THUMPER - An Expert System for Stamp Duty

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ABSTRACT

THUMPER is an expert system developed within Ernst & Young for use by our tax practitioners when advising clients on the potential liability of a commercial transaction to Stamp Duty and Stamp Duty Reserve Tax. Its development demonstrates the commercial exploitation of legal expert systems.

This paper introduces Stamp Duty and outlines why THUMPER was developed; describes the system itself, the expertise within it and the 5 stages of development; and finally outlines the envisaged benefits of having developed the system.

1 BACKGROUND

As advisers and consultants on many aspects of business, knowledge and expertise are important commodities of Ernst & Young. It is our expertise in specific areas of business which is of value to clients and the use of expert systems is seen as a logical step to providing clients with a value added service.

The expert systems initiative within Ernst & Young began in earnest in 1986. Since then the main activities of the group have been:

- development of expert systems for use in key areas of the business i.e. audit and tax; and
- increasing awareness of the potential of expert systems technology both within and outside of the Firm.

The first major system to be developed was VATIA, the VAT Intelligent Assistant [1] which places specialist VAT expertise in the hands of auditors enabling them to carry out overview checks of clients' VAT affairs. The system has been in use for two years now, is installed on approaching 1000 audit machines and is an integral part of the Ernst & Young audit approach.

A second system to be developed, in conjunction with Phillip Capper, then Chairman of the Oxford University Law Faculty, and an expert in the law of latent damage, was The Latent Damage System [2]. This system was developed to demonstrate the potential of expert systems in law, and was the first such system to be developed in the UK.

THUMPER is a system developed for use by corporate tax practitioners within Ernst & Young. Advisers on the structuring of commercial transactions, and on tax and financial planning, must give comprehensive advice to clients. The consideration of Stamp Duty and Stamp Duty Reserve Tax is just one aspect of the area of tax liability and planning, but the expertise is scarce and the legislation and case law complex.

Tax law is a popular area for the research and development of expert systems; examples include ExperTAX [3], TAXMAN [4,5] and TAXADVISOR [5]. In [6], Susskind discusses the reasons for this, basing his arguments on a statement made by Niblett [7] that "the sources of tax law are statutory and the taxing statutes are construed strictly...Thus the meaning of a taxing statute may be more clearly discerned than the meaning of other legislation..." in order to justify a prediction, made some years ago, that "...the first practical machine will give advice on tax law". This in itself, does not seem to justify the development of expert systems in the area of tax law as expert systems are well suited to domains which are complex, and in which the expertise is not well structured and formalised. Indeed, Susskind argues that almost any expert system in the area of tax law would in fact need some relevant judicial precedents represented in the knowledge base in order to give expert performance, and that many taxing statutes are

extremely complex. This view certainly seems to match more closely with the kind of expertise embodied in THUMPER.

2 THE DOMAIN OF STAMP DUTY

Stamp Duty is one of the United Kingdom's oldest and most complex taxes, dating back to 1694, and affecting almost all commercial transactions. It is governed by the Stamp Act 1891 and the Stamp Duties Management Act 1891, as amended by subsequent Finance Acts and other Acts, and is essentially a tax on instruments (written documents) [8,9,10]. The substance of the instrument determines the stampability of it and the head of charge (charging category) under which it falls. Stamp Duty Reserve Tax (SDRT) is a separate tax introduced by the Finance Act 1986 which is effective on agreements to transfer chargeable securities.

There are many reasons for developing an expert system in this area - some relevant to the above discussion, others more concerned with commercial issues.

First, Stamp Duty expertise is scarce both within and outside of Ernst & Young. The development of an expert system for disseminating Stamp Duty expertise therefore fits within our goal of developing expert systems:

> *"Through the use of computer technology, to make scarce human expertise and knowledge more widely available and easily accessible".*

Second, scarce expertise alone is not a sufficient reason to develop an expert system; there has to be a need for that expertise to be used elsewhere. Stamp Duty is a tax which is liable on almost all commercial transactions, and although generally the rate is only 0.5% or 1% of the consideration paid for the purchase, this can amount to a significant figure on a large transaction, such as the acquisition of a business. When advising clients on the tax implications of large transactions, Stamp Duty cannot therefore be ignored.

Third, the tax is extremely complex, for the following reasons:

- the large amount of applicable statute and subordinate legislation;
- the existence of multiple charges - which charges are applicable to a given transaction will depend on the subject matter and type of the transaction;
- the presence of SDRT - many securities transactions can be chargeable under both Stamp Duty and SDRT; and
- the amount of relevant case law.

The combination of these factors - the scarcity of the knowledge, the need to give comprehensive advice to clients and the complexity of the tax are all prime reasons for developing an expert system.

The precise nature of the expertise within THUMPER is discussed in more detail in a later section of this paper.

3 OVERVIEW OF THE SYSTEM

The Stamp Duty system (Fig. 1) is made up of the knowledge-based expert system, developed using the expert systems shell XiPlus[1] and additional functions written in C which the users can access and browse as required. The first of these is a glossary of terms that either have specific meaning as regards Stamp Duty, or that the user group had identified as requiring explanation. The second is a series of screens on the Concepts underlying Stamp Duty. These could be written more efficiently in C, and use is made of the ability to roll XiPlus out of memory to run external programs.

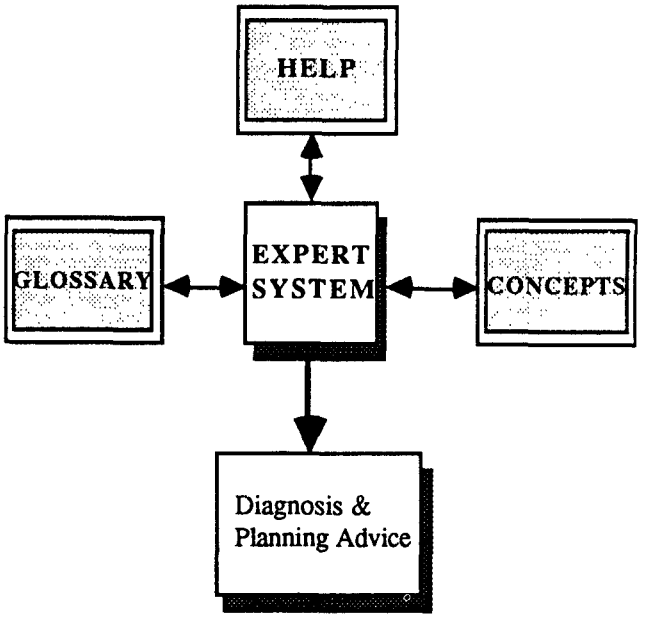

Fig. 1 THUMPER system structure

The knowledge-based element of the system is divided into five parts - consultation control, information gathering, general exemptions, transaction details, and reporting. Fig. 2 illustrates the interaction of system modules during a consultation.

Information Gathering

The first 3 modules are concerned with gathering information from the user on the nature of the transaction, specifically on:

[1] *XiPlus is a trademark of Inference (Europe) Ltd*

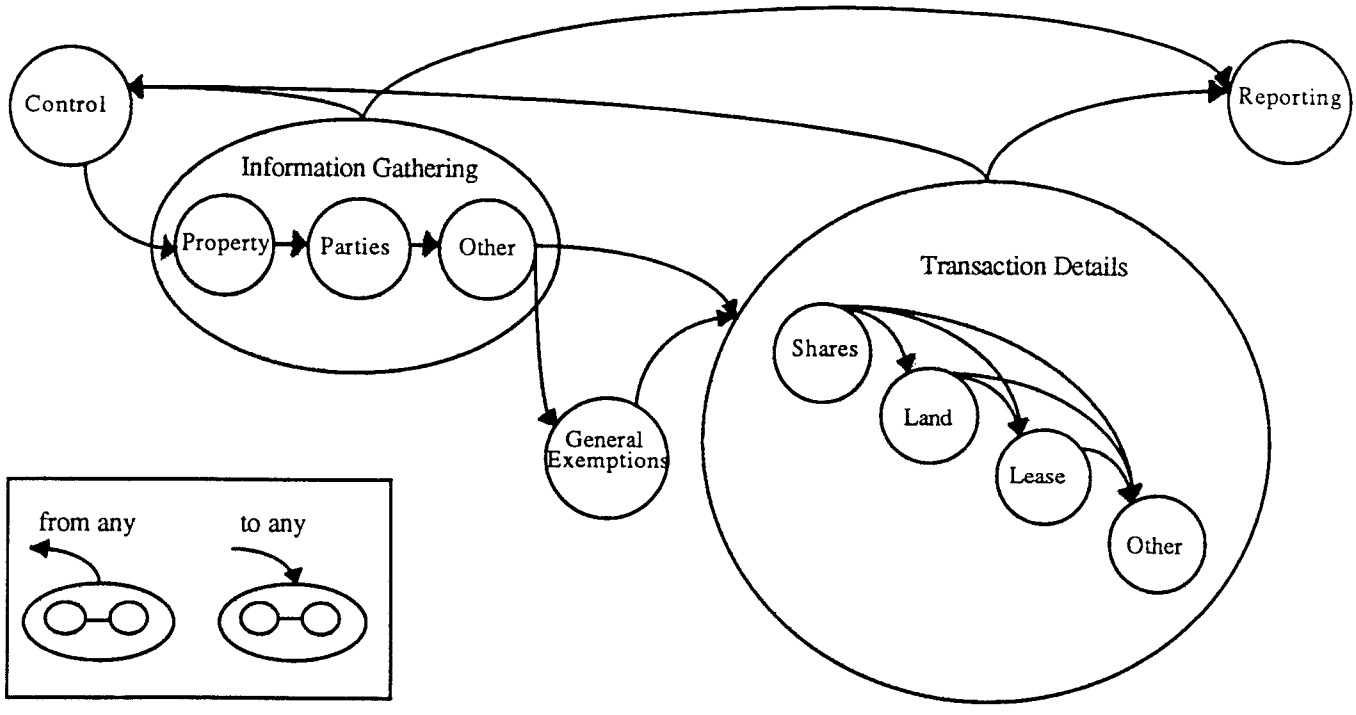

Fig. 2 Stamp Duty Modules and Consultation Flow

- the nature of the property or assets being transferred;
- the parties (i.e. vendor(s) and purchaser(s)) involved in the transaction;
- the place of execution of the document, or the relevance of the transaction to the UK; and
- the type and value of the consideration passing in respect of the property transferred.

It may become evident at this stage that the transaction is one which either cannot be handled by THUMPER, or which is exempt from Stamp Duty. Examples of the latter would be the transfer of assets to a registered charity, or a transaction concerning a licence. In either case, the consultation will end appropriately.

The complexity of the consultation in this module will vary depending on the type of transaction. The transfer of freehold land is a single property transaction and is straightforward. The sale of a business, however, may involve the transfer of many types of property (land, fixed assets, goodwill, intellectual property, debts etc.) each with a different liability to Stamp Duty.

General Exemptions

At this point, the user takes control of the dialogue and can choose whether or not to run the General Exemptions module. General exemptions available are linked directly with the type of transaction or the circumstances of it (for example, the transfer of assets on a liquidation), of which the user should be fully aware.

As in the Information Gathering modules, the consultation may end at this point, if the whole transaction is found to be exempt.

Transaction Details

There are four separate modules within the Transaction Details section, each dealing with a separate category of property. The four categories are: securities; land (& buildings); leases; and "other" (intellectual property, goodwill, debts etc.).

These modules can be regarded as the charging sections of the system as they mainly determine exactly which charge is applicable - for example, whether it is a fixed duty of 50p under the heading Conveyance of any other kind or an *ad valorem* duty of 0.5% or 1% under the heading Conveyance or Transfer on Sale. In addition to charges, however, it is still possible at this stage to find exemptions from the duty.

Reporting

In the above sections, XiPlus demons (forward chaining rules) are used to compile lists of report codes where each

code represents a specific report paragraph. At the end of the consultation, the report is assembled in a logical order, using these codes to access the relevant paragraphs which are held in a report library.

A straightforward transaction such as the sale of a freehold property will result in a short report which will conclude exemption, liability at 1% of the purchase price, or a combination of the two. For a complex transaction such as the acquisition of a business the report could be very short, if, for example, there is an exemption from the duty which covers the whole transaction, or could be very complex, consisting of different charges to Stamp Duty for different parts of the transaction.

In addition to the above advice, the system pin-points opportunities for minimising the liability to Stamp Duty either by re-structuring the transaction, or by changing the circumstances or environment in which it is carried out. An example of the former is the suggestion to use multiple documentation, where, for example, some of the assets being transferred are not UK property and therefore not subject to UK Stamp Duty. A suggested change in circumstances could be to consider the creation of a 90% associated group of companies which can sometimes be carried out at very little expense, thus making savings on Stamp Duty. Such planning points are offered to the user as suggestions for the client thus allowing the user or the client to assess their implication in a wider context.

4 THE USER INTERFACE

THUMPER has an interactive user interface where the dialogue is controlled by the system, as proposed for legal expert systems in [6], and as used in The Latent Damage System [2]. The user cannot describe the problem in natural language and cannot volunteer information, or indeed a partial analysis, as suggested by McCarty [14]. However, the advantages of the interactive interface used possibly outweigh these shortcomings.

First, the user is asked to provide only that information which is relevant to solving the current problem. As a non-expert, the user may not know just what information regarding the transaction is important for Stamp Duty purposes, and thus the guidance offered by the system ensures that the correct information is elicited. Further, if an exemption is discovered after only a few questions have been asked, then the user is saved from having entered irrelevant data which is not required to solve the problem.

Second, by posing questions which either require yes / no answers or the user can answer by selecting from a menu, it is easy to define the scope of problems handled by the system. Options such as "none of the above" and "other" are built into menus, and if these are selected by the user, then the system states that the problem is out of its scope and further advice should be sought.

Traditionally, expert systems have offered an explanation facility which answers the question "How was the conclusion reached?". In THUMPER, ths facility is not offered in the standard way, i.e. by offering a trace of the rules used during the problem solving, as this often results in more confusion than explanation. The report produced at the end of the consultation does, however, offer explanations as to how the various conclusions have been reached. These explanations are an integral part of the report text and do not relate specifically to rules. Where, for example, a transaction is exempt from Stamp Duty according to a section 42 Finance Act 1930, in addition to stating the exemption and the legislation reference, the conclusion states that it is the 90% association between the vendor and purchaser which allows this exemption. The user can thus relate the conclusion to specific questions asked during the consultation.

5 DEVELOPMENT

The development of THUMPER was divided into 5 main stages from the initial investigation, through to implementation. Elements of STAGES, Ernst & Young Management Consultants' in-house expert systems development method [11], were used throughout the development cycle.

The five phases are outlined briefly below:

Investigation: production of a sampler system to demonstrate the benefits of developing an expert system in the domain of Stamp Duty.

Feasibility: assessment of the commercial viability and technical feasibility of developing THUMPER; establishment of a user group and production of a full functional specification for the system.

Prototype: development of a prototype system to demonstrate the structure and functionality of the full system, reviewed by the user group.

Development: elicitation for and coding of the full system; development of the full help system, concepts and glossary functions; validation and verification of the knowledge base.

Implementation: installation of THUMPER at all user sites (about 35), for a 3 month evaluation period, followed by final amendments and full release.

6 EXPERTISE

In [12], McCarty distinguishes between expert systems for legal analysis and those for legal planning. The former type of system is described as one which provides an analysis of a set of facts elicited from the user, using a set of legal rules explicitly represented in the system. The latter is described as a system which, when given a set of facts describing both the current situation and the desired

result, suggests a suitable course of action which satisfies certain specified constraints. McCarty further states that most legal expert systems fall into the first category and are unable to address the issue of planning due to their purely rule-based nature.

THUMPER falls within both of these categories. The user does not explicitly describe either the current situation or the desired result, but specifies a commercial transaction such as the acquisition of a business. The user is only asked to describe those aspects of the current situation that are relevant to the transaction and which may affect liability to Stamp Duty. The system analyses the facts presented and provides a report on the Stamp Duty payable (and any relevant exemptions), and as patterns emerge, is able to provide planning advice.

Whereas the backward chaining rules are used to provide the diagnostic type advice on liability, forward chaining rules or demons are used to identify emerging patterns in the case and consequently give planning advice.

Although represented in a rule-based shell, the expertise contained within THUMPER can be described as a conceptual model. The knowledge base of The Latent Damage System [2] has been described as such because it embodies more than just the legislation relevant to latent damage. At least half the knowledge base consists of the expert's less formal, experiential and judgemental interpretation of the law. In the KADS expert systems development method [13], one result of the analysis phase is a conceptual model which is a combination of the model of expertise, and a model of cooperation between the problem solver (i.e. the expert) and the user. McCarty's idea of a "deep conceptual model" [14] is more theoretical and complex than either of these views, requiring the development of a representation language to model concepts within the legal domain. As an example, the Language for Legal Discourse, discussed in [14] allows modelling of states, events and actions, and modalities over actions such as obligation and permission.

The expertise within THUMPER combines both of the first two views of a conceptual model and can be described as a three-layer conceptual model where the outermost layer represents the users' view of the problem, the next the expert's interpretation of the principles and legislation of Stamp Duties, and the innermost layer the legislation and case-law itself. It is the representation of more than just the legal rules which enables the system to recognise when planning points may be applicable to the case being presented. The user view was considered to be of utmost importance in order that a system was developed at the knowledge level of the users. The concept of developing user independent expert systems where the user interface must be defined at the knowledge level of the users is discussed further in [15].

In practice, it is this three-layer model which drives a THUMPER consultation. The three layers of the model represent three categories of expertise:

- knowledge of commercial and financial transactions;
- general Stamp Duty knowledge; and
- Stamp Duty legislation and case-law.

Thus, the structure of the system, and consequently the flow of a consultation is driven not by Stamp Duty legislation, but by knowledge of commercial and financial transactions. Although not the most efficient way of reaching a conclusion, this approach is the most logical for the users. The system asks just sufficient questions about the transaction to decide which Stamp Duty charge(s) and principles are applicable and therefore which legislation and case-law may be applied in later modules.

The second category of expertise is represented by the application of Stamp Duty principles and by the expert's problem solving approach. Without this interpretation of the legislation, it is doubtful that the system could be described as truly 'expert'.

The third category is represented by the application of specific legislation and case-law to a transaction, in order to specify charges, exemptions and reliefs. The legislation is easily translated directly into rules, although the ordering of clauses is often changed, a significant amount of rewording and interpretation is needed, and many help screens and glossary terms are required as back-up explanation for the users.

Of all the modules in THUMPER, the General Exemptions module uses the Stamp Duty legislation in the most overt way - as an example, the rule below checks whether the transaction gains exemption under section 75 of the Finance Act 1986 [16], as a specific type of acquisition. The rule is in effect a direct translation of the legislation, but with a slight amendment in the order of the clauses in order to give a more logical order to the questions asked.

if genex next includes "acquisition of an undertaking
in exchange for shares"
and s75 acquisition is yes
and s75 reconstruction of vendor is yes
and acquirer uk is yes
and s75 share distribution is yes
and s75 other consideration is no
and bona fide is yes
and s75 common shareholdings is yes
then section 75 exemption is yes

Other rules use legislation less explicitly. The rule below uses a basic principle of Stamp Duty - that if nothing is being conveyed, there can be no duty. A variation of rights by special resolution is not deemed to be a conveyance for Stamp Duty purposes [10].

if share transaction is variation of rights
and variation of rights by special resolution is yes
then force securities report includes SR012
and "ordinary shares" is done

The report paragraph SR012 simply states the exemption, referencing the applicable legislation.

Case-law is used both to back up conclusions based on either general principles or legislation, and to illustrate planning points. For example, in the case of an exchange of freehold land for the same, the user may be made aware of the *Portman* trap[2] which demonstrates that care should be taken with the documentation of the exchange in order to avoid the transaction being treated as two sales.

7 CONCLUSIONS

It is envisaged that there will be significant benefits of using THUMPER, both for Ernst & Young and for clients.

The envisaged benefits for the client are:

- potential financial savings;
- an improved quality of service; and
- an increased scope of advice from one source.

For Ernst & Young, two types of benefit can be identified. Those specific to THUMPER are:

- an increased market for Stamp Duty work; and
- an increase in scope of the knowledge of tax professionals;

and those relevant to all expert systems are:

- the dissemination of scarce expertise;
- the reliable delegation of tasks;
- efficient resource allocation;
- training; and
- an enhanced image through the use of expert systems technology.

In summary, the development of THUMPER has solved a significant problem, by achieving the cost effective dissemination of scarce, complex expertise, in order to give an improved quality of service to clients.

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