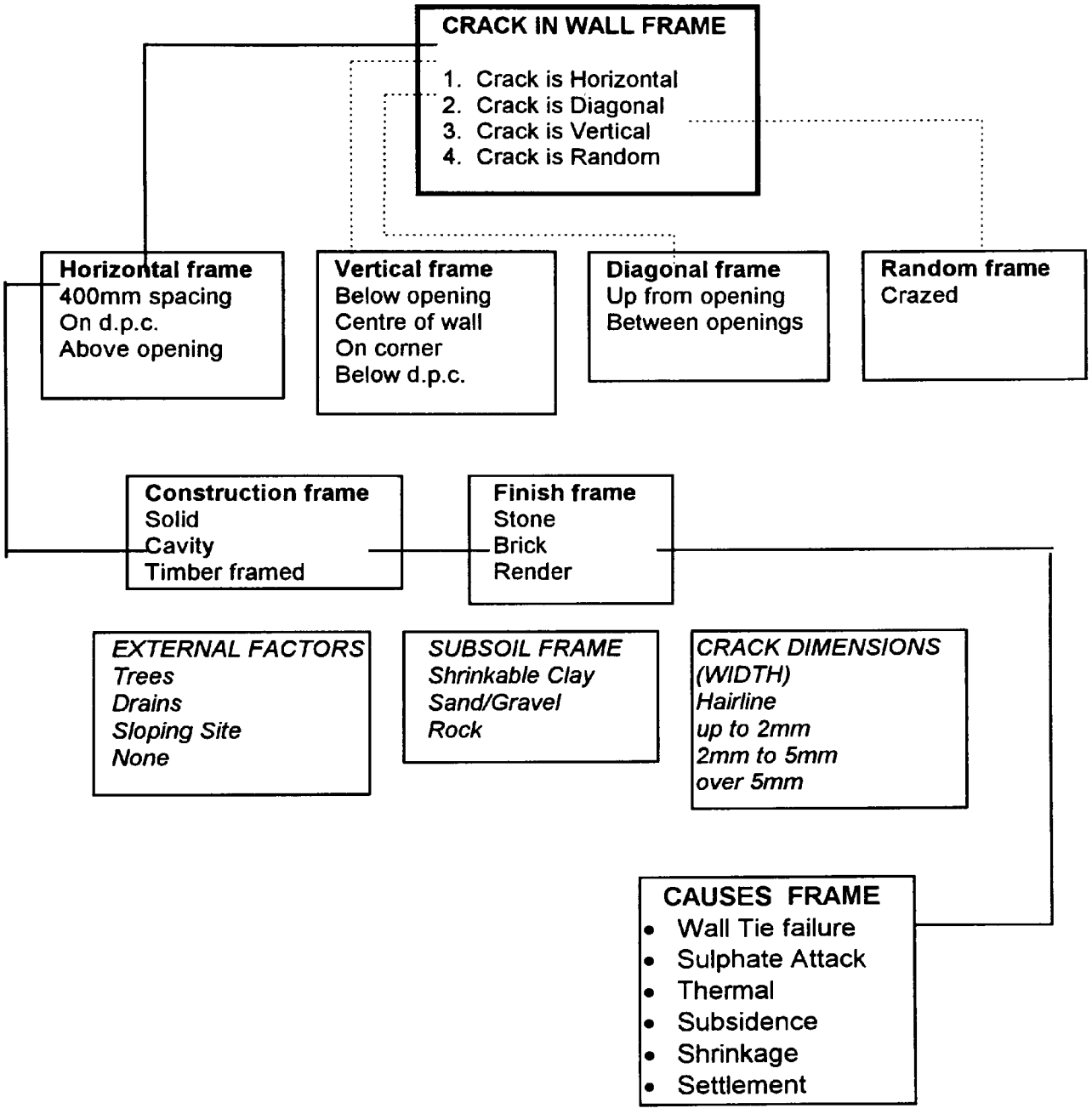


**Figure 12. Schematic of Frame Based Expert System.**

Gronow and Jenkins ( op. cit. ) considered Frames to be a suitable approach to mortgage valuation expert systems in the context of the valuation process. Grant and McTear (1992) used a combination of rules and frames when developing a prototype expert system for mortgage valuations.

Jenkins (1992) suggested that expert systems can be easier to develop to assist in the inspection process than for valuation analysis because much of the valuer's declarative knowledge focuses on diagnostics. The above is an illustration of how a framed based approach could be beneficial to the diagnostic process.

Having found structural cracking to a property the valuer is required to either provide an 'on the spot' diagnosis or consult an expert. Obviously as valuers build up their expertise the need to consult an expert diminishes but there will always be situations that the valuer has not encountered before. The expert system can provide the expertise and therefore speed up the valuation process. It is necessary to make the diagnosis as the degree of severity of the defect or problem that has been encountered will have an impact on value.

In the illustration above the order of the frames starts at the higher level in a generalised form with the nature of the crack, through the lower levels the user is queried to provide more detail to enable the diagnosis to be made. The system will be able to guide the user to the appropriate next frame based on the response.

Gronow and Scott (1987) when considering the user interface commented that it

*"provides advice by asking the system user questions, the responses to which are used to formulate a course of action."*

In this instance once it has been established that the cracking is horizontal with a 400mm spacing in cavity brickwork the diagnosis can be made without the need to interrogate the user on, for example, external factors, crack dimensions and sub soil.

The process used in the frame based approach above is an example of forward chaining. Expert systems can be developed to work towards an unknown conclusion (forward chaining ) or to prove a known factor (backward chaining)

Czernkowski ( op. cit. ) described the differences thus:

*"the chief difference between backward chaining and forward chaining lies in the speed with which conclusions are obtained. Where there exists a single conclusion to be proven (facts to be found), backward chaining may be more efficient because investigation of the environment is goal orientated. If however, a number of conclusions is possible forward chaining may be more appropriate."*

Gronow and Scott (1987) indicated that forward chaining is the most appropriate technique for valuations given that a value is sought from the data rather than the data being sought to prove a pre-existing conclusion. Whilst this is strictly true from an academic standpoint, Gallimore (1995) established a considerable degree of confirmation bias in the valuation process. This bias is to a certain extent brought about by the commercial pressures outlined in Chapter Two and these should be ignored in the development of an expert system.

To be of value the solution must provide impartial, unbiased advice. It should replicate what a valuer should do, not necessarily what he does.

Backward chaining could legitimately be used in a valuation expert system to test the accuracy of valuations placed on property for mortgage by external or sub-contracted valuers.

Gronow and Scott (1987) put forward the proposition that

*" a valuer when selecting a system must decide on what functions he requires and to what purposes he intends to use it"*

and went on to provide a specification for a system for mortgage valuations.

The specification stated that an expert system for mortgage valuations should:

1. arrive at an acceptable value by forward chaining.
2. be able to access external functions such as a comparables data base.
3. include an induction package - due to the lack of a basic methodology.
4. have the ability to deal with uncertain information.
5. be easy to use and construct.
6. be capable of running on commercially available hardware
7. be cost effective

Item four above highlights one of the features of expert systems that is not present in the statistical methods of analysis. That is the management of uncertainty. Uncertainty can occur for a variety of reasons.

Zahedi (1993)

*"Knowledge could be vague, experts could be uncertain or even wrong and the user may not have the ideal data for the case."*

Byrne (1995)

*"It is generally agreed that uncertainty results from imperfect information and lack of knowledge."*

Uncertainty can face the valuer in a number of ways and these have been summarised by Scott et al. (1989)

*"Types of uncertainty, imperfect (incomplete) knowledge, intrinsic randomness, inherent interdeterminancy and categorical uncertainty."*

In the valuation process imperfect knowledge may relate to unknown lease details and, in situations such as this, the valuer would make and state assumptions that qualify the valuation placed on the property. An expert system could be programmed to make such assumptions in the absence of relevant information.

Intrinsic randomness relates to situations where the facts are not known, only the probabilities about those facts (Scott , op. cit.). This situation is less likely to face the valuer in the actual valuation process but is present in other areas where expert system may be of assistance such as the Tree Identification System referred to in the next chapter.

Probabilities or confidence factors could be assigned to aspects of tree identification such as bark colour (low probability) and bud pattern (high probability).

Byrne (1996)

*"In any decision involving uncertainty, probability is used to describe the amount of uncertainty present."*

Scott ( op. cit. ) uses the diagnosis of dampness to explain inherent interdeterminancy where an effect may have more than one possible cause; again probability is used by the expert system to manage the uncertainty present. Categorical uncertainty in the valuation process relates to those attributes or situations where the required solution is situated within a range of values. This has been described as 'fuzzy' in nature. An example would be when adjusting a comparable for valuation purposes; it may be known that the effect of a property being in a different part of the town would have an impact on value of between 5 and 15%.

This range of values would have been established by the expert through experience and could be managed by applying fuzzy reasoning or fuzzy logic. Zahedi( op. cit. )

*"Fuzzy logic is a method for approximate reasoning, when the proportions are inexact or vague."*

Byrne (1995)

*"The basic proposal is that vagueness and ambiguity can be described and distinguished mathematically."*

It is no longer necessary for a valuer to be fully conversant with the mathematics of probabilities and fuzzy reasoning, an application called FuzzyCalc makes this possible.

Byrne ( Ibid. )

*"This investigation has been made possible by the availability of the special purpose spreadsheet package FuzzyCalc. This is a Windows based software product, which uses fuzzy arithmetic to model the imprecision or vagueness which fuzziness implies."*

FuzzyCalc operates like a straightforward spreadsheet in many respects, its distinction is that it allows 'crisp' values to be replaced by 'fuzzy' values. This can be applied to any or all attributes of a comparable. In the above example the 'crisp' value , (if this figure could be known for certain) would be the centroid of the range i.e. 10%. The 'fuzzy' value would lie somewhere within the range 5 to 10%.

FuzzyCalc allows a 'belief' to be attached to the range of values, indicating the level of confidence in the favoured value in the range.

Used on its own this application would rely on subjectively assigned values provided by the user. This is not altogether desirable but does offer a degree more sophistication of analysis than manual or simple spreadsheet approaches.

Byrne ( Ibid. )

*"It can be argued that the most important thing is to actually attempt the analysis, by whatever method, simply as a way of reducing the amount of risk/uncertainty, or vagueness, in the decision."*

The preferred solution is a rigorous analysis of available data using a statistical approach such as MRA or an ANN to establish a more precise value for the various attributes. That value can then be managed using a fuzzy application.

Byrne (1996)

*"Well informed decisions and decisions that explicitly confront the problem of measuring uncertainty, depend substantially upon an adequate information base."*

Expert systems potentially offer the greatest assistance to valuers in the residential valuation process but as Wiltshaw ( op. cit. ) pointed out there lies a challenge for system developers to make them acceptable to the property profession.

*"Expert systems challenge appeals to 'feel' , 'experience' and 'judgement' in human decision making."*

## 4.06 Geographic Information Systems - GIS

A GIS is a computerised way of replicating, analysing and manipulating information that previously has been contained in the main in paper based maps.

ESRI inc (1993)

*"A GIS is not simply a computer system for making maps. A GIS is an analytical tool."*

Antenucci et al. (1991)

*"Analytical capabilities permits sophisticated processing and interpretation of spatial data. Examples include: Functions that rely on complex algorithms for engineering and demographic analysis and modeling and are used for such tasks as assessing property values with Computer Aided Mass Appraisal."*

In addition GIS provide a means of storing and accessing data (in this instance property related data) in a geographic context.

Finch (1992)

*"A GIS is defined as a computational database management system for capture, storage, analysis and display of spatial (locationally defined) data."*

Oberymeyer and Pinto (1994)

*"What sets GIS's apart from all other types of information systems are their reliance on spatial referencing as their organising framework and their ability to perform graphic analysis."*

A GIS essentially is made up of two types of data. These comprise the geographical or 'locational' data and the attribute or 'non-locational' data. Maguire et al (1990). Geographical data would include the topographical features (roads, rivers, railways, buildings etc.) . Attribute data may relate to aspects of those geographical features (for example: classification of roads, pollution levels of rivers, ownership of railways or condition of buildings).

Maguire (1991)

*"in GIS, the geographical element is seen as more important than the attribute element and this is one of the key features which differentiates GIS from other information systems."*

Finch ( op. cit. ) identified four conceptual components of a GIS:

" *1. Measured location data (absolute position)*

*2. Relative location data (relative position or topological)*

*3. Attribute data (non-locational)*

*4. Time."*

In Chapter 3 it was demonstrated that location is one of the key attributes affecting property value.

Dixon (1992)

*"It is important to realise that the spatial aspect of property is one of its key features."*

Wyatt (1995a)

*"The influence of location on value is regarded by many as the most important value factor."*

Unlike property size the locational influences on value cannot be measured or quantified numerically (a later chapter will explore the various approaches to identifying and quantifying locational factors employed by the Halifax Valuation Surveyors and developed for the Dragon project).

Wyatt (1995)

*"Locational influences on value do not lend themselves well to the rigours of statistical valuation techniques such as regression."*

Geographic Information Systems provide a means of recording locational factors, locations of property and their subsequent analysis. A GIS could be used to map property values in relation to the various geographic influences that may affect value. Wyatt (1995a)

*"The use of GIS offers the ability to identify and analyse locational influences on property value using established geographical methods such as network analysis and overlay techniques."*

Dixon ( op. cit. )

*"Surveyors are not trained specifically as geographers but many of their activities are based on considering values in a locational sense."*

Barrett and Okuruwa (1993)

*"GIS permits geographically referenced information to be stored, edited, manipulated and analysed to generate interpretive maps and related statistics relevant to decision making."*

A GIS provides the property professional with a highly appropriate new way of analysing and maintaining property data.

Oberymeyer and Pinto ( op. cit. )

*"GIS represents a new and improved way to do what we and our predecessors have always done."*

Residential valuation surveyors are involved in the recording and analysis daily of numerous property transactions and it is in this area that GIS offer the greatest potential. Maguire ( op. cit. )

*"Applications which record transactions and require the frequent use of simple queries are particularly suited to this approach."*

Antenucci et al. ( op. cit. )

*"Real estate applications of GIS technology promise tremendous potential that to date is largely unexplored."*

In practical terms the elements of a GIS have been described by Finch(op. cit.) as:

" a. *A **data input** system which collects data from existing maps.*

b. *A **storage and retrieval** system, allowing regular updates of information held as spatial data.*

c. *An **analysis** element which performs various estimates, counts and optimisations related to area and distance.*

d. *A **reporting** system capable of displaying spatial information."*

These elements can be considered in the context of the valuation process.

**Data input** would take two forms.

1. Geographical information would need to be obtained from an external supplier. To provide the information to the level of accuracy required, in-house would be prohibitively expensive as not only would it need to be input initially but it would require regular maintenance.

Finch ( op. cit. )
*"GIS is undoubtedly an expensive technology."*

The most likely supplier of such data would be the Ordnance Survey but there are other suppliers who can provide less detailed, less expensive, map data. For example the complete database of 1:10,000 black and white raster maps for Great Britain supplied by the Ordnance Survey would cost £295,000 at 1995 prices. At a much more affordable level the Personal Navigator software package offers coverage of Great Britain at 1:250,000 scale with a location database facility and postcode search (map centering on 1.7m postcodes) for £152. An additional option to this software is a GPS (Global Positioning System) receiver which enables location to be pinpointed to within 25m anywhere in Great Britain - a useful feature for valuers working in rural areas.

Map scale would be dependent on the applications to which it is applied but it is unlikely that the 1:250000 scale would be suitable for the residential valuation process. Ideally in urban areas the 1:2500 or 1:1250 scales would the most suitable however these may prove to be prohibitively expensive and only viable for specific applications.

2. Attribute data could be obtained from a variety of sources (see table 6.1 below) but a large amount, particularly the property specific data (identified in Chapter 3) would be obtained by the user and input either directly from the pen pad Cory, (1992) or using office based facilities.

Gunston (1993)
*"For a GIS datacapture can be time consuming and expensive. Maintaining data accuracy is crucial and this process can also be costly."*

The ability to **store and retrieve** attribute data in a geographical context would be extremely useful to the residential valuation process. On receipt of instructions to value a property for mortgage purposes the GIS user could immediately locate the property using either the postcode search facility referred to earlier or the more comprehensive Address-Point database.

Black (1996)

*"The Royal Mail has a product called PAF (Postcode Address File) which contains the postal addresses for about 25 million delivery points. Ordnance Survey has created a national dataset using PAF called Address-Point. This identifies a national grid coordinate and unique reference for each of the postal addresses."*

Having located the property an initial search for previously inspected properties in the area could be made and their files retrieved simply by selection from the map. Finch ( op. cit. )

*"The GIS provides a dual key system for accessing the (attribute data) information, either by conventional database query or commands or by 'positioning' on a map."*

Gunston ( op. cit. )

*"attribute data may be managed by the GIS directly, or it may be acquired as needed by a related, but separate, database management system. It may also be analysed or queried by conventional methods that do not require reference to location."*

Reference to the various 'layers' (referred to later) would immediately identify any potential hazards or matters to be given specific attention on the inspection which is to follow e.g. flooding, subsidence, mine workings.

The base map would also provide information on distances from value affecting features such as shops, industrial premises, leisure facilities etc.

The real power of a GIS and the potentially greatest benefit offered to the property professional lies in the ability to **analyse** the data.

McAusland (1994)

*"GIS performs operations which if carried out manually would be prohibitively expensive. Its ability to query and manipulate data, to analyse complex data and to bridge departmental boundaries provides real benefits and potential cost savings."*

Wyatt (1995a)

*"The use of GIS will allow a more explicit analysis of locational factors that affect property value."*

The use of GIS for the analysis of property values is still in its infancy and the real benefits that it can offer would only become apparent after extensive attribute data has been collected and stored in such a system. This would be a time consuming process but the resulting property terrier and analytical possibilities that it could present would be extremely valuable. A typical application would be the analysis of the impact on property value of the proximity to water courses.

Wyatt (1995)

*"It is argued that a more explicit analysis of spatial influences on value can be undertaken using computerised techniques available on a GIS."*

A GIS would give greater flexibility to the operation of comparables search and selection. In comparison to a conventional database it would be able to better replicate the actual search criteria of the valuer. Locational searches on a conventional database tend to be restricted to the address file attributes, street, town, county or postcode. In practice using manual search methods the valuer would be most likely to search by proximity to the property (a 1 mile radius for example) or distance from a value affecting feature (such as the city centre).

Using the conventional database these search criteria could be applied but the process would be cumbersome and labour intensive or unsuitable properties would be selected. The search could be effected by separately listing all of the streets which fall within a certain radius of the property - this would be very time consuming. Alternatively several postcodes could be selected but this would select properties beyond the required radius. The search for properties a certain distance from the

town centre would be virtually impossible without the use of a GIS. The following diagram (Figure 13), illustrates this point.

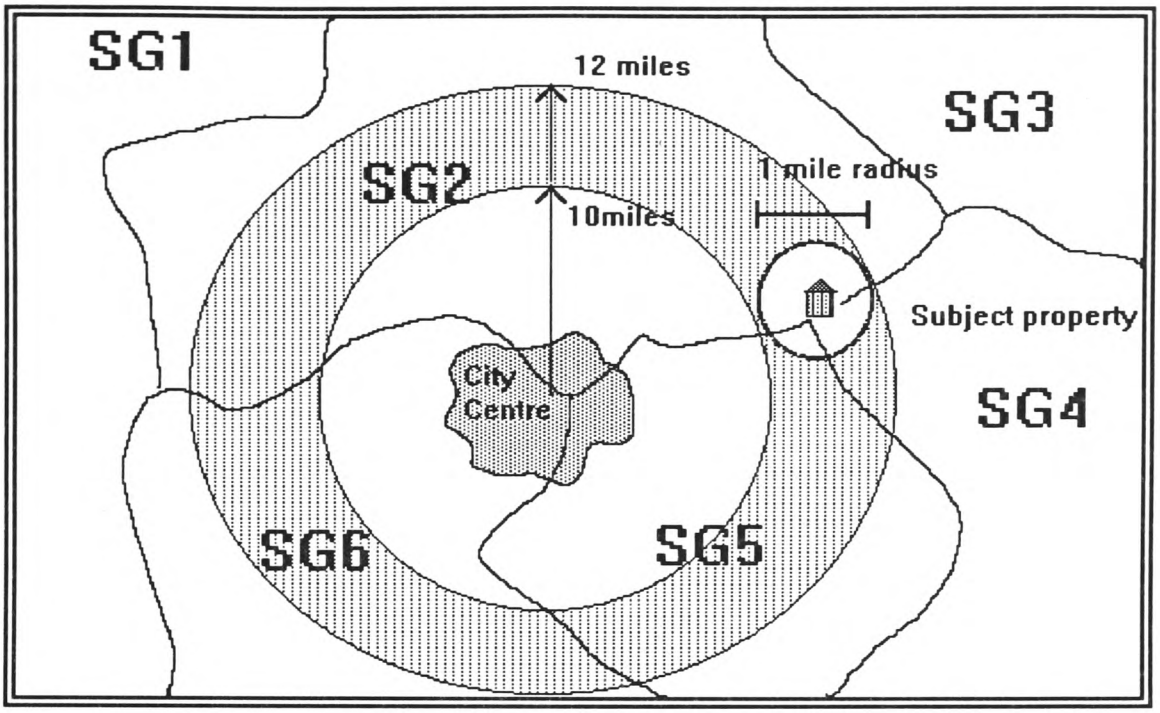


**Figure 13. Comparable Search Options. R. Dennett**

The **reporting** potential of a GIS and the ability to display spatial information would not be of real significance to the residential valuation process as most lenders who issue instructions for mortgage valuations require reports in a pre-determined format. This facility would however be useful for presentations or site appraisal reports where some support to valuation propositions is required.

An understanding of the basic principles of a GIS is required if a solution is to be developed. A GIS essentially comprises two main components, a graphics module and a database. The first storing and representing the geographical data, the second the attribute data. The two are connected via a unique reference code which enables attribute data to be located on the map.

Finch ( op. cit. )

*"The location identifier is a unique code which not only serves as a record identifier but also represents a unique feature which can be identified on a map."*

Gunston ( op. cit. )

*"attributes are linked to the graphic elements through a unique identifier that is stored in both graphic and non-graphic records."*

Gill (1991)

*"There are a number of different methods used to create the key or unique property reference number (UPRN) for each property. Typically they are based upon postcodes and national grid coordinates."*

The Address-Point dataset referred to earlier provides such a link between O.S. map data and data held in a separate attribute database.

Grimshaw (1994)

*"there are a number of data products available which will help to geocode internal company data. An example of such a product is AddressPoint, marketed in the U.K. by Ordnance Survey, which translates an address to a grid reference."*

The graphic and attribute elements of the GIS are held in the system in separate sections which can best be considered as a series of flat files or 'layers' stored on top of each other such that a vertical section through the layers would reveal all of the information relating to an individual property or location. Fung et al. (1995)

*"the system may be conceptualised as a stack of floating maps, tied to a common map base in a way that enables features from individual layers to be correctly referenced to one another from a spatial standpoint."*

Antenucci et al. ( op. cit. )

*"Each layer is a set of homogenous features that is registered positionally to the other database layers through the common co-ordinate system."*

Gunston ( op. cit. )

*"Each layer is a set of homogenous features that relates to the other database layers through a common coordinate system."*

In the Residential Valuation GIS the layers would be organised to provide a range of information relevant to the valuation process. These cover a wide range of topics, with data supplied from a variety of sources. Initially it may not be possible to obtain the data in digital format for all layers and some data preparation may be required by the user. The layers envisaged and their sources are shown in the following table.

| Layer | Source |
|---|---|
| Property Specific Data | Valuer's Site Inspection |
| Postcode | Post Office |
| Address Point | Ordnance Survey |
| Contaminated land | Local Authorities |
| Landfill | Local Authorities |
| Mineworkings | National Coal Board |
| High Voltage Electrical Apparatus | Electrical Companies |
| High Risk Insurance Areas | Insurance Companies |
| Crime Rate | Police |
| Areas Liable to Flooding | Environment Agency |
| Radon Affected Areas | National Radiological Protection Board |
| Contours | Ordnance Survey |
| Roads, Boundaries, Buildings | Ordnance Survey, 1:2500 or 1:1250 |
| Geology | National Geological Survey |

**Table 7. Suggested Layers for a Valuation GIS. R. Dennett**

Fung et al. ( op. cit. )

*"map layers in a GIS database can be organised in a variety of ways, the two most commonly used formats are the 'raster' and 'vector' data structures."*

All geographic features fall within three basic forms, the point, the line and the polygon. In GIS these features are digitised in two distinctly different ways that have their own advantages and disadvantages.

Peuquet (1984)

*"Common usage has usually considered the two basic spatial data model types to be raster and vector."*

In vector format these features are represented by x,y coordinates, singly for the point, in pairs for the line and in series for the polygon. Raster format is a form of tessellation which can be on a rectangular, triangular of hexagonal grid. In their simplest forms both raster and vector data structures have limitations but there have been developments in both fields to improve their efficiency and reduce data volumes (such as run length codes or quad trees for raster data structures). Vector data tends to be of lower volume than raster for any given map area but is less suited for analytical purposes. Conversion of existing maps to digital format is quicker and cheaper using the raster format from scanned images. Satellite images are also captured as raster data.

Gill ( op. cit. )

*"Vector map data gives greater versatility than raster data and is therefore perhaps preferable as the map base. However, vector data is more expensive and it is still not yet available for all urban areas of the country. Raster mapping may then be the only option for certain authorities and more especially those with large rural components."*

The following table lists a comparison of the advantages and disadvantages of the two data formats.

| | Raster | Vector |
|---|---|---|
| Data capture | Fast | Slow |
| Data volumes | Large | Small |
| Graphics | Medium | Good |
| Data structure | Simple | Complex |
| Geometrical accuracy | Low | High |
| Linear network analysis | Poor | Good |
| Area/polygon analysis | Good | Poor |
| Combining data layers | Good | Poor |
| Generalisation | Simple | Complex |

**Figure 14. Advantages and disadvantages of raster and vector data. Source: Gunston (1993)**

Raster data when presented in graphic form tends to have a jagged appearance which can be improved by reducing the cell size but this in

turn increases the volume of the data. There must therefore be a trade off between the two. Burrough (1986) demonstrated the differences with this simple diagram.

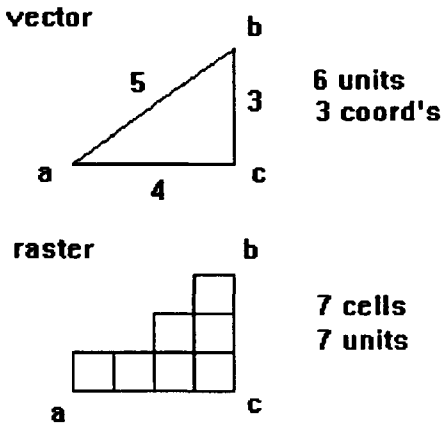


**Figure 15. Raster v Vector - Resolution 1. Source: Burrough (1986)**

The raster representation of the triangle requires 7 cells and gives an incorrect indication of the area enclosed. The image is very 'blocky'. To improve both area representation and graphic quality would have a significant impact on data volume as shown by the extension of Burrough's concept below.

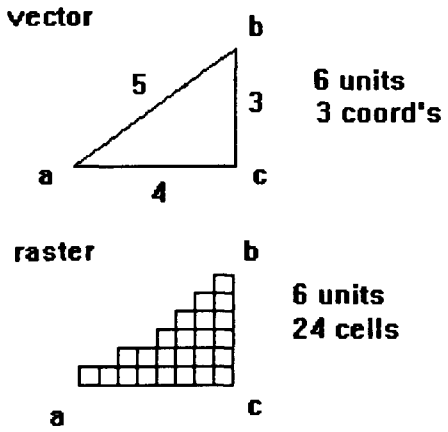


**Figure 16. Raster v Vector - Resolution 2. Source: Burrough (1986)**

Fung et al. ( op. cit. )

*"a vector format provides a more precise approach to feature representation,.....unlike a raster dataset where the polygon boundary is implied the, the polygon boundary in a vector dataset is explicitly defined."*

Most GIS applications now offer raster to vector conversions of data and vice versa. An application which combines both types utilising each for the most appropriate form of analysis or representation would probably be the most efficient. Burrough ( op. cit. )

*"The two modes should now be seen as complimentary in any GIS..... it is probably better to acquire a number of tasks (e.g. vector mapping, raster overlay analysis, interpolation, image analysis) and link them together so that they can make use of common data sources, than to attempt to find a single universal system that can do everything."*

Peuquet ( op. cit. ) concluded that neither type of data model is intrinsically a better representation of space. The choice of format may therefore be dictated by the supplier the data or if the GIS is purchased 'off the shelf' by the system manufacturer. Whatever the format the potential for applications incorporating GIS is enormous.

Finch ( op. cit. )

*"the appeal of a GIS is its ability to generate information itself."*

The use of GIS by the property profession is still very limited. GIS are at the cutting edge of the technology available for use in the residential valuation process. Any information technology solution to the residential valuation process would need to incorporate a GIS.

Leslie (1995)

*" GIS has much to offer any business but particularly the property profession which, paradoxically, has been slow to embrace the technology."*

Fung et al. ( op. cit. )

*"As the real estate industry essentially deals with spatial data, GIS technology represents the most natural in the business. The mapping capabilities incorporated with a RDBMS (Relational Database Management System) provide the ideal tool for managing and displaying property locations."*

## 4.07 Conclusion

It has been shown that to date none of the statistical techniques have been able to achieve the levels of accuracy that would be necessary to be of value in practice or to overcome the scepticism of property professionals. Artificial neural networks have come close when used in conjunction with a Geographical Information System, Borst (op. cit. ).

This success would seem to be in part to the handling of one of the prime determinants of value, location by the GIS. However, in the work by Borst ( op. cit. ) the GIS was used only to develop neighbourhood value correction factors and it has not been demonstrated how effective this approach would be if the system were extended to a sub-regional, regional or even national level. Work by Lewis et al (1997b) has indicated that at the sub-regional level at least , Census data could be used to handle the location component.

One of the prime requisites of a statistical approach to property valuation is a large amount of data. This is not always available in practice so it will be necessary to develop a system that can work to an acceptable level of accuracy with limited data.

The solution will most probably lie with a hybrid system that operates as an expert but with the backing of statistical analysis.
Zahedi ( op. cit. )
*"The integration of neural networks and expert systems has proven to be a useful way to develop real world applications."*

An expert system could be used as a stand alone for providing assistance on inspection (e.g. in identifying problems such as crack diagnosis or tree identification) and in the valuation process as the first step in selecting comparables for analysis by, for example, an artificial neural network..
Zahedi ( op. cit. )
*"beyond its role as an alternative, neural computing can be combined with conventional software to produce powerful hybrid systems. Such integrated systems can use database, expert system, neural network and other technologies to produce the best solution to complex problems."*

Independent research being carried out at the University of Glamorgan concurrent with this thesis has reached the same conclusion.

Gronow et al. (1997)

*"We tested various alternatives using the same dataset and concluded that Artificial Neural Networks (ANN's) outperform Multiple Regression Analysis (MRA) and that the performance of ANN's would benefit from an expert system 'front end'."*

*"Neural network analysis demonstrates potential for the development of generic networks in the appraisal of residential property. In particular, the proposition that separating properties into homogenous groups (using unsupervised networks) would enable more accurate value prediction to be facilitated, proved to be well founded."*

A hybrid ANN/Expert System solution would have the advantage of overcoming many of the problems of Knowledge Elicitation required for a stand alone expert system . Areas of knowledge could be modeled using an expert system with the areas of uncertainty being modelled using an ANN linked to fuzzy analysis.

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CHAPTER FIVE

# 5.00 AN EXPERT SYSTEM DESIGNED TO ASSIST VALUERS

## 5.01 Introduction

The last chapter showed how a frame based approach to an expert system could be used to assist in the crack diagnosis process. As part of this research an investigation has been carried out to explore the practical problems encountered in developing an expert system for use in problem solving and to assess the receptiveness of a 'technology resistant' profession to this form of assistance.

Valuation Surveyors carrying out an inspection in preparation for a report for mortgage purposes are required to have a broad knowledge of a wide range of subjects sufficient to be able to identify any matters that are likely materially to affect the value of a property.

Annex A to Practice Statement 9 of the RICS Appraisal and Valuation Manual Section 1.1.2 states that the valuer's role is to
*"advise the Lender as to the nature of the property and any factors likely materially to affect its value."*

These matters can include the identification of all property types and constructions (such as those designated as defective under the Housing Defects Act 1984), the causes of structural cracking and whether trees are within influencing distance.

## 5.02 Tree Identification

Tree Identification was chosen for the investigation as it presented few problems of knowledge elicitation and good opportunities to utilise a graphical user interface (GUI).

The need for valuers to be able to identify different types of trees is important in areas where the sub-soil is highly shrinkable clay.

NHBC Standards 4.2 D4(c)

*"Shrinkable clays are widely distributed throughout the country. Most highly shrinkable soils are found in an area south east of a line drawn between Exeter and Hull."*

Trees extract moisture from the soil to be able to breathe and grow. Where the sub-soil is clay this extraction causes the soil to shrink and this can result in structural damage. Cutler and Richardson (1981)

*"Changes in volume occur in clay soils as their water content alters, shrinking taking place as the soil dries out; in some this is greater than others. This may be compounded when active tree roots further dry the soil causing local differential shrinkage."*

NHBC Standards 4.2

*"Water demand varies according to tree species"*

Different types of tree extract varying quantities of water and as a consequence of this can affect buildings from differing distances. It is therefore important, if trees are in the proximity of a building being offered as security for a mortgage, for the type of tree to be identified. Furthermore, the valuer will need to be aware of the zone of potential influence which is determined by the mature height and water demand of the tree. Cutler and Richardson ( op. cit. )

*"under certain conditions serious damage can be caused to buildings by neighbouring trees."*

The introduction of subsidence cover into domestic policies in the early 1970's by insurance companies, and the unusually extreme climatic conditions that included the 1975-76 drought have brought the influence of trees on buildings to the awareness of the public.

It is rare for a valuer to have the level of expertise necessary to be able to identify all tree types that may be encountered, and most will resort to books when they are faced with an unknown tree. This can be time consuming. An expert system can offer a fast efficient aid to tree identification and provide more valuer specific information that is not contained in most tree identification guides.

The most commonly used method of tree identification uses leaf samples but these are not always available (particularly in winter).
Coombes (1992)
*"becoming familiar with the principal parts of a tree, and their variety, can help you to identify trees at any season of the year."*

The range of distinguishing features identified by Coombes,( Ibid. ). include leaves, flowers, fruit and bark. For broadleaves alone there are 10 basic leaf shapes, the variety of flowers, fruit and bark is endless and so the task facing the valuer is not easy.

The expert system can incorporate all the distinguishing features of a tree and allow the user to select those that can be readily identified at the time of inspection.

## 5.03 The System Shell

The last chapter considered the features and benefits of expert systems together with criteria for selecting a system. The shell chosen for the Tree Identification System is Microsoft Access (Version 2.0). Reasons for its selection are as follows:

- Microsoft Access is one of the most powerful commercially available relational database programs suitable for use on P.C.'s. Whilst there may be more powerful systems available these require advanced programming knowledge whereas Microsoft Access has many built in features to enable its use by non-specialists.
- It utilises the Windows interface which provides a user friendly environment with the ability to incorporate graphics and pictures which are very helpful in distinguishing the various tree features.
- It is cheap. As part of the Microsoft Office Professional package it is readily available for less than £400. It can be purchased separately for under £250.
- Being used for a wide range of functions there are many books and guides on its use and support for persons developing an application.

## 5.04 How the System works

Wiltshaw (1986) identified the three key features of an expert system as a knowledge base, an inference engine and an explanatory interface. The knowledge base for the Tree Identification System comprises two tables, one containing data for Broadleaves the other data for Conifers. The tables are structured differently because the two main categories of trees have differing distinguishing features. For example, broadleaves do not have cones and conifers do not have buds. The two tables could have been combined into a single data file but this would have contained many empty fields which would not have been an efficient use of the data storage facility and there would be a time overhead on data retrieval.

There are a number of other tables created to aid data input and to assist the user in responding to questions asked by the system. One further table contains photographs/graphics of the tree shapes and leaf sizes. These tables are linked to the two main tables.

The inference engine utilises production rule reasoning but this is not immediately apparent from the users perspective. The user is required to feed in details of the distinguishing features that are available to him, the system then makes a selection from the database of the trees that exhibit those features.

For example:

| | | |
|---|---|---|
| IF | | The tree is a broadleaf |
| | AND | The bud pattern is opposite |
| | AND | The bud grouping is compound |
| THEN | | The tree is either a Horse Chestnut or an Ash |

In this example the user in responding to three questions posed by the inference engine and has been provided with two alternative selections. By responding to a further question the selection can be narrowed down further.

AND The bark pattern is smooth
THEN The tree is an Ash

The construction of this expert system was straightforward as unlike the domain of valuation expertise there are no uncertain relationships between the distinguishing features of the trees. Identification of the various distinguishing features is a matter of observation in the main rather than judgement. It is a matter of fact rather than speculation. This can be illustrated as follows. The difference between a leaf of the common lime as opposed to the small leaved lime is a matter of size, whereas the difference in value between otherwise identical end terraced and middle terraced houses is a matter of judgement.

The process demonstrated in the example above is 'forward chaining' where the conclusion is reached by moving forward from the data.

The Windows environment provides a visual, user friendly, way of inputting data. With the use of text and combo boxes the user can easily input data with the ability to hold on screen those inputs for review, revision or updating as required.

The status bar at the bottom of the screen displays help texts appropriate to the control (text box, combo box, button etc.) that has been selected. The help texts can display information about a control, such as instructions on what type of data to enter in it.

The amount of instruction that can be contained in a status bar "help text" is limited to 255 characters. This limitation can be overcome by the use of on screen help text boxes and graphic aids such as the leaf shape help pop-up which appears when selected.

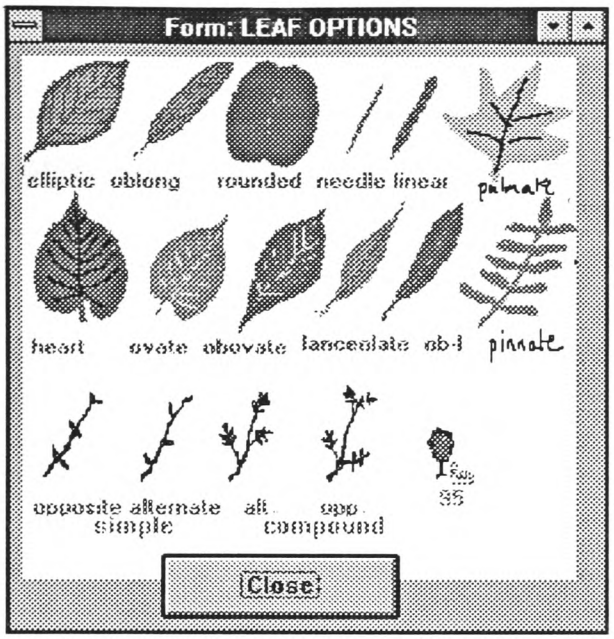


**Figure 17. TIS Leaf Option Help Screen. R. Dennett**

The explanatory interface has also been provided by the design of the expert system. It enables the user to:

- make an inquiry by inputting data such as bud pattern
- review the tree selections that are made from that piece of data
- revert to data input mode and add additional data
- make further inquiry of tree selections and so on until a single tree selection is made.

The use of tree graphics gives the user final visual confirmation/ reassurance that the system has made the correct selection.

## 5.05 Step through the user interface

A run time version of the Tree Identification System is attached to this thesis. The following is a step by step guide to its use.

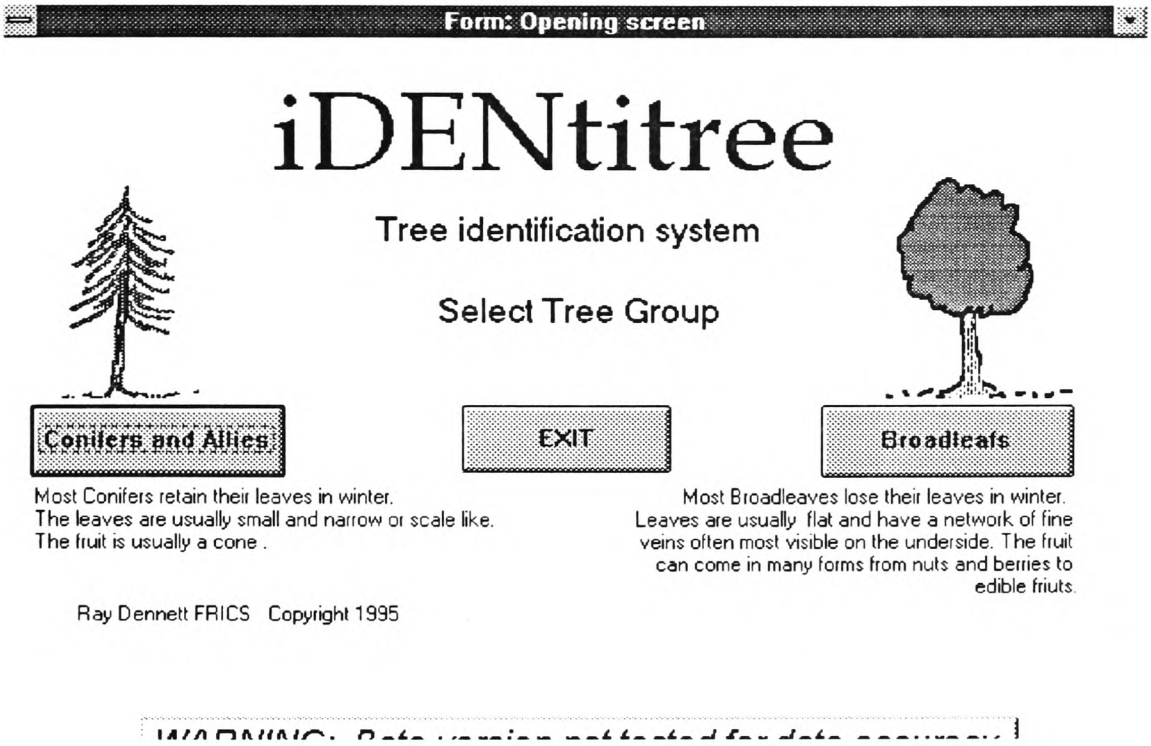


**Figure 18. TIS Opening Screen. R. Dennett**

The opening screen asks the user to select a search for Conifers or Broadleaves. There is a further division of tree types identified by Coombes ( op. cit. ), Palms, which are limited in number and, for the purposes of this system, have been incorporated into the Broadleaf section.

The selection of either Broadleaf or Conifer instigates a search from the respective data file.

Help in making the selection is given on the opening screen but as this system has been developed for valuers it is anticipated that no help will be required at this stage. The selection opens one of two similar screens

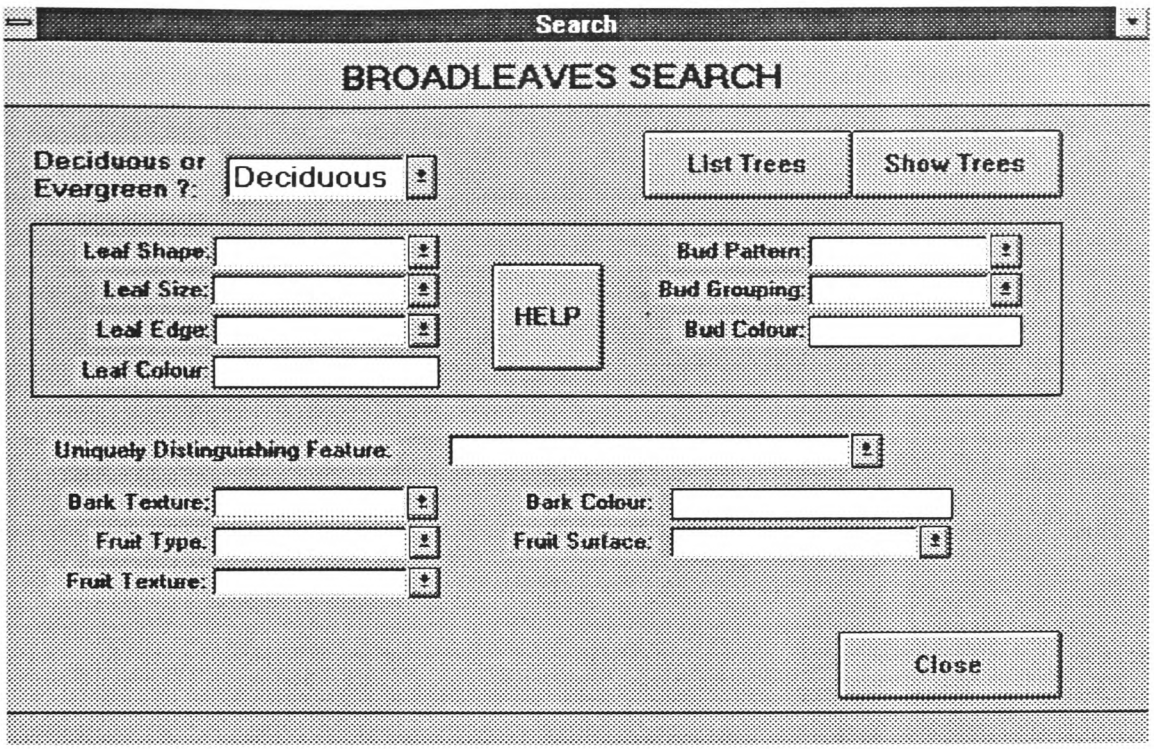


**Figure 19. TIS Broadleave Data Input Screen. R. Dennett**

On the second screen the user enters details of as many features of the tree as he can. Bud pattern and bud grouping for broadleaves are always available and the most reliable in interpretation. Bark pattern and bark colour, whilst also always available, may not be as easy to distinguish.

If the bark pattern is cracked/scarred it may not always be possible to distinguish from ridged. Trees such as beech have predominantly smooth bark but this can be damaged or diseased and appear cracked/scarred.

Colour coding of the background to the data input fields Green, Amber, Red gives the user an indication as to the degree of reliability that can be attached to the data input. Where the user is uncertain as to the input to be made or has no knowledge of the input required (i.e. Fruit not available for identification) he will be advised by the system to leave the field blank. The inference engine will draw conclusions from the data available.

Inaccurate identification of the distinguishing features is not vital as the system provides visual checks and confirmation for the user.

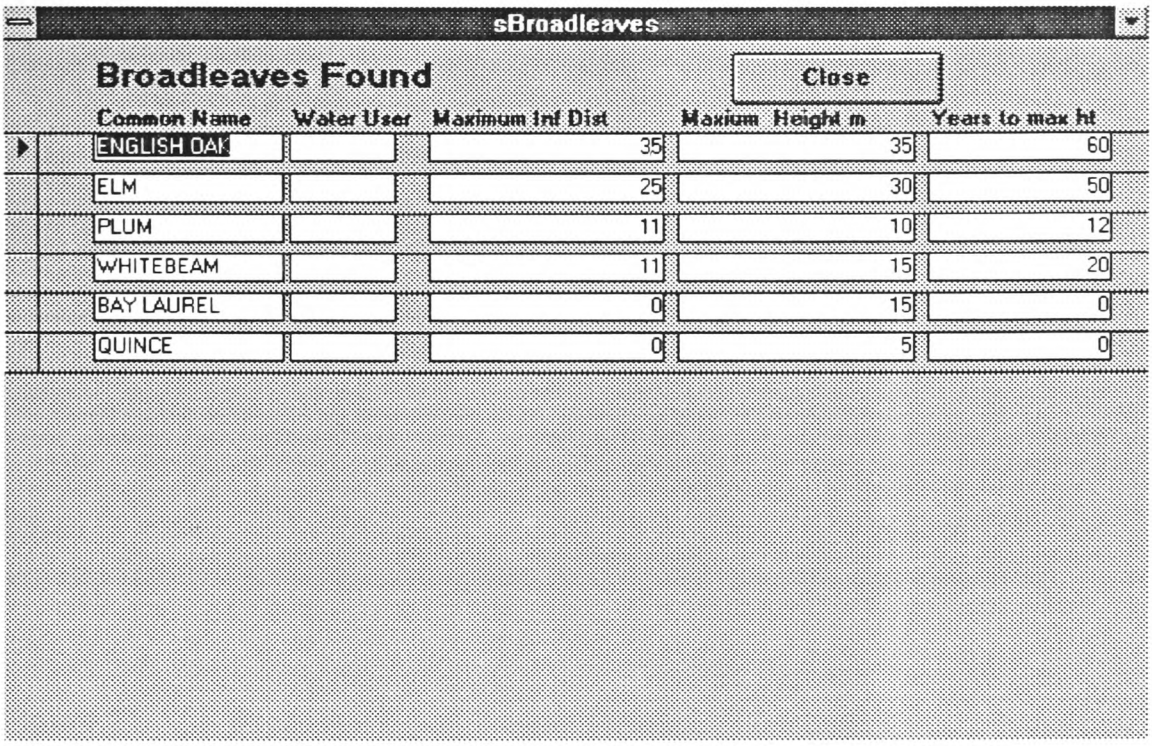


**Figure 20. TIS Broadleave Initial Selection Screen. R. Dennett**

The system provides the user with two outputs. The screen illustrated above gives a list of the tree selections made. This option is most suitable for the early stages of a search. As the search progresses and narrows down the number trees selected the other output which provides graphics of the trees and leaf shapes for the tree selected is more useful.

This screen is shown following. Figure 21.

Once the tree has been identified the valuer is in a position to determine whether or not reference should be made to it in the report.

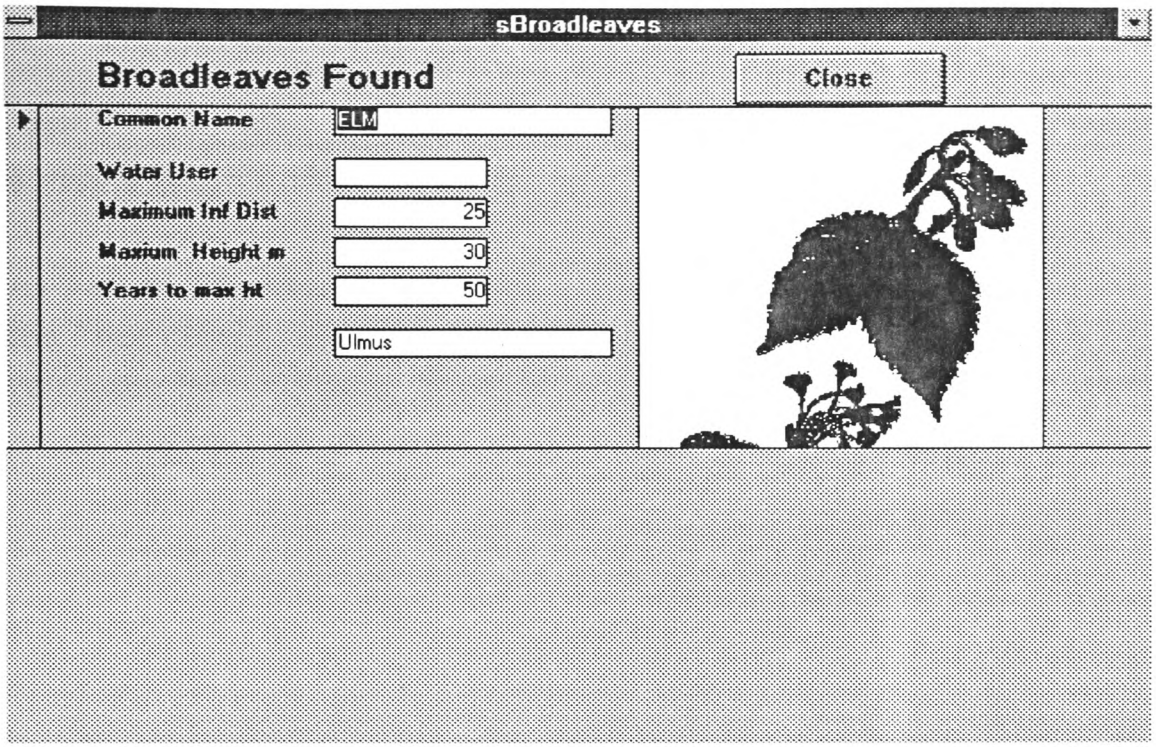


**Figure 21. TIS Broadleave Full Output Screen. R. Dennett**

## 5.06 Findings

In operation, this expert system takes only a few seconds to arrive at a conclusion as to the tree type and to provide in a simple valuer friendly way salient details in respect of influencing distance.

The Tree Identification System has been demonstrated to a number of practising valuation surveyors both internally within the Halifax and to valuers in other organisations. Although none of these have had the opportunity to test the system in practice (it does not yet contain data on every tree type encoutered in Britain) the responses have been very positive and encouraging.

A development of this system could be a link to a G.I.S with information on soil types. For example, Royal Insurance have developed a G.I.S whereby geological information has been input down to 500m x 500m square accuracy. Each soil type has then been categorised into degree

of risk by a panel of experts. This is used to assist the underwriting decision when reference is made by a valuer to trees in a valuation report. The Trees Identification System linked to such a G.I.S. would be a very powerful tool indeed.

As part of an integrated system providing help to valuers on inspection the Tree Identification System could be linked to inputs on tree location (distance from building, whether on site or neighbouring land) and tree height/maturity, to generate report paragraphs.

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CHAPTER SIX

# 6.00 SOFTWARE CONSIDERATIONS

## 6.01 Introduction

The last two chapters have explored the potential of the various applications available to assist in the valuation process. This and the following chapter will consider the software and hardware platform requirements for the complete integrated package. O'Brien and Pantouvakis (1992)

*"whilst the development of any software product involves many factors, there are two important models which have particular pertinence to this work. On the one hand there is the set of user requirements, the 'requirements model' and on the other there is the set of facilities available on a particular hardware and software base, which we have called the 'facilities model'."*

The System and User (requirements model) and Software Considerations (facilities model) will be explored in this chapter. Hardware Considerations (facilities model) will be investigated in Chapter 7.

## 6.02 System and User Requirements

The system and user requirements can be considered in terms of the three main components of the residential valuation process as identified in Chapter 1. All three of which need to be completed and incorporated into the system if a fully integrated information technology solution to the process is to be developed. These three parts are:

1. Inspection
2. Valuation
3. Report (and Administration).

To these must be added a fourth and, some would argue, critical consideration, cost.

Whilst there are a number of commercially available applications developed specifically to support valuation surveyors, none provide a platform that integrates all three components.

1. Inspection

Assistance can be provided on the inspection in two ways. Firstly a platform for recording notes which enables a degree of automation of the report and, secondly, additionally expert help on areas of uncertainty that confront the valuer. Kirkwood (1997)
*"What surveyors need are forms which are flexible, embody checks on input data and transfer the information automatically to a computer."*

Presently note taking is almost universally executed utilising pen and paper for mortgage valuations. However, a new product on offer by DataBuild of Macclesfield (reviewed by Kirkwood, Ibid. ) has provided a platform for note taking but without the expert help referred to above.

It has been common practice on building surveys, of large properties in particular, for practitioners to dictate notes for later transcription. Voice driven interfaces are commercially available. Roberts (1996)
*"Using IBM's Voice Type Dictation software in addition to Windows 95, and wearing a contraption on my head I am dictating straight into my word processor."*

Voice dictation was considered an option for the Dragon project but discounted by the practitioners, mainly on the grounds of confidentiality but it also lacked the functionality of the pen when the need for sketching plans was considered. Jenkins et al. (1995)
*"It discussed the relative merits of voice and device driven interfaces and decided, inter alia, that the system would need a pen driven interface for site work."*

The following chapter explores further the reasons for adopting a pen interface. At this juncture it is sufficient to point out that for any system

to be adopted by a profession that is resistant to change, it needs to be user friendly. Jenkins et al. (1995)

*"Certainly technophobia has an influence in a traditional profession like valuation surveying."*

Almond et al (1996)

*"Part of the problem is cultural, with many older members of the profession feeling threatened by computers."*

The pen interface is as close to the existing practice as can be offered by current technology. It is a much more natural way of manipulating applications than using a mouse for example. A later section in this chapter explores the software options for a pen interface.

Areas of uncertainty that confront a valuer on inspection can include:

- Nature of the underlying geology.
- Unseen locational factors that can affect the property such as liability to flooding, crime rate, conservation areas and green belts, radon and mine workings.
- Forms of construction in particular system built properties and P.R.C. buildings
- Causes of dampness.
- Causes of structural cracking.

Help can be provided in a number of these areas by use of a geographical information system (considered later in this chapter) and in others an ability to display graphics and or photographs linked to explanatory text will be essential.

The previous chapter on Tree Identification demonstrated how a help system utilising graphics and explanatory text could work. Additionally valuation surveyors operate in an environment that utilises plans and diagrams for descriptive purposes. The likelihood of ready adoption of the system would be enhanced by the use of a GUI and the incorporation of graphics.

Typical uses for graphics would be description of construction types and causes of cracking. The GUI also offers the user an environment which facilitates easy input of data and navigation through the application. Cory (1992)

*"A computer which allows the mobile manipulation of graphical data will be an effective tool."*

Defect notation is occasionally effected by sketching and again the provision of this facility would have the same benefits.

As has been demonstrated, there will be a need to collect detail on a large number of attributes and, if reports are to be generated, detail on all factors affecting value including defects must be recorded.

2. Valuation

Valuation database programs are commercially available from a wide range of suppliers. Packages offered by Quest and Fulgent are the most widely used amongst residential valuation surveyors, others include ValueCraft and PI Audit for Valuers. Additionally a number of valuers have developed their own database programs using database software such as Microsoft Access/Fox Pro, Lotus Approach and Borland Paradox.

Garbett (1996) considers the relative ease of creating such databases using software such as Microsoft Access an application with which many undergraduates are becoming familiar.

The systems available tend to record information on a limited number of attributes and provide only basic manual search facilities. None of the packages provide any form of automated analysis of the data collected. It is in this area that an information technology solution can make the greatest contribution to the valuation process. Options for this have been explored earlier. Gronow and Scott (1987a) investigated a number of system shells that could be used in this respect, however Jenkins and Gronow (1993) in a later paper found that developments in relational databases have enabled them to provide many of the features of these earlier shells. No reviews of software available for use in Artificial

Neural Networks, Genetic Algorithms or Multiple Regression Analysis have been found which relate to applications in residential valuations.

Given the dirth of comparable information that frequently faces valuation surveyors it would be useful to index link sales data to prolong their 'shelf life'. Both the Halifax and Nationwide Building Societies publish data on house price movements which could be of assistance in this respect.

3. Report (and Administration)

Administration functions required by a fully integrated application include instruction logging, accounting, report and letter generation and the production of business management information.

To be commercially viable it will be vital for the system to be able to generate reports for the many lenders involved in the residential mortgage market. The systems offered by Quest and Fulgent offer this facility integrated with the database and also providing accounts and business information. Colleys, a division of the Halifax, have also developed a system which can produce reports on the forms of the majority of mortgage lenders.

4. Cost

A prime consideration for the user of any system is the cost.
Garbett ( op. cit. )
*"Quantifying the costs and benefits of an I.T. strategy is difficult. The costs are easy - hardware and software costs are known and can be readily costed. Establishing the benefits is more difficult."*

Cost will be dependent on the basis on which the system is acquired. If the system is to be developed in house or with the collaboration of a supporting body costs will include the Development Application (or Shell) and the accumulated development costs. If specialist programming is required this will need to be built into the equation. The alternative would be to purchase a complete off the peg package which would

include sums for the developers profit. In addition the maintenance of the software will need to be included.

Against these acquisition and maintenance costs can be offset a number of potential savings which have yet to be quantified. The fully integrated system which would include report generation should reduce the requirement for secretarial support. There would therefore be the potential for a saving in staff costs. Gronow and Scott (1987b) have argued that further savings could be made by de-skilling the valuation staff opening up the possibility for residential mortgage valuations to be completed by trained technicians rather than fully qualified surveyors and valuers.

Jenkins (1992) showed how, using a computer based valuation system, technicians could be employed for the valuation of council properties for sale under the right to buy scheme.

The system should offer a real potential for eliminating risk and improving accuracy on valuations. This would reduce the number of negligence complaints against practitioners and thereby provide the potential for reduced professional indemnity insurance premiums for those firms or valuers using the system. This would be similar to discounts available to owners of high risk (in terms of theft) cars that install tracking devices. Professional Indemnity premiums are a major cost to valuers and savings in this respect could (over the lifespan of a system) make a significant contribution to the costs of acquiring and running a solution. Typically, for a single valuer practice, the annual premium to provide a minimum of £500,000 cover on a single claim would be in the order of £2000 to £4000 depending on claims experience. It has been shown that adoption of valuation support software can reduce insurance premiums.Martin (1995)

*"the industry has been slow to react, but things could take off soon. A group of insurers was impressed enough at a recent conference to offer a 5% discount on professional indemnity premiums for users of the software."*

Allied to cost is the performance of the integrated package. It has been demonstrated that there is a need for greater consistency and accuracy

in the field of residential valuations. The system will need to deliver these two features but it must be without any detrimental impact on valuer productivity indeed some users would be looking for an increase in same. As a minimum therefore it would need to be possible using the system to complete a valuation through inspection to report in the same length of time it would take completing the process manually.

A final consideration for the system user is the speed with which it is assimilated and integrated into his daily routine. Lawson (1995)

*"A key point to consider when choosing valuation software is how long it takes to learn to use it."*

### 6.03 Developer Requirements

The prime task of the developer of any application is to identify precisely his customers' requirements to ensure the product that he develops will meet the customers' expectations. Schach (1993)

*"The task of the developers is to determine exactly what it is the client wants and to find out from the client what the constraints on the development process are. Typical constraints are cost and deadline.....reliability, size of code - will it run on the P.C."*

The starting point in this process is the drafting of a **clear specification**. It is appreciated that with cutting edge technology in may not be possible to draft a detailed specification of how the system should be constructed. It should however be possible to specify what the system should deliver, and some would argue with software development that this is all that is required. Jones (1994)

*"Both of these views lead however to the conclusion that the specification should describe only the external view of a system (WHAT it does) and omit the description of the realisation (HOW it works)."*

Hargitay and Dixon (1991) point to the systems approach as the optimal way of producing the specification.

*"The identification and specification of the various tasks should be addressed by using the systems approach."*

The alternative approach is to use rapid prototyping a technique which is particularly useful in software development where it is not possible to specify what the system should do and its operational characteristics at the outset. Miller-Jacobs (1991) summed up the problems with the traditional approach thus....

*"The process does not work because it is based on the misconception that a system can be specified 'a priori' and then built to those specifications."*

...and described the background to the emergence of rapid prototyping.

*"Rapid prototyping has emerged for two primary reasons: shortcomings of the traditional development process and the availability of software tools that facilitate the rapid prototyping process."*

Elements of rapid prototyping were adopted for the development of Project Dragon and will be considered later. The process involves the creation of a simple model of the product to be developed. This gives the user the opportunity to experience the look and feel of the system together with some of the basic functionality at an early stage and enables him to participate in the development process. Franklin (1991)

*"Rapid prototyping - here a small prototype with stubs of the major components is readied for the user's comments. Then new functions are gradually added. This has the advantage of better feedback from users who may be unable to specify the requirements in advance, but will know what they want when they see it. However the evolutionary development may allow major irreversible decisions to be taken before all the implications are known and this can lock the designer into a bad choice."*

Despite the problems with rapid prototyping noted by Franklin ( Ibid. ), it is a method of software development that is rapidly gaining favour particularly in areas that are breaking new ground. Rouff and Horowitz (1991)

*"Rapid prototyping of user interfaces allows a designer to produce a proposed interface in a short time, to easily experiment with different approaches to the interface and to allow the end users to try early in design, when it is most cost effective to make changes."*

Whilst not a consideration for commercial developers, if the application is to be developed by a private individual or educational establishment the choice of software should be one with which the developer is familiar or can readily assimilate.

Jenkins and Gronow ( op. cit. )

*"the valuer/developer hybrid is concerned only with suitability, productivity and ease of use"*

Jenkins et al ( op. cit. )

*"Access had the advantage that it allowed novices an opportunity to contribute to development."*

In any development environment it is useful if the software manufacturer offers support and back up to its purchasers, this can speed up the development process if programming difficulties are encountered. Support can be provided via the internet, over the telephone or through manuals and books.

It is inevitable with any software application that 'bugs' will emerge, often as developers push applications to the limits and sometimes beyond the bounds of their intended use. It is in these circumstances that maintenance is required from the manufacturer to overcome or iron out the bugs.

Continued development of the chosen software by the manufacturer can be useful to the system developer as more effective solutions can sometimes be found.

It is unlikely that a single software application will be found which can satisfy all of the requirements of a residential valuation system: database, expert system, word processing, Object Linking and Embedding (OLE), Geographic Information System (GIS) and pen interface. It will therefore be necessary for the applications chosen to be compatible with each other. Hargitay and Dixon ( op. cit. )

*"Of course, no software is perfect. But it is better to select packages for particular tasks and aim for an integrated, overall system than to select many packages to cover the whole effectively."*

An important consideration for the developer is the facility for producing run time versions of the software, to enable distribution to multiple users in a cost effective manner.

Zahedi (1993)

*"one important consideration in buying expert system software is the availability of the run time or field delivery version of the software as opposed to its development version."*

The final requirement of the developer is good communications with the client or system users particularly if the rapid prototyping approach to software development has been adopted. Lanning (1991)

*"Probably the most important reasons users as designers, should be included in the design process is their ability to add perspectives insights and information that professional designers just do not realise they are missing."*

## 6.04 Options for a Pen Interface

A pen interface gives the user the ability to replicate the basic functions of a mouse, with the convenience of handling a pen together with a range of other functions. These include check boxes, drop down lists, free hand drawing, simplified CAD, note taking and handwriting recognition. Hockley and Scanlon (1995)

*"when used with customised data validation and field navigation, these features significantly improve the speed and quality of data collection"*

Estates Gazette (1994)

*"The user can draw, edit, or query a document quickly by touching the pen to a set of easy to understand commands."*

A check box provides a quick way of inputting data which responds to a yes/no, either /or option. A check box from the Microsoft Access database is shown below. A simple tap with the pen makes the selection.

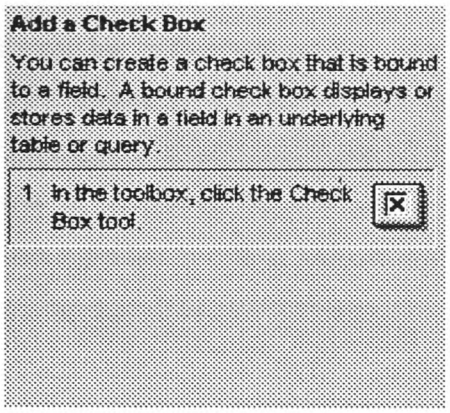


**Figure 22 Microsoft Access Check Box. Source: Microsoft Corporation**

A drop down list or 'combo box' as it is referred to in Microsoft Access, on selection gives the user the ability to select from a range of pre-determined options as illustrated below.

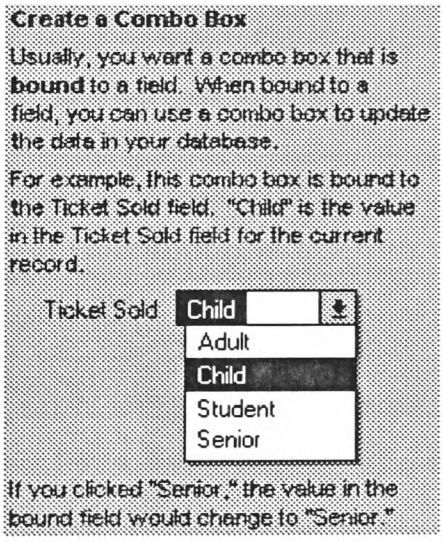


**Figure 23 Microsoft Access Combo Box. Source: Microsoft Corporation**

The benefit with this approach to entering data is that, where the number of options needs to be limited, the selection can be restricted to the options available. The selection can be made by two pen clicks rather

than in this example, for instance the typing or writing of the word 'Child' in full.

Free hand drawing can be effected using any of the 'paintbrush' type packages. In addition there are a range of simplified CAD (computer aided drafting) applications that could be used for sketching plans, elevations etc., some incorporating the ability to calculate areas. This later facility would be useful for fire insurance calculations which are required for most mortgage valuation reports.

There are a variety of software packages which facilitate the pen interface.

Microsoft Windows for Pen Computing provides all the requirements for a pen interface with a basic level of handwriting recognition. It is pre programmed to recognise standard characters giving for most users, who carefully form their letters, a reasonable degree of recognition.

The software also provides the facility for training the recognition system to recognise personal styles to an acceptable level. For those circumstances where the user is having difficulty with the handwriting recognition facility a small on screen keyboard is available.

The success rate and speed of interpretation of handwriting using Microsoft Windows for Pen Computing is open to criticism and a number of other packages are available.

One criticism is that the form of handwriting is not truly natural in that it will not accept letters that have been joined up. Developments in this area are awaited. Partridge (1993)
*"New handwriting recognisers such as Concept and Lexicus from the U.S.A. will translate cursive script but are not yet readily available."*

## 6.05 The Chosen Platform

Chapter 5 outlined the main reasons for selecting the Microsoft Access relational database software for the development of the Tree Identification System. To summarise, it is readily available, powerful, user friendly and relatively cheap. Any database program that satisfies the selection criteria considered above would be suitable for the development of an application for residential valuation. This section will consider some of the main features of Microsoft Access (Access).

Microsoft (1994)

*"Microsoft Access is an interactive relational database management system for Microsoft Windows"*

Access is interactive, it is structured in such a way that applications can be developed by relatively inexperienced developers. It has a number of help facilities including 'wizards' (which can create forms, tables, reports etc.), step by step help, in the form of 'cue cards' and pre-developed applications that can be customised. A wide range of graphical tools are provided to assist in creating and modifying objects in the database.

Jenkins (1994)

*"P.C. based relational database tools like FoxBase, SuperBase and Access are readily assimilated, a key feature if valuers are to remove cultural barriers and develop their own systems."*

At a hidden level Access is a serious productivity tool coming with Access Basic, its own powerful database programming language.

Access is a relational database management system. A database management system is a system that stores and retrieves information in a database. Being relational various chunks of data can be linked to avoid duplication and thus reduce storage and input requirements. This makes Access very flexible and efficient. Updating data is fast and accurate.

Data is stored in tables, presented in columns (fields) and rows (records). Data is retrieved using queries which are questions asked about the data in the database. Forms are used to display, input, update or print individual records in the database and reports are used to present either individual records or summaries/totals of a group of records. The whole process from inputting data to printing reports can be automated without the need for programming by using 'macros' (a list of actions that can be specified by the user). Alternatively Access Basic can be used to automate functions or perform calculations, such as would be used for an expert system, multiple regression analysis or artificial neural networks.

Being designed for use in the Windows environment, Access makes full use of the ability to employ graphics in forms for data collection or help screens and reports. Graphics can take the form of graphs, diagrams, illustrations or photographs (black and white or colour).

It is possible using Access to produce publication quality reports to virtually any design or layout, using a wide range of typefaces and fonts.

Being part of the Microsoft Office suite of applications, outputs from Access can be linked to a wide range of other applications including word processors and spreadsheets. Through OLE (object linking and embedding) graphs, pictures, photo's etc. can be extracted from other applications and placed in an Access object. Jenkins et al ( op. cit. )

*"Importantly it was felt that Access also allowed (from the point of view of the end user) connection to other existing softwares that were of use to the project. Object linking and Embedding, Dynamic Data Exchange (DDE), Access' own RunCode facility and PC Cardware were different kinds of cement that allowed such extensions."*

Access is therefore very versatile and ideally suited to satisfy the software requirements for the basic shell.

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CHAPTER SEVEN

# 7.00 HARDWARE CONSIDERATIONS

## 7.01 Introduction

Any platform capable of operating the software chosen could be used for the Information Technology Solution to the Residential Valuation Process, desk based p.c., or portable. However, for the real benefits that such a solution can deliver to be realised it is vital for the application to be used on site, or at the very least in the valuer's car. This is for the following reasons:

Expert Help - It is not known until the inspection of a property commences what problems will be encountered and therefore what form of help will be required. The Tree Identification System outlined in an earlier chapter is an example of this. It could be argued that notes (or even samples) could be taken on site for later reference. This would however introduce an unnecessary step into the process that would be time consuming and unproductive.

The same argument could not be put forward for a help system giving guidance on identification of Non-Traditional construction forms. It would be important to have this information to hand as the inspection progresses. The help system could provide guidance on specific defects to look for related to any particular form of construction. Holding this information off site would probably necessitate a second visit to the property.

Comparables Search - It is very helpful to a valuer to be able to verify the validity of comparables chosen to support a valuation. Carrying the database with him the valuer on completion of an inspection could

conduct a comparables search and, having selected suitable properties, inspect these from the outside before leaving the area. This would again save a revisit to the area.

Property Records - On revisits to a property the valuer will need to make reference to previous reports and documentation. Over a period of time a property file can grow significantly. Modern techniques make it possible to condense this information and hold it on a computer file. To be able to retrieve this information on demand and on site would be very beneficial.

The search for a suitable platform for these reasons revolved around portables and, in particular, notebooks with the ability to operate with a pen interface. These will be referred to as Pen Pads (Pen operated notepad computers). Partridge (1993)

*"The technology is still so young that the industry has not even agreed on a name for it. So far the choice is between notepad computers, pen-based computers, personal digital assistants (PDA's) and tablets."*

Conic Systems (1992)

*"Pen computers offer significant benefits over 'conventional' portables. Anywhere that a clipboard is used, you can use a pen computer."*

As with software considerations it is considered important for the hardware to be user friendly. This is necessary to overcome any resistance on the part of the valuer to its use.

## 7.02 Advantages of Pen Pads

Pen pads offer the easy transition from 'pen to paper' to 'pen to screen'. More importantly, the use of a pen interface can obviate the need for a keyboard.

Partridge ( op. cit. )

*"What they all have in common is a touch sensitive screen which can be written on with a stylus. The QWERTY keyboard is conspicuous by its absence."*

The ability to use a pen pad without the need for a keyboard has distinct advantages to the valuer on site. Firstly, most valuers do not have keyboard skills. It is evident that with the growth in Home Computers more and more people are developing keyboard skills (many of which are self taught). The following statement was put by the writer to seventy valuation surveyors employed by the Halifax (a representative cross section of the surveying fraternity in terms of age and background).

" I have a good working knowledge of the computer/typewriter keyboard and am competent in its use (not necessarily speedy)."

The respondents were asked to say whether they agreed strongly, agreed slightly, neither agreed nor diisagreed, disagreed slightly or disagreed strongly with the statement.

The responses showed that only 30% agreed with the statement, i.e. considered to have a working knowledge of a keyboard. Only four had any real confidence in their abilities. By contrast 27% disagreed strongly with the statement.

Conic Systems ( op. cit. ).

*"For many people who do not have keyboard skills, a pen interface takes the frustration out of computers."*

Cory (1992)

*"Using a pen is more intuitive than a keyboard as there is direct interaction with the screen, in the same way as pen and paper."*

Secondly, when inspecting a property for mortgage valuation a valuer will carry as a minimum a pen, clipboard, tape measure, torch and damp meter. He will also have available a wider range of equipment including a ladder, camera, spirit level, screwdriver and plumb line but would not expect to carry these at all times. To replace the clipboard and pen with a pen pad and pen is (subject to the considerations discussed later) feasible. It would not be practical to carry a notebook with hinged keyboard, even if it has a built in trackball or touch pad as opposed to a mouse. This would be very cumbersome.

A number of notebooks available commercially have detachable keyboards, and allow the pen interface to be used in the field. The Husky FC-486 has an integral keypad in a one piece slab construction.

Linked to the pen software, mentioned in the previous chapter, handwriting recognition and the pen offer ultimate flexibility to the user. This provides the ability (using memo and sketch facilities) to cope with circumstances which may not have been anticipated in the software development.

A further consideration is that valuers are required to make sketch plans of the building and its site, to record information sufficient for calculating building size and locating significant external features such as trees, streams, rights of way and drainage runs.

Partridge ( op. cit. )

*"One proven area for pen-based computers is with geographic information systems."*

Conic Systems ( op. cit. )

*"Pens are very effective and natural tools for handling graphics and menus, buttons and check boxes."*

Tests have shown that this is difficult with a mouse and very difficult/impossible with a track ball or touch pad. It is very easy with a

pen. Occasionally it may also be necessary to sketch features encountered on an inspection such as structural cracking, although digital cameras have the potential for offering solutions in this area.

Husky Trade Literature

*"Pen input is the fastest and most intuitive way of moving around a computer in the field."*

An advantage of pen based inspection systems, perhaps more to the management than the user, is development of a routine to ensure a consistent approach to note taking. Partridge ( op. cit. )

*"A pen computer will record the results of the inspection in computer form whilst imposing discipline on the inspector by preventing omissions."*

Computers in the field (and that includes pen pads) offer other distinct advantages to organisations with potentially significant cost savings. Linked to mobile phones (which now offer world-wide digital networks) the mobile p.c. can communicate directly to company mainframes and office based servers. This will enable instant downloading of data following site inspection without the need for the valuer to return to the office thereby saving time and hence costs. Valuation instructions can be received by the pen pad user in a reverse of this process.

Conic Systems ( op. cit. )

*"there are major projects under way to introduce a whole range of wireless communication services, from improvements to mobile phone systems to completely new networks dedicated to radio transmission of computer data."*

Once a mobile p.c. has access to the telephone network either through a mobile phone or a direct connection via a standard point, the full range of communication facilities become available. This would include connections to the internet. Connection to the internet offers the possibilities of access to unlimited sources of property related information. Expert help could be provided through this medium with the controlling organisation setting up its own web site as opposed to the

user carrying all the 'expert' information on his mobile. This approach may be useful for disk space hungry data such as graphics and photographs.

The GO Corporation have developed systems which exploit the remote communications opportunities to the full, including automated data transfer. Conic Systems ( op. cit. )

*"If the service required is unavailable at the time, PenPoint will store away the request in its 'Out Box'. When you plug in your printer, network cable, or move into range of the wireless network, the computer will detect that the channel is now available, and carry out all stored requests appropriate to that connection It will also pick up any mail sent to you, download any waiting files, and put them into the 'In Box', ready for your attention."*

The last chapter considered the benefits of employing the use of a Geographic Information System in the residential valuation process. Cory ( op. cit. ) considering the application of pen based computing saw distinct advantages in its use.

*"Survey data is only one element in the data input of GIS. Spatial information of a variety of types could be captured on such devices by surveyors and non-surveyors. This provides a route directly into GIS, instead of via some other, usually manual process, avoiding errors and data formatting problems."*

### 7.03 Criteria for the Selection of a Pen Pad

Various hardware selection criteria were identified by Hargitay and Dixon (1991). Whilst these did not relate specifically to pen pads they are worth considering here as a basis for formulating a strategy for hardware selection. The criteria identified are as follows:

- speed and versatility of the microprocessor
- operating system
- capacity of random access memory (RAM)
- capacity, speed of access, reliability of mass storage-disks, disk drives and other storage devices
- connectivity and compatibility with other computers
- communication facilities
- ease of expansion, enhancement and upgrading
- visual display and keyboard ergonomics
- physical dimensions and portability

These criteria can be compared with those identified through testing and usage in a pilot of the system developed as part of project Dragon. These specifically relate to a hardware platform for use on site. The criteria listed below are in addition to the overriding consideration of cost. Presently this hardware is very expensive when compared to other forms of P.C. However, the potential cost savings and improvements in quality that these solutions could offer make this less significant than it may first appear.

Durability

Valuers find themselves from time to time in challenging environments from building sites to dilapidated properties. If valuers are to carry a pen pad on their inspections it is important that the hardware is sufficiently rugged to perform numerous inspections.

In addition to general build quality and ability to survive frequent handling, experience has shown that portables will be dropped. On a normal residential mortgage valuation potentially the greatest height that one would be dropped would be a storey height (approximately 2.4m),

such an occurrence would hopefully be rare but a drop from waist height (the typical position in use) is more likely.

Inspections are often carried out in the rain. In heavy downpours even the traditional pen and paper requires protection from an umbrella however the requirement to be showerproof to prevent inspections being delayed by light rainfall is considered appropriate. It is also necessary for the equipment to be dustproof.

Some platforms such as the Husky FC-486 can satisfy all of the above criteria in an unprotected form (the manufacturers claim that it can withstand total immersion and a drop from 2m onto concrete), others rely on protective carrying cases.

Bray (1995)

*"the Husky is to computers what the Land Rover is to cars".*

Portability

In a typical day comprising five inspections each lasting on average 40 minutes the valuer can be expected to carry the portable for 3 to 4 hours. Testing by Halifax valuers as part of the Dragon Project identified weight as the critical factor in the selection of a portable. Allied to this is the size and balance of the machine. It must be comfortable to hold and use. Carrying cases with supporting straps can offer significant benefits in this area.

Screen Visibility

Most portables are designed for use internally but if the portable is to be used for valuation inspections it must be capable of use both internally and externally. Glare from sunshine can render some screens virtually unreadable. Portables can offer colour or monochrome screens. The tests referred to above showed that monochrome screens tend to perform best in this respect. There is a wide range of quality in screen visibility.

Processor Speed

It is important that any system does not slow down the valuers inspection. For the system to be viable it must be cost effective and time is money. The Windows environment and in particular Microsoft Access can be demanding on processors and unless, the processor and memory capacity are appropriately specified, there can be an unworkable speed overhead.

Batteries

In any portable system batteries are of vital importance. As battery technology improves battery life extends and weight reduces. It has been mentioned above that weight is the most critical factor. Batteries are a major contributor to the weight of any portable appliance from mobile phones to torches. It is a prime requirement that batteries have a workable lifespan, are easily interchangeable (preferably with the facility to change batteries without switching off the appliance), lightweight and readily rechargeable.

Pen Use/Storage

Having selected the pen interface it is important that it is responsive and operates efficiently with the pen pad. The ability to store the pen on the portable has been found to be useful, as the valuer will frequently need to put it down to use other equipment. Loss of a pen could severely hinder the inspection.

Reliability in Use

Experience of hardware faults and system crashes due to hardware deficiencies has brought this requirement to the fore. Pen pads are still relatively new in development terms. As with all electrical appliances this criteria is likely to decline in significance as improvements in manufacture and design are made.

Miscellaneous

Other less critical factors for consideration include the availability of accessories, suitability for use on desk top, and ease of use with digital cameras. As part of the Dragon project a number of notebooks were evaluated and the findings are summarised below.

| Manufacturer and Model | IBM 360 Thinkpad | Husky FC 486 | Fujitsu Stylistic 500 | Toshiba Dynapad | Compaq Concerto | NEC Versa |
|---|---|---|---|---|---|---|
| Specification | | | | | | |
| Processor Speed MHz | 33/50 | 25/50 | 50 | 20/40 | 25/33 | 20 |
| RAM supplied/max | 4/20 | 2/16 | 4/20 | 4/20 | 4/20 | 4/20 |
| Screen Colour | Colour | Mono | Mono | Colour | Mono | Mono |
| Battery Life between charges (hours). | 2.9 | 10 | 2-5 | 3 | 3.5-4 | 2.5-5 |
| Weight (Kgs) | 2.8 | 2.0 | 1.2 | 2.0 | 2.9 | 1.9 |
| Evaluation March 1995 | | | | | | |
| Durability | Poor | Excellent | Good in case | Fair | Fair | Not Tested |
| Portability | Poor | Good but heavy | V. Good | Good but heavy | Good | |
| Screen Visibility | Good internally | Poor | Good | Good internally | Good | |
| Pen Use | Good | Failed to operate | Good | Good | Good | |
| Pen Storage | Awkward | Not in use | Good | Good | Good | |
| Battery Hot Change | Yes | Yes | Yes | No | No | |

**Table 8. Notebook Evaluation. Source BUG**

During the course of the project both the Toshiba and the Compaq Concerto were withdrawn from production. The NEC Versa was a new entry and not available for test. From the machines currently available the Fujitsu was considered to be the best option being almost half the weight of its closest challenger in this respect.

To summarise, the ideal hardware platform should :

- be lightweight (less than 1 Kg.) and compact .
- have as a minimum a 50MHz processor and 16Mb RAM (if required to operate Microsoft Access or similar power hungry software).
- be showerproof, dustproof, resistant to knocks and drops from waist height.
- have a battery life of 2 hours minimum with hot change facility.
- have excellent screen visibility both internally and externally.
- be reliable and able to operate efficiently the chosen software.

Cory ( op. cit. )

*"Potentially, the pen based computer will be the one survey data capture tool, whatever the task."*

## 7.04 Peripherals

This chapter has concerned itself exclusively with the on-site hardware platform, the pen pad. To be fully integrated the system will require a range of peripheral devices. Some would be essential others not so but their choice would not be critical to the success of the system. These have not therefore been considered in detail for this thesis but in outline would comprise the following.

A server: It is likely that a number of functions could be completed by office based administration support staff. These would perform their tasks on a server which could be a desk top P.C. or perhaps a Workstation or Minicomputer dependant on the size of the operation. Functions would include data management and accounting. It may be necessary for the server to incorporate some form of mass storage device, tape streamer, CD ROM etc.

Printer: Report output could be direct to the customer using electronic communications or alternatively in the form of paper based reports.

Communications Equipment: For receiving instructions or despatching reports.

Digital or Card Camera: The benefits of recording photographically defects or aspects of a property have been discussed earlier. It would be possible to use conventional photography and then scan the photos for insertion in the property file. The alternative would be to use a camera connected to the pen pad and appropriate software to enable the photo to be placed directly into the file. This would have particular benefits where reports are being dispatched directly from the mobile using electronic communications.

Geographic Information Systems Support: Depending on the approach taken to the sourcing of data for a GIS it may be necessary to have plotting, scanning and digitising facilities.

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# THE DEVELOPMENT OF A FULLY INTEGRATED INFORMATION TECHNOLOGY SOLUTION TO THE RESIDENTIAL PROPERTY VALUATION PROCESS.

## PART THREE

## THE FIRST STEPS TOWARDS DEVELOPMENT OF AN INTEGRATED SOLUTION

CHAPTER EIGHT

# 8.00 DEVELOPMENTS IN THE MANUAL SYSTEMS OF HALIFAX VALUATION SURVEYORS

## 8.01 Introduction

Before looking at Project Dragon in some detail it is considered worthwhile to review some of the developments in inspection and reporting routines adopted by Halifax Valuation Surveyors. The rationales behind these developments are relevant to any considerations for a computerised residential valuation system. Additionally these established routines were influential in the direction taken by certain aspects of the project.

Halifax Valuation Surveyors (HVS) is at the time of writing (May 1997) a department of the Halifax Building Society (soon to become Halifax plc.). In building society terms HVS were latecomers to the concept of 'In-House' or staff valuers, becoming operational initially in the North-West region in early 1987. This was followed by teams in the Midlands, East, North, London, South East and South West over a two year period and some years later - Scotland.

Valuers were drawn from a wide range of backgrounds including private practice, local authorities and other building societies. They brought with them an equally wide range of inspection routines and reporting styles. Interpretation of the approach to commonly occurring defects also varied.

With the main objectives of raising quality of service throughout the country, developing consistency and providing better advice to mortgage processing staff a number of key areas of the residential valuation process were considered.

## 8.02 Site Notes

From the early days of the valuation service a simple standardised site notation form was in use. The form was brief and gave very little assistance to the valuer by way of checklists or reminders. As a consequence many valuers either used their own forms or produced supplementary forms, some used plain paper or ruled notepads. Estates Gazette (1994)

*"Blank note books or A4 pads are a possibility, but these offer no support as a checklist."*

This variety of forms and in particular the valuers' handwriting or own shorthand made interpretation of the notes at a later date difficult or in some cases impossible. This was important in complaint situations particularly if the valuer was not available to transcribe his or her notes for whatever reason. Estates Gazette ( Ibid. )

*"To be of any value such notes must be capable of being read and interpreted, in many cases some considerable time after the date of the inspection."*

It was considered necessary to develop a standardised approach to note taking which satisfied the following objectives:

- Overcome the difficulties of poor/illegible handwriting
- Ensure all accessible parts of the property are inspected
- Ensure that all relevant enquiries are made
- Record all limitations on the inspection
- Record extent and positions of damp meter readings
- Record the position and severity of cracking noted to external walls

Two basic approaches to the format of the site notes were considered. Some valuers prepared a sketch plan of the property and annotated the plan with features, defects, position of damp meter readings etc. This had the benefit that in the process of preparing the plan the valuer was giving consideration to the way the building had been constructed. This helped in interpretation of defect causes and in alerting the valuer to hidden or less than obvious problems. An example would be the presence of a chimney breast on the first floor with no continuation on

the ground floor. This would alert the valuer to the possible lack of adequate support for the remaining section of chimney breast.

The alternative approach (and that which was eventually adopted), was the format that the writer initially developed for use in the East Region. Its distinctive approach was the treatment of the interior of the building. It used a series of rectangular boxes to represent the various rooms in the building in a stylised form as shown here:

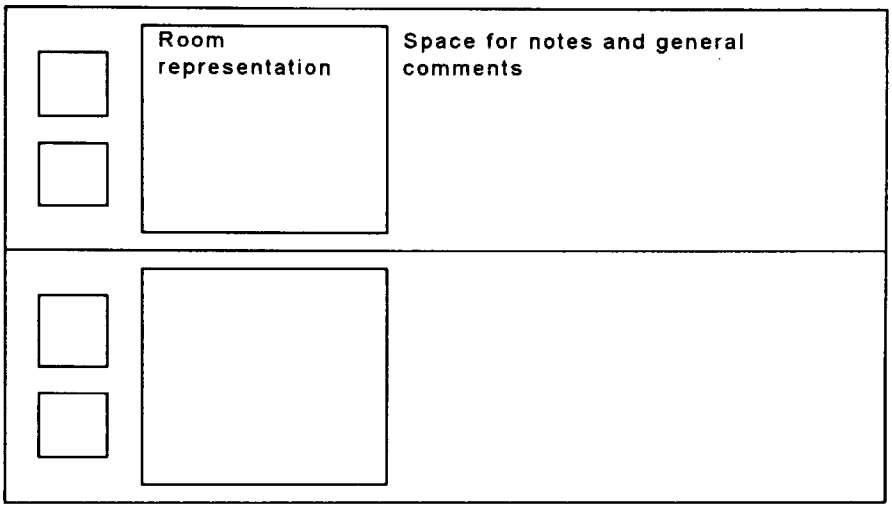


**Figure 24. Extract from Halifax Site Note Form - Room Notation. Source: Halifax Plc.**

The sketch plan approach whilst it had its merits was felt to be too detailed and time consuming for a mortgage valuation. It was considered to be more appropriate for surveys than for valuations. The stylised approach exploited the fact that the vast majority of rooms are rectangular and that the construction of most residential dwellings is straightforward. It offers the facility of a graphic representation of the room, its furnishings and limitations on the inspection, together with the position of defects and damp meter readings.

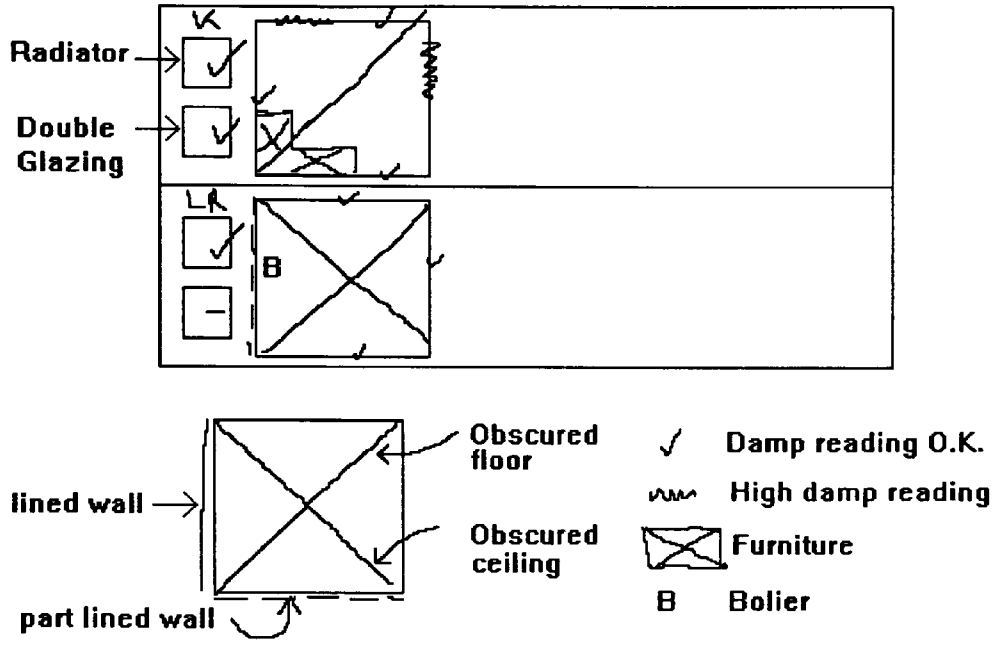


**Figure 25. Completed Room Notation with Key to Annotations. Source: Halifax Plc.**

The illustration above shows how a great deal can be recorded about a room using this approach without having to write a word. The page is orientated with the rear of the building to the top. With a few strokes of the pen, limitations to the inspection can be recorded together with positions of damp readings and large items of furniture. Additionally room features can be recorded. To have recorded the same level of information in a written form would be very time consuming and run the risk of poor legibility mentioned earlier.

Checklists were provided for the roof void inspection and service installations.

For the exterior of the property various approaches were considered and a number piloted before a very simple virtually free form format was adopted. The writer's preference was for an elevational format based on the premise that most residential properties have a maximum of four elevations. Although this gained favour from a number of valuers the majority preferred the free form approach and so this was adopted. The elevational element was retained for recording the severity of cracks noted to the various elevations as follows:

| CRACK CATEGORY | |
|---|---|
| Front | |
| LHS | |
| Rear | |
| RHS | |
| Other | |

**Figure 26. Extract from Halifax Site Note Form - Crack Notation. Source: Halifax Plc.**

In this instance the valuer is expected to record the category of damage on a scale of 0 to 5 (Negligible to Very Severe) in accordance with the classification produced by the Building Research Establishment (1978).

Space was provided on the exterior section of the form for a sketch plan and notation of external features such as trees, outbuildings etc. On the general section of the form a checklist was provided as follows:

| CHECKLIST | | ACTION |
|---|---|---|
| Structural Movement | | |
| Structural Alterations | | |
| Extensions | | |
| Building Regs | | |
| Planning Permission | | |
| Damp | | |
| WBI | | |
| Trees within ID | | |
| NEW BUILD | NHBC | |
| | Foundation 15 | |
| | Consultants Cert | |
| ROADS | Private | |
| | Adopted | |
| | Charge Liability | |
| Occupied | | |
| Furnished | | |
| Known Site Problems | | |

**Figure 27. Extract from Halifax Site Note Form - Checklist. Source: Halifax Plc.**

Additionally space was provided for the manual recording of details of comparable properties used in arriving at the opinion of value. Attributes to be recorded include address, type, age, number of bedrooms, condition factor, floor area, garage, price, date of valuation, rate per square meter of floor area and source.

At the time of production of the site note forms, little guidance was available from the professional bodies as to the content of site notes. RICS (1990)

*"The valuer is advised to make and retain legible notes as to his/her findings and, particularly, the limits of the inspection and the circumstances under which it was carried out."*

Recently with the publication of the 'Red Book', the RICS (1995) have produced a comprehensive list of matters to which reference should be made by the valuer in his records. The site note forms devised by HVS covered virtually all of the recommended matters and indeed it could be argued the HVS forms were influential in the formulation of the recommendations put forward by the RICS.

With the increasingly litigious nature of residential valuation work (referred to in Chapter 2, section 3) the recording of detailed and legible site notes has become vitally important, particularly in the defending of claims of negligence made against valuers. Estates Gazette ( op. cit. )

*"In the event of difficulty, a claim for negligence perhaps, the site notes are likely to be the only evidence that the surveyor has exercised the proper level of skill and care."*

This has certainly been the experience of the writer. One complaint against a valuer acting for the Halifax Building Society alleged that the valuer failed to bring to the attention of the purchaser defects in the floor screed to a Flat. Recalling the site notes confirmed that at the time of the inspection the room was carpeted and a heavy item of furniture was placed over the area of defective screed. The claim was refuted with confidence and the matter was pursued no further.

There is evidence that if a surveyor or valuer can demonstrate a thorough and methodical approach to the inspection that the courts will look more favourably on their case. Compare Mr. Justice Phillips

summing up in the case of Cross v M. and Mortimer (1989) where he commented:

*" Mr. Mortimer's notes show that he took a lot of care over this survey."*

with the case of Watts v Morrow (1990) when His Honour Judge Bowsher QC commenting on the surveyors practice of dictating his report on site without the use of written notes stated:

*"his report being strong on detail but negligently weak on reflective thought."*

Site notes are therefore the vital first step to producing accurate valuations and comprehensive reports. The next step is to transfer the contents of the notes into the report.

**8.03 Preferred Paragraphs**

As mentioned in the introduction to this chapter valuers have a range of ways of interpreting defects encountered on inspection and with this comes a variety of ways of reporting same.

This causes confusion amongst the personnel interpreting the reports and making the underwriting decisions. This applies to building society staff and those employed by companies offering insurance cover on the proposed securities.

HVS developed the concept of preferred paragraphs to aid these personnel and to ensure greater consistency in the reports produced not only by the staff valuers but also by the Halifax's panel of valuers. Standard paragraphs had long been in use by surveyors and valuers to aid report writing. Preferred paragraphs are not only standard in their form but they are presented as guidance to valuers in how to interpret defects and what emphasis to place on them in terms of degree of severity.

The guidance notes to valuers produced by the RICS (various editions) and latterly the Red Book gave general advice on matters which should be reported upon in a mortgage valuation report. For example:

RICS (1992)

*"3.4 Any obvious evidence of serious disrepair to the property or obvious potential hazard to it should be reported, as should any other matters likely materially to affect value."*

When considering the occurrence of structural movement to a building it can be reported in a number of ways. A typical report phrase may be "a crack was noted beneath the window to the side elevation considered to be due to minor movement". The movement could be due to a range of causes including, subsidence, settlement, shrinkage, thermal movement or impact damage. Whatever the cause of the movement this phrase gives no guidance to the underwriters as to whether further investigations are necessary or whether the property can be accepted without repair.

HVS developed two paragraphs to give clear indications as to severity and actions required and agreed the form of words with the insurers to streamline procedures.

These are :

*"SM1. There is evidence of minor movement to.....This movement appears to be of longstanding with no evidence of recent or continuing movement.*

*SM2. There is evidence of movement to .....A full report on the cause and full extent of the defect should be obtained from a Chartered Building Surveyor or Chartered Structural Engineer together with recommendations for works necessary to ensure the future stability of the building and an estimate for the costs. Any works to be carried in full under the supervision of and to the satisfaction of the specialist.*

With SM1 the mortgage processing staff can accept the property without reference to the insurers but with SM2 further investigations will be necessary.

Preferred paragraphs were developed to cover a wide range of commonly occurring situations including damp and decay, trees, radon, mineworkings, electrical defects, alterations and extensions. So useful have they been that other organisations have adopted the phrases and many valuers use them when reporting for other lenders. In the recently

published 'Red Book' the RICS (1995) have incorporated 'Recommended Paragraphs' for matters such as Radon, High Voltage Electrical Apparatus and New Build valuations.

**8.04 Condition and Risk factors**

Valuers working for HVS are in a relatively unique situation in that they have access to a database of property transaction comparables unequaled in the residential property market in England and Wales. This database relates to approximately 20% of the market. Evidence is provided by way of copy reports supplied to the valuation department by all valuers acting for the Halifax. This includes In-House and panel valuers. Unless the property has been personally inspected, the valuer will have little indication of its condition and matters that have not been recorded on the database such as locational influences not provided by the address.

The concept of a condition factor was introduced in the first instance to overcome this problem. During discussions as to the form that this factor should take it became apparent that the development of a number of other factors could assist the underwriting staff assess the risk of taking the property into mortgage. The concept of risk factors was thus borne.

The risk factors identified initially were:

- Condition
- Property Type
- Location

to these a further factor was subsequently added:

- Marketing category

Chapter 3 has already considered the merits of condition factors as opposed to providing a valuation of the property in average condition and so this will not be discussed here. The decision was taken by HVS to adopt a scale of 1 to 4 for the condition factor. This scale was chosen as pilots of a 1 to 5 scale found that the majority of properties were

being rated at the centre of the scale i.e. 3. In reality this was to be expected for the majority of properties are likely to be average, as in a 'normal distribution'. Byrne (1996)

*"The normal distribution is one of the most important of the continuous probability distributions. Practically, the normal distribution closely fits the observed frequency distributions of many phenomena and many others can be assumed to take this distribution even if the actual distribution has not been observed."*

The condition factor was intended to reflect all aspects of condition, structural, internal and external. Property type should reflect a variety of factors to include style, design, form of construction.

Location was subdivided into three classifications against which separate risk factors were applied. The concept of zooming in to the property was developed to enable valuers to understand these three elements of location.

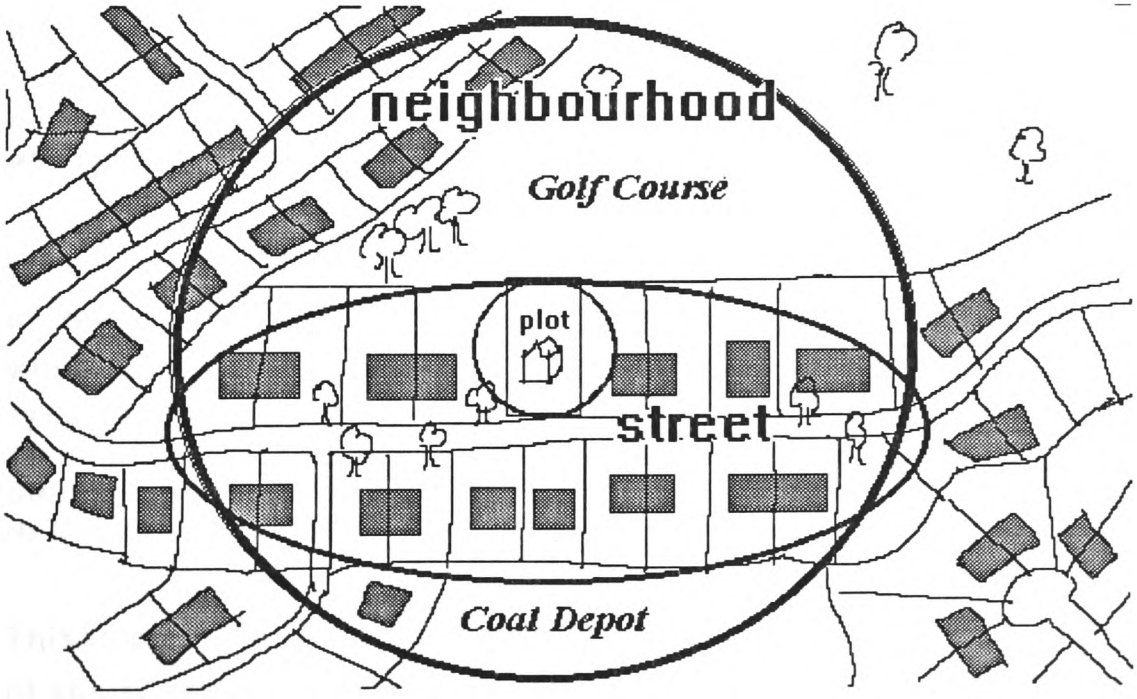


**Figure 28. The three elements of location. R. Dennett.**

Plot relates to those matters which have a direct bearing on the individual plot as distinct from the majority of other properties in the

vicinity. For example an electricity sub-station or the plot size. In the illustration above the subject plot backs onto the golf course and would expect to have a different factor to those plots on the opposite side of the road which back onto a coal depot.

The street factor relates to the quality of the street within 150 metres of the subject property and would be determined by such factors as the housing mix, street scene, levels of vandalism etc.

The concept of neighbourhood within the context of these risk factors relates to a distinct unit of housing. It may be determined by the social mix (an area of local authority housing), geographic location (an area of housing bounded by a river and a road), age (a modern housing development) or in a rural area it may be an entire village. It is the term distinct which is most relevant here. The neighbourhood in this respect is organic rather than planned.

Ring (1970) considered that economic and social influences may distinguish neighbourhoods and found them easy to define.

*"Usually it is not difficult to delineate a neighbourhood, because of natural or man made barriers which enclose it or because of physical attributes or development practices that characterise the area."*

Gibson (1984) also considered organically developed neighbourhoods to be readily definable by the inhabitants and therefore the professionals within an area.

*"The neighbourhood may be a stretch of countryside where your nearest neighbours are only just in sight on the other side of the valley; or it may be a few streets clustered around a tower block. But everyone who lives in the neighbourhood knows its extent."*

This is opposed to the concept of neighbourhood proposed by a number of social geographers and planners where it is planned and delineated artificially. Pahl (1970) reported that in Willmott's(1962) study of Stevenage New Town he found that, although 60 per cent of his sample used the local neighbourhood centres for weekday shopping, only 31 per cent, when asked what neighbourhood they lived in could name it, although most of the rest could name their housing estate (of which there were five or six to a neighbourhood unit).

Compare this to the comment made by the GLC (1965)

*"the few social studies available suggest that real communities of neighbours conscious of their existence as such are seldom larger than a street or 'precinct' of small streets and are measured in a few hundreds of households."*

As part of the development work for risk factors an alternative approach to the valuer determined classification mentioned above was considered. This relied on geodemographic information obtained from the Census. Information supplied by two of the leading data agencies.

Grimshaw(1994)

*"There are three leading data agencies in the U.K.: CACI Market Analysis, CCN Systems and PinPoint Analysis. These agencies offer a range of data services. The major GIS offered are ACORN, MOSAIC and PIN."*

The Halifax chose ACORN (A Classification Of Residential Neighbourhoods) and PinPoint to classify the neighbourhood element of the location risk factor in the pilot study. Grimshaw, ( Ibid. ).

*"Acorn is a classification of residential neighbourhoods using 11 housing groups and 38 socio-demographic types. According to a recent MORI survey of marketing directors in blue chip companies it is the most widely used of the systems currently available.....The PinPoint system is based on a digitised postal district system; profiles of census, wealth and financial data are available."*

During the pilot studies it became apparent that whilst these broad based social classifications may be suitable for marketing purposes they were too crude and inaccurate for use as a valuation aid. Very diverse changes in groupings could be found in adjoining inward postcode areas and this often applied to adjoining houses in the same street.

This finding is borne out by the comments of Grimshaw ( Ibid. ).

*"Geocoded segmentation data such as MOSAIC or ACORN, whilst having high availability, will have lower accuracy than internal customer files."*

It was for this reason that the Halifax opted for the more subjective but more accurate valuer classification.

Marketing Category was introduced to reflect the general all round saleability of the property in the locality and would be considered to be a

reflection of the supply of the particular property against the demand for same. The intention was that this factor should reflect general marketability conditions rather than those prevailing at the time of a property boom or recession

A period cottage in relative terms will always be more marketable than an estate house of comparable size and condition.

It will be seen in later chapters how aspects of these manual systems were taken to assist the development of the system produced in Project Dragon.

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CHAPTER NINE

# 9.00 PROJECT DRAGON - STRATEGIC ISSUES

## 9.01 Introduction

The next chapter will look in some detail at the inspection module developed as part of Project Dragon. This chapter will consider some of the broader/strategic issues that had to be addressed during the course of the project.

Project Dragon was a development of the work of D. Jenkins which included the first practical application of a computerised support system (that went beyond a comparables database) to the residential valuation process. His work at Cardiff City Council (Jenkins, 1992) was utilised in the valuation of properties under the right to buy legislation. It related to a fairly homogenous group of properties in a relatively tight geographical location. Whilst the system that he developed was eminently suitable for its purpose, it required further development to become a useable application for residential mortgage valuations over a wider area. For the development to take place access was required to large amounts of data on property transactions.

D. Clarke the Chief Valuation Surveyor for the Halifax Building Society, had the foresight to see the potential for an information technology solution to support the mortgage underwriting process. The Halifax could provide the data required together with 'Expert Knowledge' in the field of residential valuations and so the project was launched.

Several project groups were formed with various roles and responsibilities. The 'Top Down Group' (TDG) comprised of D. Jenkins (Centre for Research into the Built Environment, Glamorgan University) ,

C. Rispin, S. Dirs, R. Whentringhame and the writer, (Halifax Valuation Surveyors). The TDG's role was to act as a steering committee, determine strategic issues and act as a liaison between the two collaborating institutions at a developmental level.

D. Jenkins headed the development team at the university (UGDT) and provided guidance and direction on all technological matters. The writer headed the 'Bottom Up Group' (BUG) whose role was to provide input on professional matters in the knowledge elicitation process and to field test the inspection module. Early in the project development of the administration module was transferred (for internal reasons) to the Business Information Systems department of the Halifax Building Society.

With hindsight a criticism of the approach to the project is that whilst there had been considerable research in the academic world into the various statistical approaches to the valuation process no research was conducted into the professional aspects of the project before it commenced. Essentially the knowledge elicitation process (referred to in Chapter 4) commenced before members of either the TDG or BUG gave any consideration to their practices and procedures. It is hoped that this thesis will rectify this omission.

An illustration of the difficulties that this created can be seen in relation to the collection of property data. Unclear as to the importance of the various property data, as they were encountered in the development process, the BUG took the view that a system should be developed to collate all attributes and that at a later date those not required could be discarded. The view was taken that it would be easier to program out the recording of attributes at a later date than to program this in.

This principle did not take into account programming time and the development costs associated with it. Additionally when the module was

first piloted by users outside the BUG they were not advised of the rationale and considered the module to be too complex and unwieldy.

A second criticism of the project would be that the focus was lost and as a consequence members of the project groups became side tracked. This lead to increased development time and hence costs. Furthermore although a useable inspection module was created the prime objective of the Chief Valuation Surveyor was not achieved. That objective (it is believed by the writer ) was to develop a computerised valuation application that could be used to verify the accuracy and validity of valuations provided on properties offered as security to the Halifax Building Society. It could also be used to periodically re-value the Society's assets.

The inspection module was in reality an accident that stemmed from the desire of the project group to collect all relevant attributes. It became apparent during the early discussions on the direction of the project that it would be more efficient to collect data on site directly onto a hand-held device than to complete the inspection using manual methods and then to input the data into the system on an office based p.c. The use of a hand held site inspection device had the added benefit that it would be possible to incorporate expert help modules for the user.

It was possible to implement this decision because of the advances that were being made in hand held devices at the time (see chapter 7).

It was believed that the inspection module had a potential for use by valuers outside the Halifax and therefore was a commercially viable entity in its own right. This led to the focus of the BUG towards the inspection module alone and away from the valuation module.

Early in the project it became apparent that a structured means of communicating development requirements from the BUG to UGDT was

required. Due to the limited technology available to the BUG this evolved into a paper based control document which was referred to as the 'Benchmark Document'.

An extract from the Benchmark Document is shown here. Although not explicitly stated in the document the type of object to be used on the screen (combo box, check box etc.) is apparent from the contents of the list field. A list of entries implies a combo-box whereas a Yes/No entry indicates that a tick box can be used. The term 'Numeri' indicates that the entry to a field is purely numerical and can be entered using a utility specifically designed by UGDT for the inspection module called the 'Numeri pad', a simplified numerals only keypad that pops up when the object is selected.

| MODULE | ELEMENT | COMPONENT | FIELD | LIST | Default |
|---|---|---|---|---|---|
| Building Exterior | Roofs | Roof Description | Roof Pitch | Flat<br>Pitched | Pitched |
| | | | Pitch in degrees | 'Numeri' pad | |
| | | | Roof Form | Flat<br>Half Hipped<br>Hipped<br>Lean-to<br>Mansard<br>Ridged | Ridged |
| | | | Main Covering Type | Artificial Slate<br>Asbestos<br>Asphalt<br>Felt<br>Slate<br>Thatch<br>Tile | Tile |
| | | | Original Covering | Yes/No | Yes |

**Figure 29. Module Specification - Project Dragon Benchmark Documentation. R. Dennett**

The Benchmark Document essentially became a specification for the development of the inspection module. It defined the content of the screens and how they should relate to each other but not how the software should operate. In that sense it was not a full specification but given the nature of the project and the need to prototype and pilot ideas as they developed a full specification would not have been feasible or, as has been mentioned earlier, desirable. Martin (1982)

*"prototypes should be created quickly to see if the user likes them. The prototypes should be rapidly changeable. In this environment it is vital that the application creator works hand in hand with the application users."*

At times when the system was rapidly changing, the benchmark documentation became a record of changes that had already been made.

## 9.02 Administration

As has been mentioned earlier, development of the administration module was 'contracted out' from the main project group and so will not be considered in detail here. Elements of the administration module include logging and receipt of instructions, inspection scheduling and accounts administration.

It was necessary to provide a simple logging and scheduling function to enable a number of inspections to be completed on the inspection module during the field trials. This raised two issues that needed to be addressed:

- Inspection reference number
- Address file

Users of Geographic Information Systems will be familiar with the concept of a unique property reference number. The ordnance survey as a feature of its Address Point product provides a unique reference code

for each address (OSAPR). This form of reference would not be sufficient for a residential valuation system where it is conceivable that a multitude of inspections will be made on a single property over a period of years.

Alternatively reference numbers could be ordered by date or by valuer/valuation centre. In this system the reference number would be used to enable data relating to a single inspection, held in several different tables, to be linked together. With a multi user system where it is possible that records from a number of inspection modules will be archived on a single server there needs to be a means of differentiating the records created.

It would not therefore be feasible to use date order as many inspections across a multi user group would be completed in a single day. Similarly a single valuer will complete a large number of inspections during the course of his employment.

A composite numbering system using elements of date, valuer/valuation centre and perhaps location would overcome these difficulties. The unique property inspection reference number could therefore look like this:

| **Valuation centre/Valuer/Date/Grid Reference or OSAPR** |
| --- |
| **021-107-01071996-456831** |

**Figure 30. Unique property inspection reference number. R. Dennett**

Alternatively if the OSAPR product was not to be subscribed to and the grid reference was not known or available at the time of receipt of instructions, postcode or the sequence of inspections for the day could be used.

The other aspect of the logging process that required resolving was the way in which the address data should be entered. In the original version of the HVS database the address details (Street, District and Town) were held in a single field. This presented limitations when searches were made and therefore it was felt appropriate to dis-aggregate the address field.

Justification for this decision can be found in the growing use of the Property Address File (PAF) created by the Post Office and referred to in an earlier chapter. It is considered sensible (with a view to future developments) to adopt the same format. The ideal solution would be to obtain the Address-Point data as this is becoming an industry standard that has wider applications as explained earlier.

### 9.03 Inspection Module Architecture

For the reasons explained in an earlier chapter the decision was made to use a Graphical User Interface (GUI) for the software application. The administration module would in most instances be used by clerical office based support staff. These personnel are familiar with conventional computer based applications and therefore the appearance of the administration module was not of vital importance.

The 'look and feel' of the inspection module (which was to be used by valuers who in the main are not computer literate) was however, considered to be important to it gaining ready acceptance by the users.

A critical consideration in this respect Is the way the inspection is carried out and the data is collected. Inspection **routine** is a very personal matter for the valuer, established over many years to ensure that a thorough examination of the property is completed and that no material factors are overlooked. To be acceptable to any single valuer, the

inspection module needed to be flexible enough to accommodate as many of the individual routines as possible. It would not be acceptable to a valuer if it dictated a certain routine that jeopardised his/her ability to identify those material factors.

This objective was achieved by first creating a number of data input screens which related logically to the different aspects of the inspection (in view of the large number of data items to be collected it was not feasible to include them all on a single screen).

From a programming standpoint it would have been easier to link the screens in series as illustrated here.

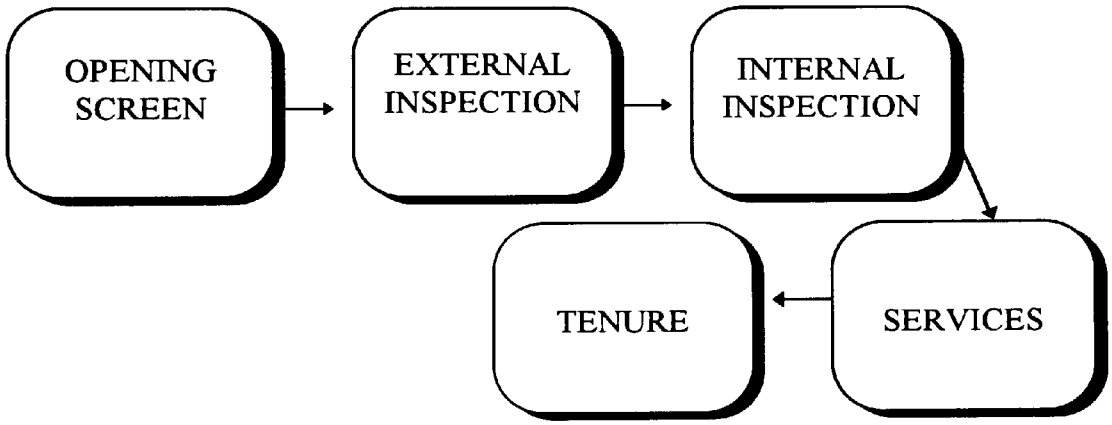


**Figure 31. Inspection screens in series. R. Dennett**

This would however, have dictated the order of the inspection which would not have been acceptable to the potential users. The solution was to give the user the ability to navigate around the system with complete freedom. This was achieved by providing the usual windows style menu bar at the top of each screen giving direct access to each of the inspection module screens.

| Screen | Menu Item | Drop down Menu | Sub Item | Other Command Buttons | *Destination* |
|---|---|---|---|---|---|
| Vicinity | Records | First | | | *First Inspection* |
| | | Previous | | | *Previous Inspection* |
| | | Next | | | *Next Inspection* |
| | | Last | | | *Last Inspection* |
| | Location | **NEIGHBOURHOOD** | | | *Neighbourhood* |
| | | Vicinity | | | *Vicinity* |
| | | Plot | Gardens<br>Trees<br>Outbuildings<br>Parking | | *Gardens*<br>*Trees*<br>*Outbuildings*<br>*Parking* |
| | | Address | | | *Address* |
| | Building | Exterior | Roofs<br>Walls | | *Roofs*<br>*Walls* |
| | | Interior | **ROOMS**<br>Voids<br>Cellars | | *Rooms*<br>*Voids*<br>*Cellars* |
| | | Services | | | *Services* |
| | | Pests | | | |
| | Tools | **MEMO** | | | *Memo Pad* |
| | | **PHOTO** | | | *Not Available* |
| | | **SKETCH** | | | *Paintbrush* |
| | | Map | | | *Not Available* |
| | | Zoom | | | *Zoom In* |
| | Checklist | Observations | | | *Observations* |
| | | **ENQUIRIES** | | | *Enquiries* |
| | | Tenure | | | *Tenure Screen* |
| | | Insurance | Buildings<br>Summary | | *Buildings Insurance*<br>*Building Summary* |
| | | Defects List | | | *Defects List* |
| | | Summary | | | *Summary* |
| | Exit | **HOME** | | | *Home* |
| | | Suspend | | | *Suspend Dragon* |
| | | Quit | | | *Quit Dragon* |
| | Help | About MSA | | | |

**Figure 32. Menu and Command Button Specification - Project Dragon Benchmark Documentation. R. Dennett**

The BUG considered that it would be useful and user friendly to provide an alternative to the menu bar for those screen to screen movements, that could be predicted to be the most likely to be made, by the majority

of users. This was achieved by creating a 'tool bar' again in the windows style but with larger buttons to facilitate easier use on site.

There was some debate within the BUG as to whether the button face should show an icon or explanatory text but the choice was essentially more one of aesthetics than functionality.

An extension to the Benchmark Document referred to earlier in this chapter specified the menu and command button options for each screen. An extract from this document is shown above (Figure 32).

Entries in **BOLD CAPITALS** indicate that the selection is also available as a command button. Entries in *italics* denote the destination of the menu or command button selection.

A criticism of the manual site note forms (referred to in the last chapter), made by a number of sceptical valuers at the time of their development, was that whilst the valuer was filling in the form he was not looking at the property and thereby running the risk of missing a material factor. To pre-empt this type of criticism being made against the inspection module it needed to be designed to make completion of its various sections quick and simple. This was achieved by adopting the following principles:

- Strong contrast between screen background and the objects for completion.
- Adequately sized and legible fonts for screen labels.
- Clear, logically structured screens.

The contrast between screen background and the various screen objects was found not only to aid screen completion but was also found to be an important factor in improving screen visibility in bright external environments. A number of valuers with less than perfect eyesight found

that clear large fonts were necessary if time was not to be taken up trying to focus on screen objects.

The options open to the developers for the structure of the inspection module were to have as few screens as possible full of data input fields or to have a multitude of screens each with data input fields specific to certain subject areas. There was considered to be the danger that with many screens the system may appear to be too complicated and imposing. This possibility was considered to be outweighed by the need to 'free up' the valuer for inspection rather than 'form filling'. The latter option was therefore chosen however, in practice during the pilots, it was found that as only one screen was open at any one time the 'depth' of the system was not immediately apparent to the user. Furthermore only screens that were required were opened. For example the tree data input screen would not be required on every inspection.

### 9.04 Location Factors

Lacking the features offered by a GIS the inspection module developed for Project Dragon required another way of handling the locational data relating to the property inspected. As has been mentioned elsewhere location is one of the key attributes affecting value and a means of recording and identifying its impact is essential. Wyatt (1995)

*"many valuers regard location as the most important influence on value yet the methods of quantifying the financial impact of location are subjective."*

The BUG developed a two tiered approach. The first tier of locational data relates to the actual physical location of the property and the second tier relates to locational features that impact on the value of the property. The aim was to make the valuer input as objective as possible

Wyatt ( Ibid. )

*"the solution to date has been to treat the locational influence on value subjectively either because of lack of data or suitable analysis technique."*

The physical location was treated as follows:

| Urban Form | Occupancy | Quality | Primary Land Use | Secondary Land Use |
|---|---|---|---|---|
| Inner City<br>Central<br>Town<br>Urban<br>Suburban<br>Semi-Rural<br>Rural<br>Village<br>Remote | Private<br>Social<br>Predominantly Private<br>Predominantly Social<br>Private Rented | Excellent<br>Good<br>Average<br>Fair<br>Poor | Commercial<br>Industrial<br>Residential<br>Agricultural | Commercial<br>Industrial<br>Residential<br>Agricultural<br>Mixed Use |

**Table 9. Physical Location Classification. R. Dennett**

Whilst certain aspects of the assessment of location using these criteria may be subjective, provided all valuers using the system are trained to ensure consistency this should not be a problem. To merely use criteria of proximity when comparing locations of properties would not give useful information on which to base opinions of value. Many examples can be provided of properties which although close geographically have wide differences in value due to locational factors.

An example from the valuation area with which I am familiar would be the southern edge of Harlow New Town, where two groups of properties sharing the same inward postcode and within 100m of each other have a significant variation in value. The Berecroft estate was developed by the Harlow Development Corporation for social housing in an urban environment. Property values on those offered for sale having been purchased several years ago under the Right to Buy legislation are typically £35,000 to £40,000 (at January 1997 prices). These are to be compared with properties in the adjoining Rye Hill Road, separated only

by an area of common land, where prices are in excess of £200,000. The location is more sub-urban with all properties privately owned.

These variable location factors could be reflected using the above mentioned locational definitions but would not be apparent from a purely geographical analysis unless large amounts of data were immediately available.

The second tier of locational data related to those locational features that can materially affect the value of properties. These can have positive and negative influences in value and can be many and varied in their form. It was considered valuable to be able, at a later date when sufficient data has been collected, to analyse the actual (rather than perceived) affect on value of these various features.

The project group took the concept of Neighbourhood/Street/Plot developed by HVS (and referred to in an earlier chapter), combining Street and Plot into a new classification - Vicinity. These two elements were expanded to encompass as many locational factors as could be foreseen.

Neighbourhood factors were broken down into Physical, Social, Legislative and Local Amenity categories including such items as coastal erosion, vandalism, conservation area and motorway access, respectively. A simple check box format was chosen to speed up data entry. To further facilitate ease of entry the neighbourhood attributes input by the user would be ascribed to the individual street and pre-loaded when a new inspection address is entered into the system. The valuer is then provided with the opportunity to amend the entry for each individual property as required, the check box format giving an at-a-glance view of the pre-selected attributes

The Vicinity attributes were placed into four broad categories, Access, Benefits, Nuisances and Sub-Soil. The nuisances being sub-divided into, Visual, Noise, Hazard, Smell, Ground Problems and Use Nuisance including such items as derelict properties, railway line, flooding, chemical plant, methane gas and bus stop respectively. The use of the senses (sight, sound, touch and smell) as sub-divisions was considered to be helpful to the user in directing him to the appropriate section of the module when a detrimental factor was encountered on site.

Collection of the two tiers of locational data on site and combining this with a GIS should in time prove to be a very powerful valuation tool. This could ultimately have wider applications in for example estate agency where assistance could be provided to prospective purchasers searching for suitable property.

If other locational data is available on a GIS platform (perhaps from a database such as that held by Royal Insurance, referred to earlier) this could be pre-loaded for verification on site as necessary.

### 9.05 Defect Notation

Among the matters that materially affect value and which must be reported on in a residential mortgage valuation are the defects found in the property. Several approaches were available to the developers for the recording of defects encountered.

The first and simplest option would be to make available a straightforward notepad utility making use of the handwriting recognition facility. This would have provided no more functionality than the manual pen and paper system currently in use and so was discarded at a very early stage.

The second option, and that used in early versions of the inspection module was to link the notation of defects directly to the attributes as they appeared on the inspection screen. For example having described the roof (as outlined in the extract from the benchmark document shown earlier) it would be a simple matter to open another combo box to select a defect attributable to the roof, i.e. tiles laminating. Whilst elements of this approach were retained in later versions (for defects to elements such as services which can occur anywhere in the property) it was found to have limitations in describing the severity, extent etc. of the defect and in the number of defects that could be recorded.

The option adopted involved the development of a 'Defects Screen' which is accessible from any screen within the inspection module either via the menu selection or a command button. The screen was designed to enable the user to describe in detail an unlimited number of defects encountered at the property with no limit on the number of defects which could be ascribed to each element of the building. Unlike the example above where a selection has been made from a combo box no more could be made (whilst two or three such combo boxes could be included on a screen it would not be feasible to include an unlimited number).

To enable the defects to be described in some detail the property was considered as a number of elements (corresponding in the main to the input screens) which represented the major sections of the building. The elements were in turn subdivided into a number of components. The system was designed to automatically record the element from which the defect screen was called and to pre-load the components that related to that element.

Once the defective element had been selected the options were made available to record, the material of the component and the defect description. The table below shows the selections available for roof verges. Where components are made up of a number of materials it is the material that is defective that should be recorded. For example a

window can be formed from timber and glass. If the defect is rot clearly the material to select would be timber.

| ELEMENT | COMPONENT | MATERIAL OF COMPONENT | DESCRIPTION OF DEFECT |
|---|---|---|---|
| Roof | Verges | Cement<br>Plastic<br>Slate<br>Tile | Badly formed<br>Cracked<br>Damaged<br>Defective<br>End of life<br>Incomplete<br>Loose<br>Missing<br>Perished |

**Figure 33. Defect Description - Project Dragon Benchmark Documentation. Source: BUG**

It may be necessary to record the location of the component in relation to the element and the position and extent of the defect on the component. This ability was provided by a constant selection of descriptors as shown in the table below.

| LOCATION OF COMPONENT | POSITION OF DEFECT | EXTENT OF DEFECT | CATEGORY OF DEFECT |
|---|---|---|---|
| All<br>Bottom<br>Compartment<br>Front<br>General<br>Left<br>Middle<br>Rear<br>Right<br>Top | All<br>Bottom<br>Compartment<br>Front<br>General<br>Left<br>Middle<br>Rear<br>Right<br>Top | All of Component<br>Most of Component<br>Part of Component<br>Multiple on Component<br>Single on Component<br>General on Element<br>General on Building<br>General on Security | Very severe<br>Severe<br>Moderate<br>Slight<br>Very Slight<br>Negligible |

**Figure 34. Defect Description Continued- Project Dragon Benchmark Documentation. Source: BUG**

For example there may be two balconies on a wall, one suffering from corroded steelwork the other from defective asphalt flooring. These defects would be entered as two separate defect records with the component locations being for example, left and right.

The categorisation of the defect enables its severity or importance to be assigned using the same categories as those used for cracks to walls produced by the Building Research Establishment (1978). It is also possible to note the status of the defect which determines where the output appears in the report.

Having made the selection of component, material, defect description etc. a number of possible outputs are presented to the user for selection as appropriate. Command buttons on the defects screen give the user the opportunity to page through defect records, bring up a list on screen or provide additional detail in a memo field. Ultimately it is intended to provide the ability to sketch the defect or photograph it using a digital camera linked to the mobile unit.

The development of the defects screen in this manner has presented the possibility of reducing the amount of descriptive data that needs to be collected on the inspection module. This development came fairly late in the project and therefore the version to be described in the next chapter has not been amended to take advantage of the potential of the defects screen.

### 9.06 Inspection Restrictions and Dampness Readings

The last chapter explained the rationale for HVS using a graphical form of representing restrictions to internal inspections and for recording the position of damp meter recordings. Initially it was felt that this approach would not be required with the inspection module as the computerised check boxes did not require legible handwriting.

The room inspection screen in the first version provided for floor, wall, ceiling and furniture restrictions as outlined in the following extract from the benchmark document.

| MODULE | ELEMENT | COMPONENT | FIELD | LIST | Default |
|---|---|---|---|---|---|
| BUILDING INTERIOR | Rooms | Restrictions | Floor | None<br>Fitted Coverings<br>Partial Coverings<br>Other | |
| | | | Wall | None<br>Tiling Full<br>Tiling Part<br>Panelling Full<br>Panelling Part<br>Dry Lining Full<br>Dry Lining Part<br>Other | |
| | | | Ceiling | None<br>Tiles<br>Panelling<br>Suspended<br>Other | |
| | | | Furniture | Cluttered<br>Average<br>Bare | |

**Figure 35. Room Restrictions- Project Dragon Benchmark Documentation. Source: BUG**

The use of a 'standard' check box provided automated completion of the combo boxes with defaults ascribed to particular room uses, the user still having the ability to override the standard selections for any or all of the surfaces. This approach was considered to be a retrograde step in respect of the recording of furniture restrictions because it did not record the location of the furniture in the room.

The method for recording damp meter readings was being developed in tandem with restrictions and this eventually led to a solution to the furniture recording deficiency.

The BUG proposed a series of check boxes around a memo field for the dampness readings. In the first version the user was simply required to check the box if dampness was present. This approach did not allow for recording where dampness readings were taken but found to be satisfactory and therefore a scrolling check box was developed to record various categories of readings.

The colour coding of the damp meter readout was adopted with green (G), yellow (Y) and red (R) check box faces representing the various degrees of dampness together with a blank white face to indicate where no readings have been taken and a black box to show restrictions to the wall. This approach worked well for the dampness readings being simple, quick and clear.

The potential was seen for adopting this approach for the recording of furniture restrictions by replacing the memo field with a grid of check boxes to represent the room in a similar fashion to the boxes used in the manual system referred to earlier.

The figure below shows how this appeared in the room screen of the inspection module.

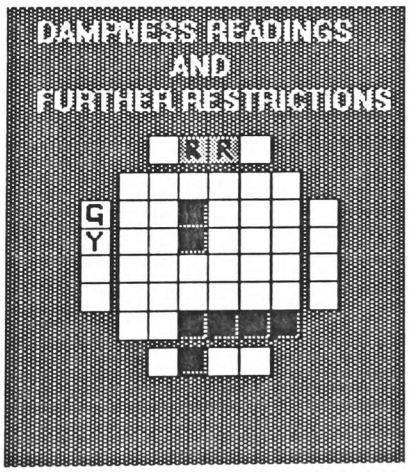


**Figure 36. Damp Readings and Room Restrictions. Source: Extract from Project Dragon Inspection Module.**

The grid provided simple 'on-off' check boxes to represent the presence or otherwise of restrictions (large items of furniture).

Possible enhancements to this approach would be to increase the resolution of the grid and to add a third check box colour (the room screen background colour). This would enable the shape of the room to be recorded and the precise location of restrictions identified.

**9.07 Valuation**

To provide utility for the comparable selection function prior to the development of an expert system or statistical valuation support a simple database selection facility was built in to the inspection module. This comprised of two main screens. The first contained derived fields from other parts of the system and input fields to enable additional monetary data and demand factors to be recorded together with the final opinion of value and the comparables used.

The second screen provides a comparable properties listing of matched properties from the database. It was intended to build in an automatic (expert) search facility to select suitable comparables. However within the TDG, agreement could not be reached as to the key initial attribute, whether it should be location or property type. The compromise solution was to provide both location first and property type first, search facilities.

A significant improvement would be to provide a customised search facility as often it is not sufficient to search merely by property type or location particularly for unusual properties such a one bedroomed cluster units for which there may be no comparables. Furthermore as the database grew it would be necessary to reduce the number of comparables being listed by narrowing the search down through additional attributes such as size or value.

| Heading | Definition |
|---|---|
| Street name | The street in which the property is located and upon which the search is being carried out. |
| Unit | The built form of security e.g. flat, house |
| Type | Appropriate type taken from the home screen |
| Size | The size of the property in $m^2$ |
| Beds | Number of Bedrooms |
| CF | Condition factor taken from the home or summary screens. |
| Price | Price being paid for the property |
| Price/$m^2$ | Automatic analysis of the price per $m^2$ |
| Age | Age of the property in years |
| G/P | Number of garages and/or substantial carports |
| Heat | Extent of central heating system |
| Livs | The number of living rooms or reception rooms at the property |
| QLTY | Overall quality assessment of the location of the property |
| SOF | Single overriding factor, that is single factor particularly pertinent to this property or its immediate vicinity which will have an effect on valuation sufficient to supersede the majority of other influences. For example, standard 3-bed semi-detached house with 4 acre paddock. |
| TRAD | Is the property of traditional construction |
| LA | Is the property in Local Authority ownership or some other form of social housing (or has it been in the past)? |
| O | Orientation of the main garden |
| Builder | Name of the builder if a new property |
| T | Tenure |
| Source | Source of comparative information |
| Tr Type | Type of transaction e.g. open market |
| Date | Date valuation was carried out |
| Value | The value ascribed to the property. Note - subject property at this stage would of course be zero unless a valuation has already been entered on the valuation screen. |
| Value/$m^2$ | Automatic analysis of the value of the property per $m^2$ |
| Name | Name of the property |
| No | Number of the property |
| Plot | Plot number of the property if new build |
| Dist/Vill | District or village in which the property is located. |
| Town | Town in which the property is located. |
| Postcode | Postcode of the property |

**Table 10. Valuation attributes selected for Project Dragon. Source: BUG**

Given the limit to the number of attributes that could be listed across a single screen the BUG somewhat arbitrarily decided to limit the number of attributes to thirty. It was felt that this discipline was necessary to ensure that the number of attributes are kept to a manageable level. The attributes chosen by the BUG for inclusion on the comparables listing for houses are shown in the Table 10 above.

## 9.08 Reporting

Two key issues had to be addressed in respect of the reports generated by the system. These were:

- Tick box v Full General Observations
- Full Automation v Report Crafting

It would have been straightforward from a programming standpoint to output the data inputs from the inspection module directly to a tick box/text box form of report however there were two reasons why this approach could not be adopted. Firstly the Chief Valuation Surveyor of the Halifax insisted that the output from the system was the same as that generated from the manual processes and by panel valuers who would not initially have access to the system. He considered it important that the recipients of the reports, the branch processing staff and society customers saw no change in the valuation report format. Any changes would require senior management approval.

The second reason was that if the system were to be marketed to valuers outside the Halifax it would be have to be able to generate reports in the formats required by the various lending institutions and not all of these use a tick box/text box format.

The general observations section of the Halifax Valuation Report is essentially a free form text format with a standard layout and utilising the preferred paragraphs referred to in the last chapter. To report in this form necessitated the production of numerous output paragraphs covering the majority of the eventualities that would need to be reported in a valuation report. Over one thousand paragraphs were produced and contained in an extension to the benchmark documentation.

| DESCRIPTIVE PARAGRAPHS | |
|---|---|
| **WLS** | Wall Construction |
| **RF** | Roof Construction |
| **OR** | Other Rooms |
| **LOC** | Location |
| **LOCF** | Location Flat |
| **GDC** | General Descriptive Condition |
| **GDCF** | General Descriptive Condition - Flat |
| **GD** | General Description |
| **GDL** | General Description Location |
| **BUM** | Buildings Unsuitable for Mortgage |
| DEFECTS PARAGRAPHS | |
| **100** | Movement |
| **200** | Dampness and Rot |
| **300** | Alterations and Extensions |
| **400** | Pitched Roofs |
| **500** | Chimneys, Flashings, Copings and Parapet |
| **600** | Flat Roofs |
| **700** | Cavity Wall Ties |
| **800** | Woodboring Insects |
| **900** | External Surfaces |
| **1000** | Internal Surfaces |
| **1100** | Electricity, Gas and Plumbing |
| **1200** | Heating and Flues |
| **1300** | Rainwater Goods and Drains |
| **1400** | Insulation |
| **1500** | Garden Structures |
| **1600** | Trees |
| **1700** | Steep Slopes |
| **1800** | New Property |
| **1900** | Non-Traditional Construction |
| **2000** | Health Hazards |
| **2100** | Leasehold |
| **2200** | Reinspection |
| **2300** | Concessionary Purchase/Shared Ownership |
| **2400** | Pests |
| **2500** | Coal mining |
| **2600** | High Alumina Cement and Mundic |
| **2700** | Restrictions |
| **2800** | Miscellaneous |
| **2900** | Non Essential Repairs |

**Table 11. Output paragraph subdivisions developed for Project Dragon. Source: BUG**

The paragraphs were subdivided into subject areas and coded to ensure that they appear in the report in order of priority. These sub-divisions are shown in Table 11 above.

The two different forms of output can be seen in the following example which relates to active structural movement. The tick box format would appear like this:

| | Yes | No |
|---|---|---|
| Is the property affected by structural movement ? | ✓ | |
| Is the movement progressive requiring further investigation ? | ✓ | |

**Figure 37. Tick box options for structural movement. R. Dennett**

The full text output paragraph as taken from the preferred paragraphs presently (Halifax Building Society, 1994) in use would read as follows:

*"The property is affected by structural movement. A full report identifying the cause and recommended remedial work necessary to ensure future stability should be obtained from a structural engineer (or chartered building surveyor) together with an estimate for the cost. The recommended works should be carried out in full under the engineers supervision. The valuation of the property cannot be given until a report and estimate of the cost of carrying out the structural work has been provided by the structural engineer."*

Having determined the form of the output the second key issue that had to be addressed was whether the report should be fully automated with no further input from the user or whether the facility for some editing or report crafting by the user would be provided. In addition to the professional considerations there were at the time of the project, personnel considerations that eventually led the project group to develop a system requiring input from the user or his/her assistant. Consideration of these factors is beyond the scope of this thesis which is concentrating on professional and technical issues.

Had a tick box form of report been chosen, full automation would have been the only option and this would have provided significant benefits to the user in the form of time savings on report generation. It was obvious during the pilots that the inspection module as developed presented a time overhead on the inspection and if the system were to be commercially viable savings would need to be made in other areas.

There is the danger with the system as it was developed that if every input generated an output the reports would become too detailed and unwieldy. On occasions, dependent on the severity or significance of a factor, it may be necessary to include or exclude an output. For example on a typical Victorian terrace where it is common to have a pedestrian right of way across the rear garden it would be sufficient to record its existence in the site notes. However if a modern estate property has a right of way across its garden and this is not typical it would be essential to report this.

Additionally where multiple occurrences of a defect have been recorded it would be undesirable to have multiple entries of the same output paragraph in a report. Finally it would be impossible to provide output paragraphs for every occurrence and occasionally it may be necessary to alter the wording of those generated by the system.

For these reasons a two stage process was developed comprising 'Smithing' and 'Editing'. Smithing gives the mobile inspection module user the ability to deselect paragraphs to be generated by the system and editing the option to change the wording of the paragraphs to suit the particular circumstances. Editing also provides the facility for free form text to be added to the report as required.

## References

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CHAPTER TEN

# 10.00 PROJECT DRAGON - THE SYSTEM IN PRACTICE

## 10.01 A Walk Through the System

This section will concentrate on the inspection module. The reasons for this are:

1. The inspection module is likely to have the greatest impact on the valuation process.
2. The administration and reporting modules whilst vital for the overall success of any application as a total package do not introduce any new concepts worthy of detailed consideration other than those strategic issues considered in the last chapter.

This 'walk through' will look at sufficient screens to give an overall impression of the operation and look and feel of the system.

Having logged an instruction, scheduled an appointment and arrived at a property the first screen that a valuer encounters in the inspection module is the **HOME** screen which is reproduced below. This screen was designed to contain general descriptive information about the property which is either input by the user or collated by the system from other entries in the inspection module. It was also intended to provide a springboard for opening screens for the inspection of the property. If a user, unfamiliar with the system found that he was getting lost the Home screen provides a familiar retreat from which to recommence the inspection.

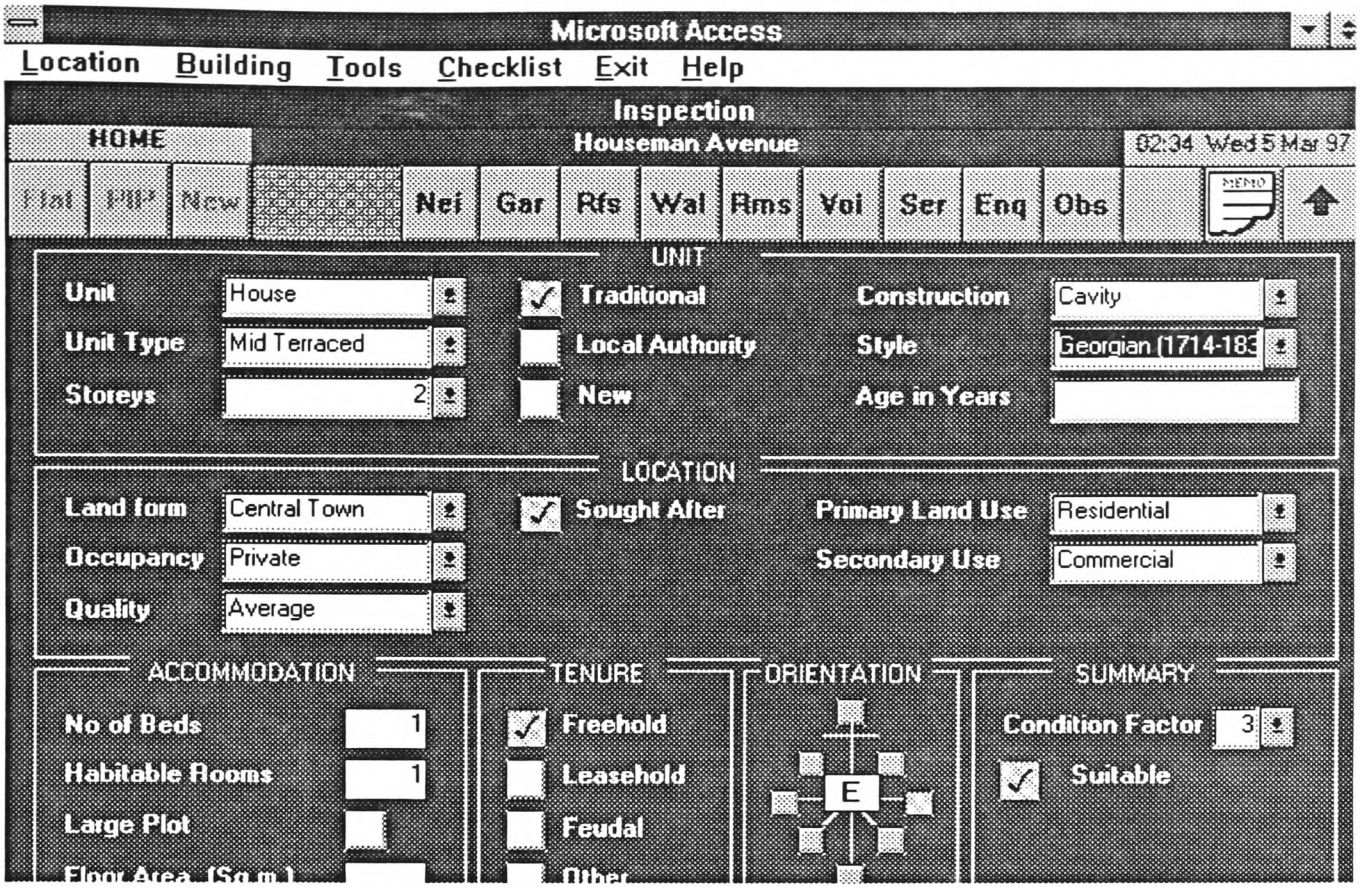


**Figure 38. Dragon Mobile - Home Scree. Project Dragon**

This reproduction shows the header information which at all times provides the user with the name of the module being used (Inspection), the address of the property being inspected (Houseman Avenue, Note: an actual inspection would contain the full address on this bar), the date and time.

The screen shows two of the objects available for data entry (combo boxes and toggle buttons). The toggle button has been designed to show a 'tick' icon when selected thereby closely resembling the tick box format of a valuer's manual site note form. Data entry is a simple matter of selecting a combo box entry or touching a toggle button. Incorrect entries can be overwritten at any time during the inspection.

In addition this screen shows the menu options and command buttons referred to in the last chapter. For any one inspection there would be only one Home screen. For elements of the property for which there may be multiple occurrences such as walls, roofs, rooms etc., the header section provides access (through the menu and command buttons) to the various records which may exist for the element in question. The reproduction of the **WALLS** screen below illustrates this point.

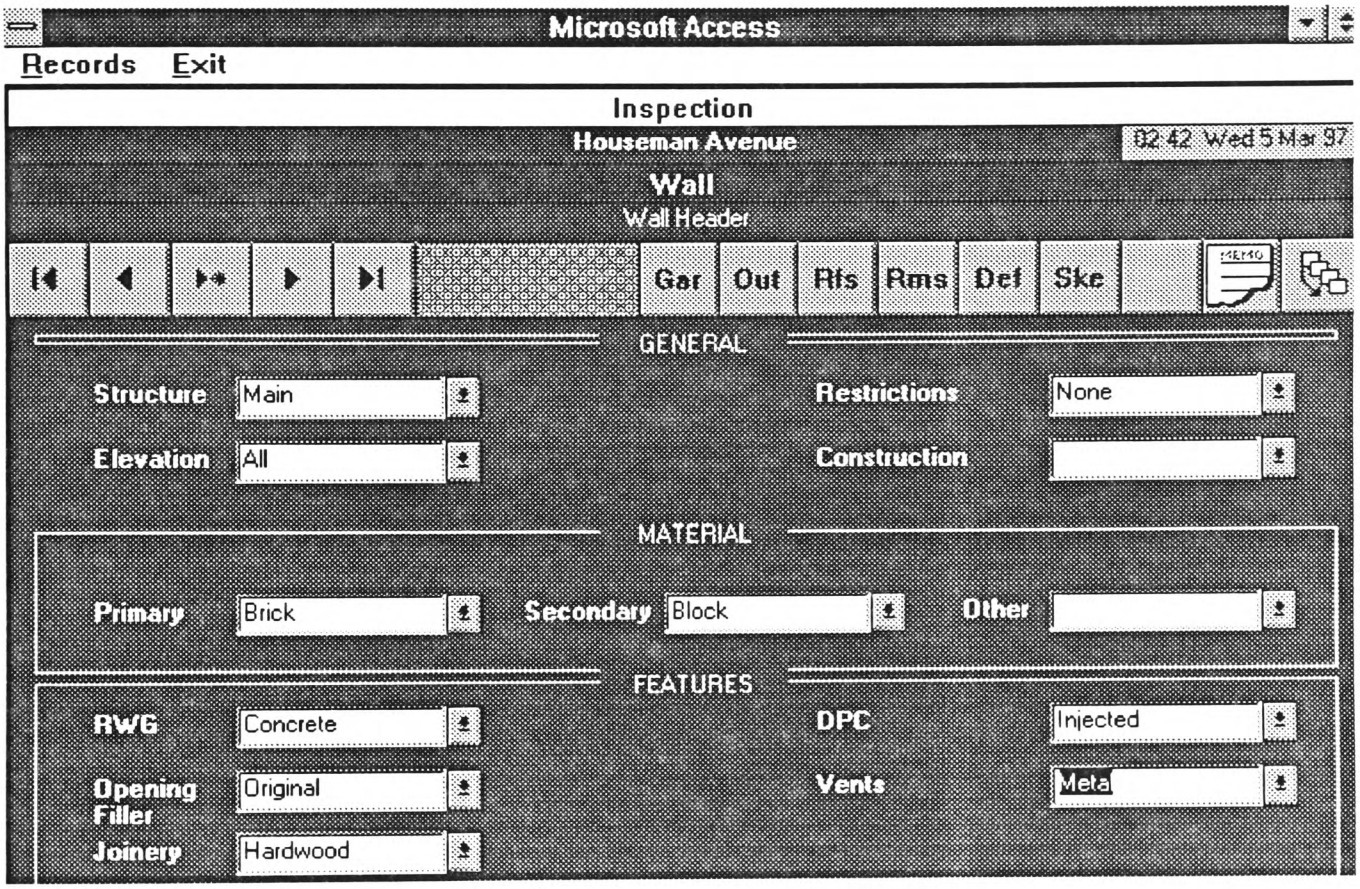


**Figure 39. Dragon Mobile - Wall Screen. Project Dragon**

The command buttons shown on the walls screen include the record selector buttons which are enlarged versions of the buttons that will be familiar to most users of windows applications.

The extreme right-hand button (whether containing an arrow or stepped page icon) enables the user to return to the last screen in use.

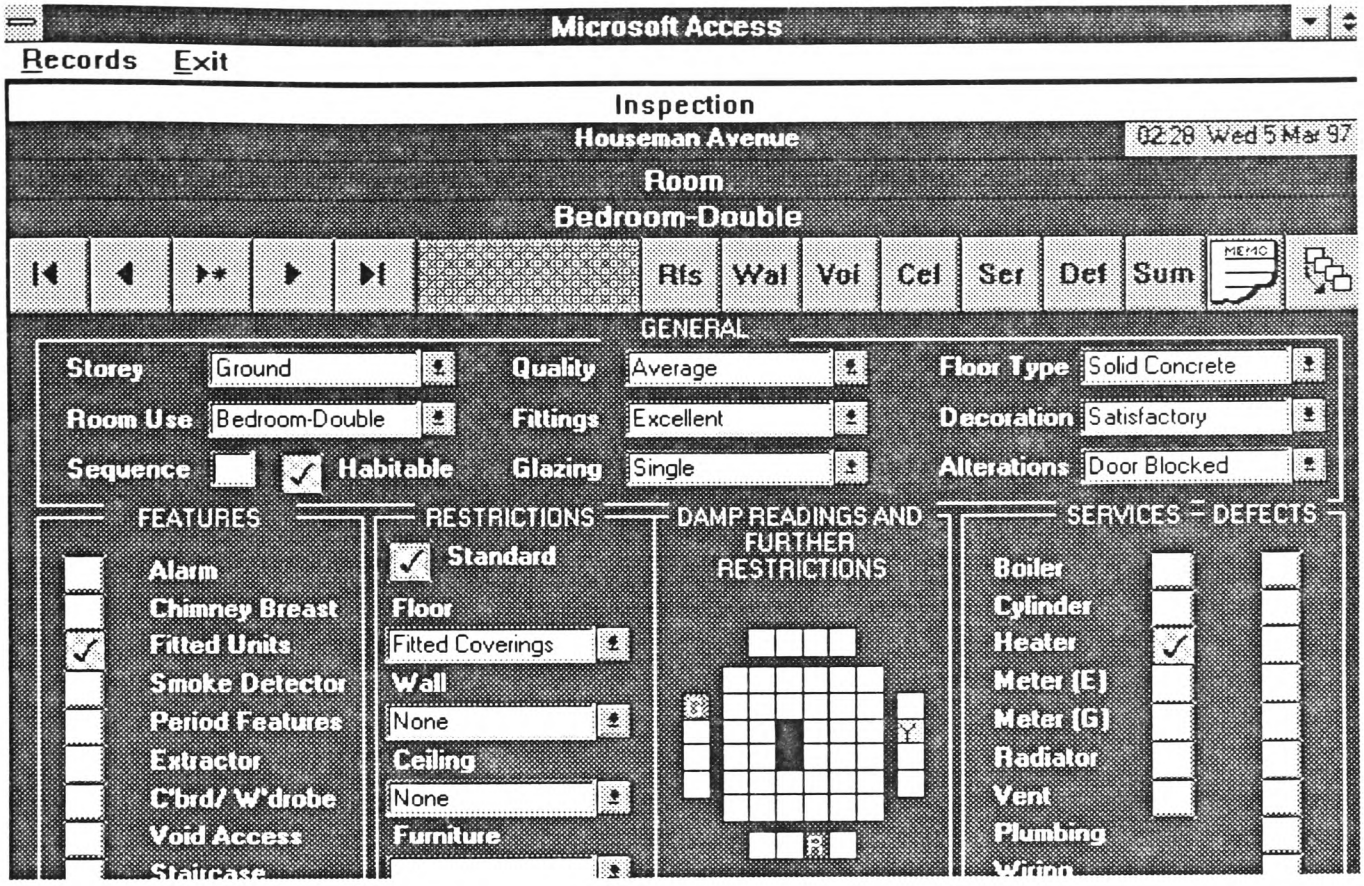


**Figure 40. Dragon Mobile - Room Screen. Project Dragon**

The **ROOMS** screen shown above is also a 'one of many' screen. In the header it gives the room use (it is intended to provide the room number for clarification in a later version). The damp reading and further restrictions grid referred to in the last chapter can be seen here with restrictions and readings recorded.

No review of the system would be complete without a look at the **DEFECTS** screen, probably the most significant single development and the one which will enable a much more streamlined inspection module to be created.

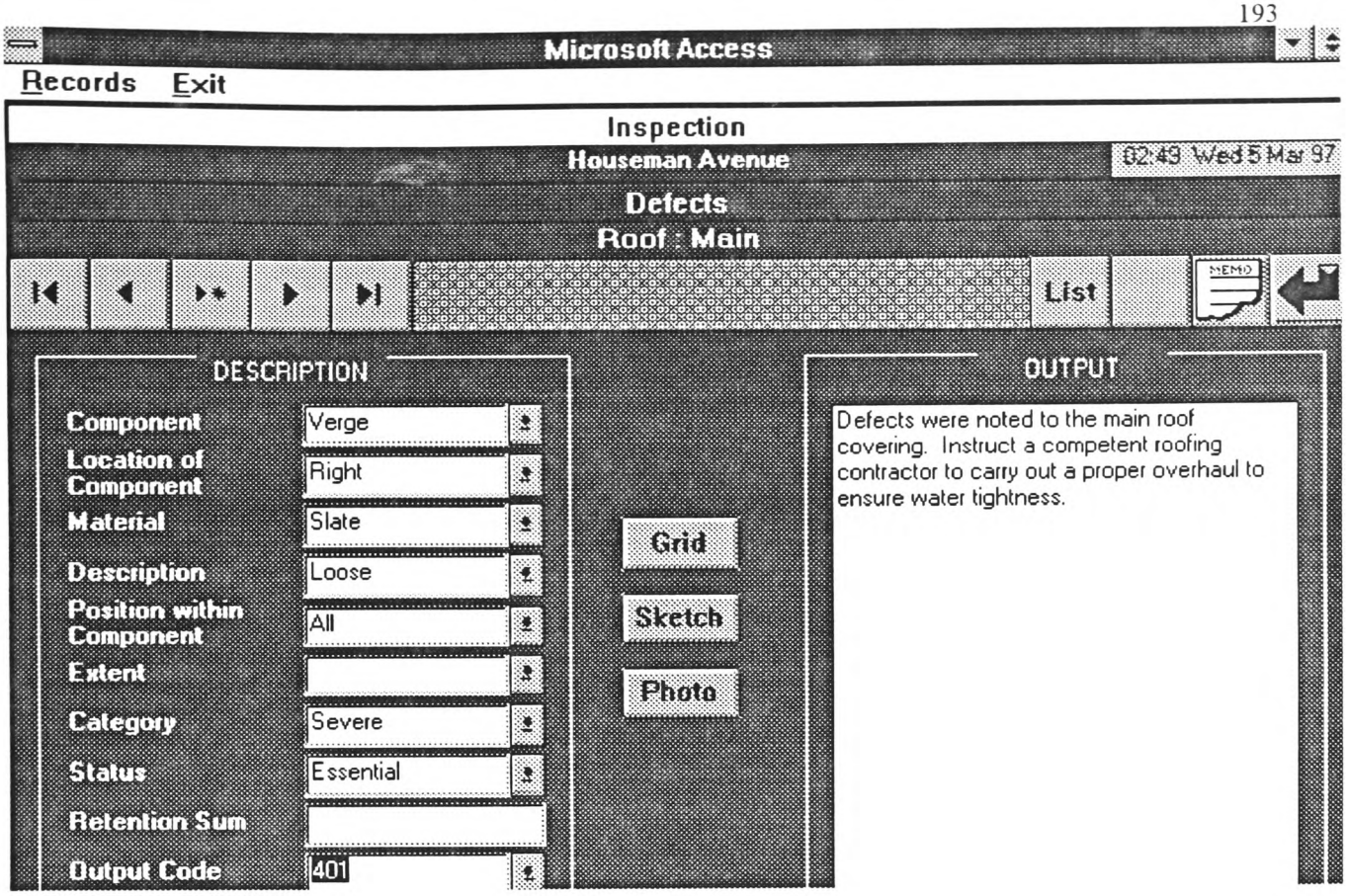


**Figure 41. Dragon Mobile - Defects Screen. Project Dragon**

The defects screen provides the opportunity to give a very detailed description of the defect and its location and to categorise it for report purposes. The output code is shown here with the text of the output provided for review at the time of inspection if required.

The List button calls up a summary list of defects recorded to that point in the inspection. This provides the valuer with an overall picture of the property and aids in the identification of causes and potentially hidden defects.

The Grid, Sketch and Photo buttons were inoperative in the pilot modules but the intention is that these would provide additional means of describing defects or their locations in a later version. The photo option

linked to a digital camera potentially offers the quickest and most useful facility.

The **PESTS** screen illustrates the diversity of factors that need to be considered when completing a valuation inspection. It also shows how the concept of the defects screen can be applied to other aspects of the property inspection.

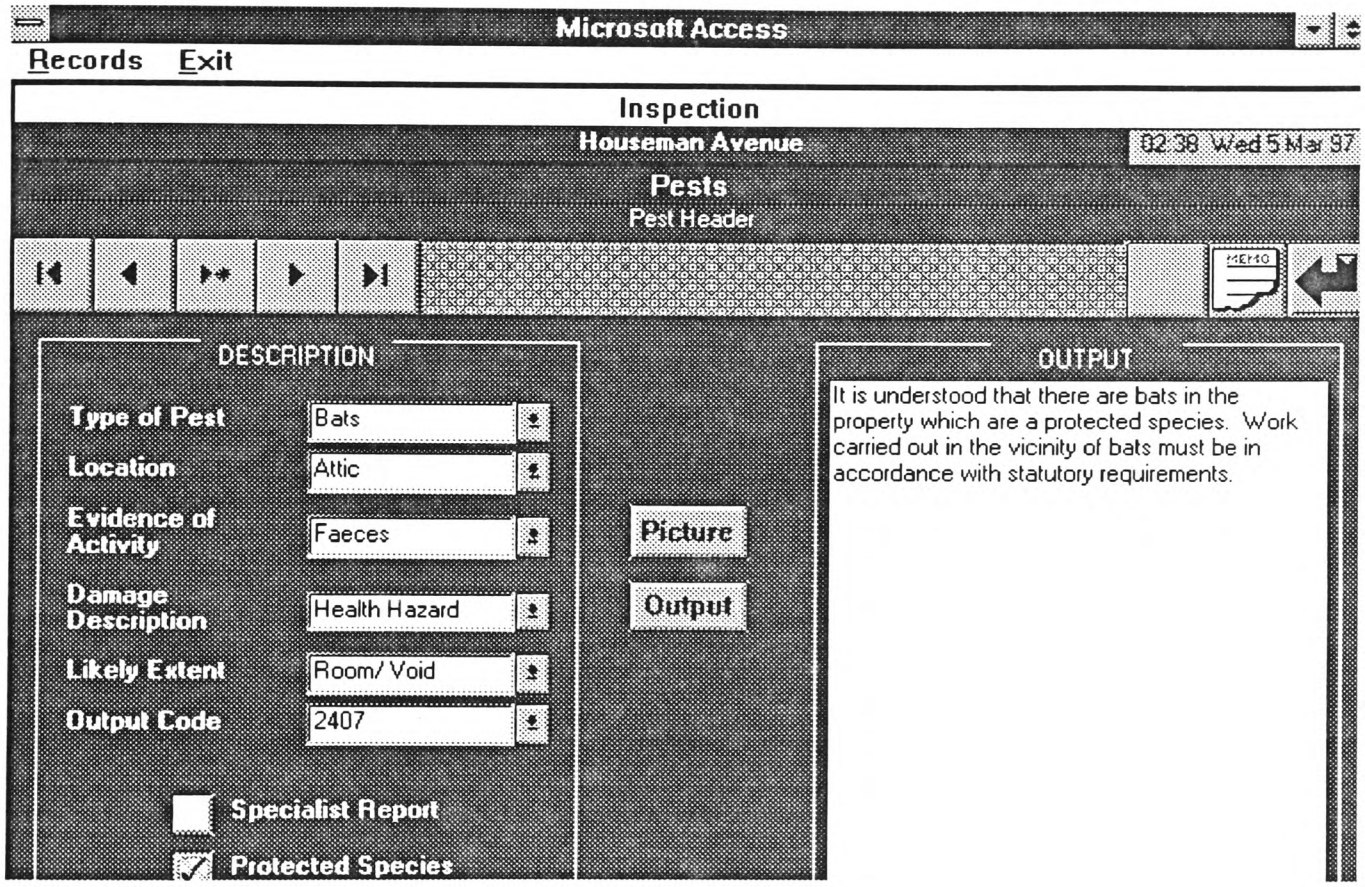


**Figure 42. Dragon Mobile - Pests Screen. Project Dragon**

The screens shown above utilise the graphical user interface referred to earlier and show the contrast between background and objects to aid visibility in bright sunlight. The inspection module comprised of around thirty of these screens enabling a very comprehensive description of the property and its defects to be made.

## 10.02 Experience of the Pilots

The inspection module was piloted by a group of valuation surveyors in the South Wales and West Region of Halifax Valuation Surveyors together with members of the BUG. In the first phase, users were given general training in the use of computers and in particular the Windows environment together with basic hardware care. After a week of familiarisation specific training on the use of the inspection module was provided. This was followed by a period of on site practice before using the system for actual mortgage valuations. At the time of the first pilot the administration system was still in development and this therefore will not be commented upon here.

Various teething problems were experienced both with the software and hardware and a procedure for reporting and rectifying bugs was established. All bugs were capable of resolution and it can be argued that these were to be expected in a project of this nature. The pilot was essentially another step in the rapid prototyping process. The bugs related mainly to the interaction of the software and the hardware platform and must be differentiated from the vast number of suggestions made for enhancements and improvements.

This section will consider the experience of the pilots in relation to the overall form of the system and its suitability for use in the valuation process. Positive feedback was received in respect of the following:

- Benefits of consistent data capture and screen prompts to ensure that all inspection criteria are considered and none are overlooked.
- Paper free - there was confidence that the system would record all inputs made.
- Consistent reporting provided by the output paragraphs.
- Potential for savings on administration and report writing.

The version of the system used in the pilots provided no 'expert help' (such as tree identification, crack diagnosis, comparable selection or automatic fire insurance calculations). It was therefore lacking in some of the key areas which would be of significant benefit to the valuation surveyor as mentioned earlier.

Despite the training and the aforementioned efforts to make the module acceptable to valuation surveyors a considerable degree of reluctance to adopt the system was encountered. Concerns were expressed that the system was too prescriptive and that more time was spent looking at the screen than the property! A criticism that was levied against the Halifax's site note forms.

The main criticism was however that the time taken on the inspection was too great and that this would have an impact on profitability and service standards. Time and motion studies completed during the early stages of the pilot showed that an inspection using the inspection module typically took twice as long as using the manual paper based methods that the valuers were familiar with. This would clearly improve with practice but not to a sufficient extent to make the system commercially viable even if savings in administration and reporting could be made. Enhancements to the software would need to be made to improve the efficiency of the inspection module.

A number of factors contributed to the time overhead other than user familiarity as mentioned above. These were:

- Amount of Data Collected
- Clutter of Screens
- Speed of software

The amount of data collected, the detail of the system, was considered to be far too great for a mortgage valuation and in some areas too much even for a Homebuyers Report. In practice the valuer records only basic descriptive information sufficient to complete the report and collate basic comparable information and then makes detailed notes on defects as they are encountered. Morgan (1995)

*"The system calls for so much data to be collected, whereas in normal circumstances, the Valuer will automatically dismiss more than he actually records, the latter being predominantly concerned with defects and their severity."*

This problem stems from the decision made by the BUG (referred to in the last chapter) to include everything initially, for programming out later. The evolution of the defects screen provided the opportunity for the inspection module to be simplified but this was not done. With hindsight the first version of the module should have been rigorously tested in the field by the BUG and rationalised before release to the pilot group. The mortgage valuation module should only contain fields necessary to:

- Generate a mortgage valuation report. It should not collect descriptive information that would not be reported upon, for example material used for damp-proof course.
- Trigger expert help.
- Collate attribute data used for valuation purposes.

Information required for supplementary reports such as an Energy Rating can be included in optional modules as necessary.

The clutter of some of the screens such as the Rooms screen shown earlier is to a certain extent a symptom of the excess data collection referred to above and despite the conscious effort to logically structure the screens. Screens full of data collection objects were not well received by the users. There was felt to be a compulsion to complete every section even if not relevant to the property being inspected.

There was a conflict here in the feedback received from the users in that whilst they did not like the full screens mentioned above the comprehensive checklist that they provided was well received.

Problems encountered with the speed of the software related in the main to the time taken to move from screen to screen. As this is a function of the Microsoft Access database software and the processor, improvements in this area that could be made by the system developers were minimal. Significant time savings could be made by forward planning of the users and by carrying out aspects of the inspection while waiting for screens to open.

In demonstrating the inspection module to potential future users the point was made that for the majority of valuation surveyors, Homebuyers Reports comprise a significant element of their work. Investment in a computerised inspection system would only be feasible if it could provide the facility for producing a Homebuyers Report. Very little development work would be required to enable a Homebuyers Report to be produced. Additional descriptive fields would be required and output paragraphs extended to provide a greater degree of description and additional help to the client.

Of the feedback received after the initial trials no mention was made with regard to any difficulties experienced with the weight of the hand portable. This was encouraging particularly as the group included a female valuer. The additional time taken using the inspection module was not presenting any problems in this respect. Accompanied inspections with users in the pilot revealed that operational practices were developed which obviated the need for carrying the hand portable at all times during the inspection.

Progress is continually being made with regard to the portability of P.C.'s this combined with the experience of the pilots would tend to suggest that the hardware problem has been satisfactorily resolved.

The resistance encountered to the inspection module from valuers in the pilot exercise tends to suggest that a modular approach to the high technology solution to the residential valuation process may be the best way forward. Users could buy modules as their confidence in the system grows. As has been mentioned earlier most valuers are familiar and conversant with proprietary word processing, spreadsheet and database packages. An integrated suite of residential valuation specific applications that can be built up into a complete solution would be a significant step forward.

## References

Morgan, A. (1995) "Project Dragon - Report on Field Tests" Unpublished Report.

# THE DEVELOPMENT OF A FULLY INTEGRATED INFORMATION TECHNOLOGY SOLUTION TO THE RESIDENTIAL PROPERTY VALUATION PROCESS.

## PART FOUR

## SUMMARY RECOMMENDATIONS AND CONCLUSIONS (INCLUDING LIMITATIONS AND FUTURE RESEARCH)

CHAPTER ELEVEN

# 11.00 RECOMMENDATIONS FOR AN OPERATIONAL SYSTEM

## 11.01 Summary

In summary, chapter three of this thesis considered in detail the Comparative Method of Valuation and made recommendations for best practice and attributes to be considered. Part two looked in broad terms at the options for technological support to the valuation process and part three reveiwed the practical experiences of the Halifax and the output of Project Dragon.

It has been intended that this research will form the basis of development work to provide long awaited support to the residential valuation surveyor. The development process was described by Lanning, (1991), thus:

*"The design process can be viewed as several overlapping tasks:*

1. *Define the problem.*
2. *List the requirements any solution must satisfy.*
3. *Select an abstract solution concept.*
4. *Specify the general parameters of the solution, and*
5. *Create a detailed implementation plan for the solution."*

Chapter two defined the problems facing the residential valuation surveyor; challenges to his expertise, a turbulent property market, business pressures and stretching of his local knowledge, all of which combined to damage his reputation. Chapter three also highlighted the poor guidance provided in the application of the comparative method of valuation and the lack of consistency in approach adopted for the analysis of market evidence.

The requirements that the solution must satisfy in both software and hardware terms were described in chapters six and seven. In addition reference was made in chapter four to the levels of accuracy required from any statistical approach to predicting values (5% being the optimum). The system must deliver support to the valuer through the entire valuation process from inspection through to report. It should provide assistance in areas of uncertainty and in the task of comparable analysis. This should all be delivered in a cost effective manner.

Much has been written in earlier sections about making the system user friendly. With hindsight and considering the experiences of the Project Dragon pilot studies it is my view that if the system delivers the above, the valuer (no matter how resistant to change and new technology he may be), will want to make friends with it. A comparison can be drawn with the damp meter, a device that when it was first introduced to the surveying profession in 1958 did no more than tell the surveyor whether a wall was damp or not. It could be (and I am sure it was) argued at the time that if the dampness is causing a problem it will be visible, and so why need a damp meter? However, today a damp meter is an indispensable tool used by all valuers.

The application structure outlined in the following section is the 'abstract solution concept' proposed by this thesis. Having considered the feedback from the Project Dragon pilots and comments made by practitioners to whom the inspection module was demonstrated it became apparent that to be commercially viable and acceptable to the widest market possible the application should be modular. The modularity would give the user the option of purchasing a bespoke package to suit his/her individual requirements. It would also give the purchaser the choice of hardware platform, desk-based, mobile or both.

The final sections of this chapter will specify the general parameters for each module and provide a detailed summary of some of the critical factors such as valuation attributes. The detailed implementation plan,

proposed by Lanning ( Ibid. ) is beyond the scope of this thesis. Miller-Jacobs (1991)

*"It is difficult if not impossible to specify all requirements of a system beforehand. In any system, changes to requirements always surface once the project has gotten underway."*

As stated in an earlier chapter (Jones, 1994) the specification for each module will state what it will do and not how it will do it, that is for the software developer. Schach (1993)

*"The specification document explicitly describes the functionality of the product, that is precisely what the product is supposed to do, and lists any constraints that must be satisfied."*

Jones (1994)

*"A specification can be viewed as a contract between on the one hand those who wish to use the object being described and on the other hand, those who are to build the object. For the user, this contract states the properties on which he is relying. The developer has a different view of the same document: for him it states the behaviour of the object he must build."*

The recommendation from this thesis is that for the persons that take up the development of the fully integrated solution, the rapid prototyping approach be adopted.

Miller-Jacobs ( op. cit. )

*"Specifications are dynamic documents that are not easily dealt with by the traditional development process."*

## 11.02 Application structure

The following diagram (Figure 43) shows the modules that should be available to a user wishing to take advantage of the integrated solution.

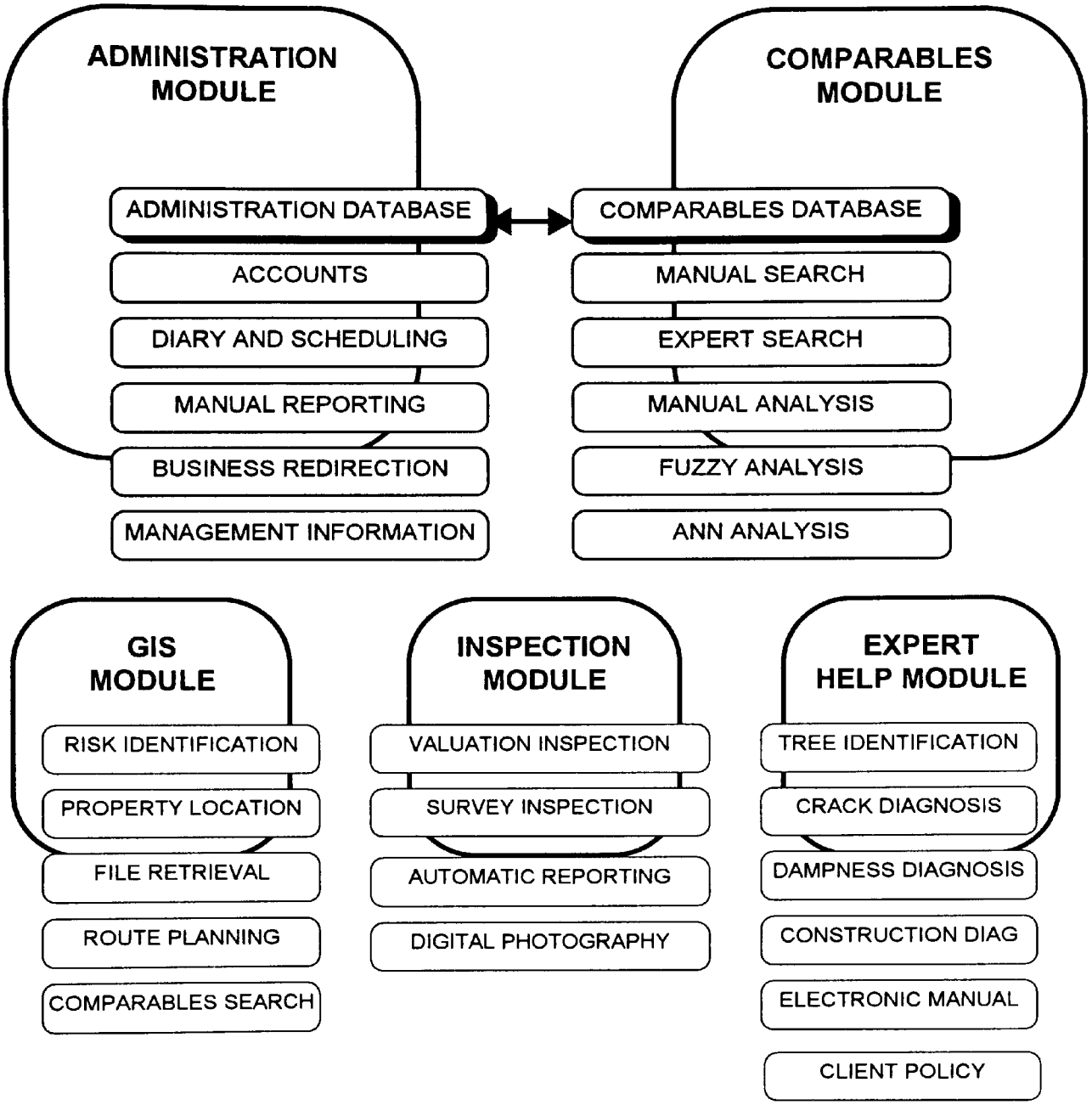


**Figure 43. Modular Structure of Integrated Solution. R. Dennett**

Shown within the modules are the various options that could be acquired subject to the needs and desires of the organisation.

The user could utilise any combination of the modules/options, subject to their limited interdependencies. For example the expert help module could be purchased in its entirety to run as a stand alone application, as

could most options within the GIS module. However, the comparables search option of the GIS module is dependent on the Comparable Database option.

### 11.03 Administration Module

The administration module should:

1. Contain a database for registering all instructions to be acted upon (See section 6.02) . This is distinct from the comparables database as not all instructions would relate to transactions that could be used for valuation comparables. For example instructions may be received to re-inspect a property to confirm that essential repairs, the subject of a retention from a mortgage advance, have been completed satisfactorily. This would generate an inspection and a fee but not a comparable.

(i) The address fields should utilise the Property Address File supplied by the Post Office to ensure accuracy and consistency (See section 4.06).

(ii) The unique property inspection reference number should be used (See section 4.06, 9.02 and Figure 30).

2. Contain an accounts facility to raise invoices for work done, issue statements and chase outstanding payments (See section 6.02).

3. Provide a diary and scheduling option (See section 9.02) that ensures inspections are completed on time and reports returned within the service standard requirements of the client. If the inspection module has not been selected this option should provide client specific inspection notes or guidance for the valuer completing the inspection.

4. Provide an option for manual report generation (See section 9.08).where the user has not selected the automatic report generation option available in the inspection module. This option should contain reporting formats required by the user's clients.

5. Enable instructions to be redirected either to another office within the same organisation, or where the user is acting as a clearing house for the client, to other firms of valuers. The facility should enable the

onward transmission of the instructions by a variety of means including, post , fax, and e-mail.

6. Provide query facilities to enable management within the users organisation to obtain information on valuer performance, service standards, income generation etc. (See section 6.02).

## 11.04 Comparables Module

The comparables module should provide a platform for the valuation process holding attribute data for analysis utilising manual or statistical methods or linked to the GIS module. It should:

1. Provide the opportunity of recording and distinguishing several tiers of attribute data (See section 3.04. Table 1). As a minimum this should include data on properties inspected personally by the user or other valuers within the same organisation, data supplied by other valuers and data obtained from non-professional sources such as estate agents. In time it is hoped that it will be possible to record data from the land registry in a similar fashion to the Sasine data that is available in Scotland.

2. Record the attributes listed in the following table (Table No.12)

(See section 3.06)

3. Index link value/price fields to a recognised House Price Index. (See Table 5).

4. Provide manual search facilities to suit the specific requirements of the user and as a minimum queries on the Date, Postcode, Unit Type, Property Style, Age, Bedrooms and Price Fields.

5. Provide an expert search facility that automatically selects the five closest comparable properties from the database using basic search criteria, with weighted valuation attributes and capable of extension or modification by the user. For example the basic criteria would be initially

programmed to search on property type. However the user may wish to specify that where the subject property is a one bedroomed house (a type for which there is limited data within his locality), unit type would be deleted to enable matches to be made against comparable sized and aged flats in the same location.

**Valuation attributes to be included in the Comparables Module:**

| ATTRIBUTE | DESCRIPTION |
|---|---|
| Source of data | Name of firm |
| Date | Date data input or updated |
| Transaction Type | Open Market Sale |
| | Possession Sale |
| | Part Exchange |
| | Right to Buy |
| | Concessionary Purchase |
| Transaction Status | Contracted |
| | Sale Agreed |
| | For Sale |
| Address | Property Address File |
| Location | Urban Form |
| | Occupancy |
| | Quality |
| | Primary land Use |
| | Secondary land Use |
| Unit Type | House, |
| | Flat, |
| | Bungalow |
| Property Style | Detached, Semi, Terrace, |
| Construction Type | Traditional |
| | Non-Traditional - Name |
| Age | in years |
| Size | Gross External Floor Area |
| Number of Bedrooms | |
| On site parking | No. of parking spaces |
| | No. of garaging spaces |
| Plot Size | Small, medium, large for type |
| Heating | Type |
| | Extent |
| Single Overriding Factor | Views, |
| | Short Lease, |
| | Local Authority |
| | Large Plot. |
| Price | Contracted or agreed sale price. |
| Valuation | Present Condition |
| | Average Condition for age and type |

**Table 12. Attributes for inclusion in Comparables Module. R. Dennett**

6. Enable comparables selected either manually or by an expert system to be analysed using a simple spreadsheet with the valuer entering adjustments manually. Ring (1970).

7. Enable comparables selected via either method to be analysed using a fuzzy spreadsheet with the valuer entering adjustments manually (See section 4.05).

8. Enable comparables selected by an expert system front end to be analysed using an Artificial Neural Network (See section 4.04 and 4.07). The ANN should from the selected comparables provide a prediction of value (to a margin of error of less than 10% but ideally no greater than 5%). It should also from the full database, provide adjustment values for individual attributes for use in a manual analysis if required.

### 11.05 Inspection Module

The inspection module should:

1. Be capable of being delivered on the chosen hand held platform (utilising Windows CE if appropriate) and communicating to the office or car based server either by physical or electronic link (See Chapter 7).

2. Use a Graphical User Interface (GUI)(See section 6.02).

3. Provide a valuation inspection option with the facility of recording limited essential descriptive information and restrictions on the inspection using a pen interface (See section 6.04). Enable the recording of defects utilising the 'Defects Screen' approach described in Chapter 9.

4. Make available a survey option to enable inspections sufficient for an inspection for the Home Buyers Reporting format to be completed. This will require more descriptive inputs but will be able to utilise the same defect reporting format as the Valuation option.

5. Make available fully automatic report generation with inputs from the inspection module completing the client's forms referred to in the Administration Module or the Homebuyers Reporting format if the client

requires a survey (See section 9.08). The reporting option should have built in intelligence to vary outputs for valuations or surveys.

6. Provide a facility for digital photographs to be linked to the inspection file and for transmission with the report. This is a peripheral that was evaluated during Project Dragon. Details of the research in this area are available but have been excluded from this thesis in the interests of brevity and because it does not impact directly on the core solution.

7. Provide a sketch pad option for sketching site plans, floor layouts and certain defects noted. Again these features were explored and field tested as part of Project Dragon but detailed description has been excluded for the same reasons as 6. Above.

## 11.06 GIS Module

The GIS module should

1. Use the raster format as this is considered to be the most suitable for the layers required and provides the greatest number of advantages of the two formats. (See Chapter 4, Gunston, 1993). This view is also reinforced by Grimshaw (1994).

*"The raster data model is essentially the simplest of the two and may well be sufficiently detailed for the purposes of most business applications."*

2. Utilise the Address-Point data supplied by the Ordnance Survey (See section 9.02). This feature would be particularly useful in rural areas where property location can be a problem.

3. Make use of the largest scale plans that can be afforded by the user organisation. As a trade-off of detail against cost the 1:10,000 scale black and white raster supplied by the ordnance survey appears to

offer the best solution which is also compatible with the Address-Point data.

4. Be capable of holding layers for risk identification on the following:

| LAYER | SOURCE |
|---|---|
| Contaminated land | Local Authorities |
| Landfill | Local Authorities |
| Mineworkings | National Coal Board |
| High Voltage Electrical Apparatus | Electrical Companies |
| High Risk Insurance Areas | Insurance Companies |
| Crime Rate | Police |
| Areas Liable to Flooding | Environment Agency |
| Radon Affected Areas | National Radiological Protection Board |

**Table 13. Layers for GIS Module. R. Dennett**

5. Provide the user with the ability of building up his own layers of point, area and polygon features to represent risks and locational features that affect value (See section 4.06).

6. Enable file retrieval from the comparables database by selection from points or areas drawn on the map layer.

7. As an option, provide a route planning facility giving optimum routes between inspection addresses and the valuer's office/base.

8. Linked to the comparables database and the ANN enable spatial analysis of comparable data to assist in the valuation process. Wyatt (1995)

*"the spatial aspect of property is a key feature, surveyors base values on locational criteria yet the potential of GIS for such an operation remains largely undiscovered."*

This feature should enable the user to define search criteria either by sketching polygons directly onto the digital map or by keying radii from spot points.

## 11.07 Expert Help Module

The expert module should provide a number of options to support the valuer by assisting in a wide range of areas capable of constant expansion but initially to include:

1. The Tree Identification System demonstrated in Chapter 5.

2. Structural crack, dampness and construction form diagnosis options using the same production rule reasoning processes utilised in the Tree Identification System.

3. Access from disk, CD ROM or internet to a variety of manuals including the RICS Appraisal and Valuation Manual. Enabling speed of search using Search and Find facilities and hypertext links.

4. In addition to the aforementioned manuals the ability to call up specific client requirements in respect of all aspects of the property. For example certain construction types are not considered acceptable securities for mortgage lending. The valuer needs to know this early on in the inspection to avoid abortive work. Linked to the inspection module this option could provide automatic prompts to the valuer, to obviate the need for manual call ups.

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CHAPTER TWELVE

# 12.00 CONCLUSION

## 12.01 Scope of Thesis and Limitations

Having completed this thesis it is hoped that its contents will stimulate interest from a profession that is notoriously resistant to change, provide food for thought and information/guidance for anyone wishing to progress the use of information technology within the profession.

In Chapter One the objectives of this thesis were set out as follows:

1. To investigate the reasons, and prove the need for change.
2. To analyse the residential valuation process and provide guidance to the valuer.
3. To research the options available for the development of a fully integrated information technology solution.
4. To consider the experiences and findings of Project Dragon (an attempt to develop an information technology solution).
5. To provide a blueprint for an application that can assist residential valuation surveyors.

The following comments would be made on the fulfilment of these objectives.

1. Chapter Two explored the reasons for change, the image of the valuation surveyor and the pressures that he/she faces.

The pressures continue as evidenced by recent offerings in the property press:

*"Be cautious of lenders valuations"* Property Week - 14th March 1997

*"Valuers feel the heat as lenders go for broke"* Property Week - 24 January 1997

*"Valuers will pay a high price for overvaluation"* Property Week - 14th February 1997

*"Valuations may go up in smoke"* Property Week - 20th June 1997

The need for the valuation profession to make a quantum leap in its approach to the valuation process has never been greater.

2. Chapter Three incorporated in full the majority of texts referring to the comparative method of valuation as used in residential valuations and should provide a valuable source of reference to valuation surveyors. It provided recommendations on best practice (that should be of direct practical benefit) and guidance on attributes and their method of adjustment.

3. In respect of the options for the use of information technology, it has been necessary to cover a wide range of topics many of which are alien to the average valuation surveyor. As a consequence it has not been possible or desirable to research in detail the practical aspects of the operation of, for example, multiple regression analysis and artificial neural networks. The research has focused on the property business and wherever possible has taken references that relate to property matters.

The use of property related references in the areas of statistical analysis and expert systems is intended to reinforce the recommendations for their adoption and to instill confidence in a sceptical profession.

4. Project Dragon was referred to in detail in Chapters 9 and 10. The intention was that the output from this project would provide a complete solution from administration, through inspection and valuation to reporting. It would provide assistance in all aspects of the valuation surveyor's role and as such would have a major impact on the valuation process. Unfortunately during the course of the preparation of this thesis the project was halted and, as yet, no commercially viable system has emerged.

5. Chapter Eleven provides an outline specification for the development of an operational system

All the objectives of the research have been satisfied. There are, however, aspects of the valuation process that have not been considered by this thesis but are worthy of mention here.

Bias and valuer behaviour in the valuation process are currently being explored. See, Wolverton and Diaz (1996) and Gallimore (1996)

*"there are also no doubt external pressures that may lead to distortions from predicted behaviour."*

Gronow et al.(1996) when considering bias have put forward the proposition that tentative transaction price should be witheld from the valuer, and this has prompted considerable debate within the profession.

The basis of valuation and the question of worth are being considered by the professional institutions and the Council for Mortgage Lenders. Mallinson (1997)

*"The real world is concerned with worth - what can this property or action upon property deliver to me. This is not just an investment question, but lies at the core of the interest of everyone who owns, occupies or uses property."*

Horler (1997)

*"The open market value (OMV) definition is a strait jacket for valuers. Estimated realisation price (ERP) and its derivatives have not addressed this shortcoming...".*

Finally there are many proponents of a national property database or national land information service (NLIS).

Wyatt (1995)

*"The RICS has risen to this challenge by suporting the Domesday 2000 initiative, which aims to create a national land information service in Britain by the year 2000".*

These debates are not essential to the core of the information technology solution that has been researched in this thesis but their resolution will have an impact on its final shape. Their resolution will not be easy (consider the question of attributes for the NLIS) and it may take some years, but the progress of the debates will need to be monitored by persons pursuing the development of the information technology solution.

## 12.02 Future Reseach

The next steps are more detailed research into the practical application of expert systems, artificial neural networks and GIS in order that a prototype working system can be developed for testing on live transactions within the daily sphere of operations.

The intention is to develop a core system that draws on the following options (Figure 44) and as specified in the last chapter.

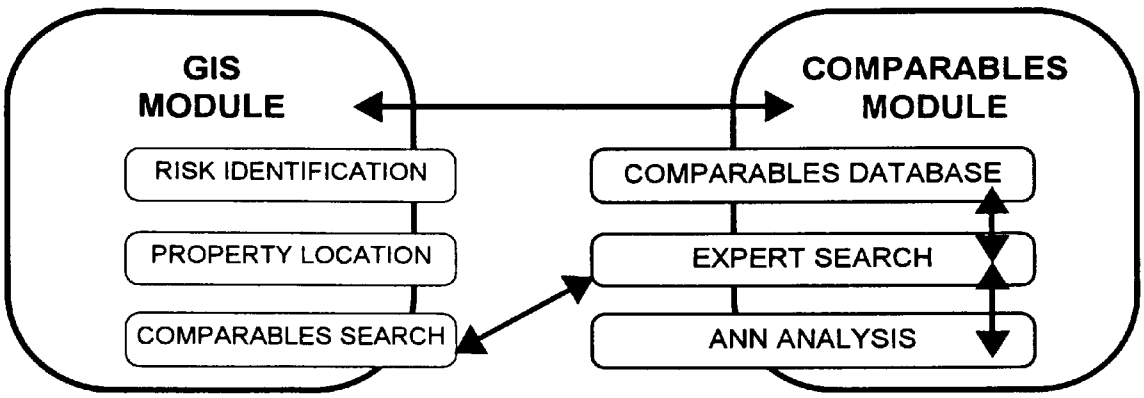


**Figure 44. Modules for Core System. R. Dennett**

This is seen as the continuation of the work that was commenced with Project Dragon and which concentrates on the valuation process. The risk identification and property location options are not essential in this respect but would give the GIS a degree of utility that would be of significant benefit to the valuer. They would also start to open up new possibilities for the valuation profession.

Only through testing and refinement in a rapid prototyping environment using live data in a variety of situations will it be possible to develop a robust application that could overcome the scepticism of the majority of valuers.

During the preparation of this thesis technology has continued to move ahead at a frantic pace. During the work on Project Dragon Windows 95 was in development and therefore the system was created in the Windows 3.1 environment. Consideration would need to be given with the creation of any new system to the latest operating environments including Windows CE which is currently being developed specifically for hand held PC's and which may provide significant benefits. This operating environment will need to researched in deatil to see if it can deliver the requirements identified in Chapter 6.

Anon (1997)

*"The next big step forward will take place this spring, when Microsoft introduces a windows system for palmtops. Known as CE, this will truly merge pocket and desktop computers, as they will share compatible versions of Excel and Word."*

Lloyd (1997)

*"Among the standard components of Windows CE are Pocket Word, Pocket Excel, Information Manager and a version of Internet Explorer. All can exchange information with the desktop versions."*

At the time of writing (March 1997) the release in the U.K. of the Casio Cassiopeia is awaited, the first of the new breed of hand held PC's (HPC) running windows CE. This is a very small unit which at 380 gms is significantly lighter than the Fujitsu Stylistic 500 (the favoured inspection platform of Project Dragon). It has a 480 x 240 pixel screen with four shades of grey which is touch sensitive using a small pen. It measures 27x175x92mm. Lloyd ( Ibid. )

*" The Cassiopeia comes with a selection of comms software including fax, e-mail and pager applications."*

The Cassiopeia though lacking a colour screen seems to offer an ideal platform for the inspection model at a competitive price. This and other innovations continue to whet the appetite and will also need to be researched. Lloyd ( Ibid. )

*" Software support for the HPC is already growing. There are applications which enable you to write or draw directly onto the screen, databases and a slew of connectivity programs and hardware including a wireless Internet connection."*

## 12.03 The Way Ahead

To date the adoption of information technology by the profession has been restricted to word processing and administration packages (that in

the main are used by secretaries and assistants), employed to make productivity savings, together with simple databases.

Barras (1996), explained the process by which information technology has tended to be adopted by service industries. He suggested that industries go through a three stage process:

- initial labour saving/capital using innovations to cut costs;
- followed by more radical process innovations to improve service quality;
- finally, employment generating and capital saving innovations to deliver new services.

At the moment the property profession is locked in the first phase. The fully integrated information technology solution to the residential valuation process proposed by this thesis is intended to move the profession into the second phase. Once developed and in widespread use it is likely that users will discover new opportunities for the profession to expand and deliver new services. It is the belief of the writer that the field of GIS offers the greatest potential in this respect.

The days of the residential valuation surveyor in his present guise, relying on intuition and feel and providing, in general, a far from satisfactory service are numbered. For the vast majority of transactions the added value that the valuer brings to the house buying/selling process is questionable.

With most of the Building Societies converting to banks, the legal requirements for a physical inspection and valuation of a property are fast disappearing. Research at Glamorgan University (Gronow et al.,1997) has shown that in a sample dataset of 104254 cases, 65% of mortgage valautions do little more than confirm the transaction price.

It is possible that before long the banks involved in residential property finance will take the view that the savings made in dispensing with the costs of a valuation outweigh the risks of doing so, especially if mass appraisal techniques are available. Purchasers for their part may take advantage of a defects insurance policy to protect their investment.

It is the Authorss opinion however that the valuation process properly managed, researched and delivered can provide much more to both the lending institutions and the property purchasers, than a valaution and a statement of condition.

Valuation surveyors can ensure their survival by a concerted effort to deliver a superior valuation or appraisal product. They can only do this however if they fully embrace and take advantage of the assistance that an information technology solution to the residential valuation service can provide.

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