CCPS: Transforming Claims Processing Using STATUTE Corporate for Microsoft Windows

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Abstract

In 1992, the Australian Department of Veterans' Affairs commissioned SoftLaw Corporation to build a compensations claims processing system as the cornerstone of their business process re-engineering project. This project aimed to turn around the performance and cost of administering compensation benefits. The resulting system, known as CCPS, is an innovative blend of tools, including an expert system, that completely transforms the delivery of compensation benefits to the Department's clients. The success of CCPS means millions of dollars of savings in program administration. The client service improvements that have resulted were possible only with the use of the enabling technologies.

Introduction

In late 1992, SoftLaw began the development of the Compensation Claims Processing System (CCPS), a Windows application incorporating an embedded expert system for the processing of compensation claims lodged with the Department of Veterans' Affairs (DVA).

Compensation claims are lodged by veterans and their dependants. Pensions are paid as compensation for disabilities or death caused by service in the armed forces. Claims are decided on the basis of a reasonable hypothesis connecting the veteran's disabilities with war service (if the veteran served overseas) or on the basis of reasonable satisfaction (for those who served in Australia).

CCPS deals with all aspects of claims processing from initial lodgement of the claim, to decision and payment. A number of different components have been combined in the complete application. These components include:

- an expert system which determines whether a pension should be paid;
- electronic publishing/hypertext;
- sophisticated document generation;
- a client/server database;
- legacy systems connectivity; and
- modules written in C.

CCPS has been the tool which has enabled DVA to completely re-engineer this aspect of its business and to thereby address a raft of problems experienced with the previous administrative arrangements and systems for processing compensation claims.

DVA had been subject to continuing criticism from client groups and administrative review bodies. In 1992, the Auditor-General tabled, in the Federal Parliament, the Australian National Audit Office (ANAO) Efficiency Audit on Compensation pensions to veterans and war widows. This report dealt largely with the administration of the system. The Audit highlighted a large number of problems with DVA's administration of the compensation program.

CCPS was DVA's primary response to this criticism. Within DVA, CCPS was seen as the only way that the Department could successfully address all of the problems which had arisen under the former manual processing system.

This paper deals primarily with the use of expert systems technology, the changes this technology has enabled, and the problems its use has solved.

The Problem

DVA's administrative procedures for dealing with claims, prior to the introduction of CCPS used an assembly line approach to processing claims. A claim physically went through at least nine stages before it could be finalised. Individual officers would be responsible for single aspects of processing a claim: when their task was complete the claim would be passed on to the next person. There was no one person with overall

responsibility to ensure that a claim was processed within a reasonable amount of time.

Furthermore, no guidelines existed for handling material or issues which were common across claims. All claims were handled on a case by case basis, as if there were no similarity in their subject matter. In fact common elements were the rule rather than the exception. A survey of 500 claims, carried out to provide information for the proposal to develop CCPS, found that:

- 60% of all claims lodged dealt with 17 medical conditions while 80% dealt with 43 medical conditions; and

- almost 90% claimed that a medical condition was caused by smoking and that the smoking habit developed as a result of service in the armed forces.

The method employed by DVA to process claims caused numerous problems. These included:

- lengthy processing times;

- excessive, inconsistent and sometimes unnecessary investigation of claims;

- inconsistent decisions and inconsistent approaches to policy;

- poor quality decisions;

- high levels of appeals against decisions;

- dissatisfied clients;

- high administrative costs of processing claims and appeals.

The time taken to process claims had been a recognised problem for a number of years. DVA had previously established a target of 180 days to determine a claim. This target was never achieved for the majority of claims. When the time for processing appeals was added to the time for processing the initial claim it was common that a claimant would wait up to 3 years for a final decision on their claim. The Auditor-General found that:

"DVA's approach to processing claims is inefficient; it is characterised by an unnecessarily large number of processing stages and poor co-ordination, excessive 'dead' time between processing stages, a lack of collective responsibility for the overall processing task and over-classification of some staff positions.

The ANAO considers that inadequate central guidelines and insufficient support, management and monitoring of the decision-making process are the major reasons for the level of inconsistency observed. Rectification of these shortcomings has been inadequate and inefficient. The scale of the problem has warranted a speedier and more concerted approach by DVA."

The lack of guidelines or a detailed policy approach on how to treat medical conditions being claimed contributed to many of the problems which have been highlighted. Acceptance rates of claims for disabilities ranged from 55% to 68% across the six offices that processed these claims. For death claims, the range was from 42% to 63%. These discrepancies could not be explained away by demographic or geographic differences. The Auditor-General in his findings concluded that:

"The design of the Compensation Sub-program which involves discretionary decision-making on a case by case basis, makes achievement of consistency difficult. DVA's administrative processes do not manage risk sufficiently. Inconsistencies in decision-making have been significant, readily identifiable and a feature of the system for many years. They have far reaching consequences for both program expenditure and equity."

The cost of this inconsistency is evidenced by the fact that the appeal process increased program administrative costs by 80%. Program figures for March 1991 showed that in excess of 30% of decisions made were appealed and that of these, approximately 40% had their decision amended. Appealing an unfavourable decision had become so entrenched that client groups readily admitted to advising claimants to withhold information to present during appeal.

The problem for DVA was how to reduce the number of stages and the number of hands that a claim passed through, given the complexity and the volatility of the material being considered. Furthermore, it needed to develop a consistent approach to the treatment of claims, whereby a claim for a particular medical condition would be investigated in the same manner, and consider the same issues, as any other claim for that condition.

The Solution

DVA had spent time investigating expert system technologies and in 1989 had purchased a site license for the use of *STATUTE* KBMS (now called *STATUTE* CORPORATE). DVA chose *STATUTE* for a variety of reasons, including:

- it was designed expressly for the modelling of business and administrative policy and regulations;

- its natural language knowledge representation scheme, considered an essential feature, was not available in any other commercially available expert system development environment;

- DVA could have significant input into its future development; and

• the product developers were local and could act as consultants on projects.

An expert system was seen as essential for CCPS because it would enable DVA to equip claims processing officers with the information, decision support and guidance necessary for them to handle all aspects of the claim process.

The development of CCPS was undertaken with several objectives. CCPS was intended to:

• enable single officer determinations;

• eliminate or substantially reduce delays in claim processing (in many cases same day processing was seen as achievable);

• eliminate or substantially reduce problems with quality and consistency in decisions;

• eliminate or substantially reduce client dissatisfaction with the compensation claims process;

• reduce the cost of administering the Compensation Program by reducing the number of staff involved, eliminating the need for Departmental doctors to be involved in all claims and by reducing the classification level of the decision-makers;

• improve the standard of communication with clients; and

• provide a superior service to clients.

The Architecture of CCPS

Organisationally, CCPS consists of a number of co-operating processes managed by a central, compiled C program. This is a graphical, multiple document interface (MDI) program that executes under Microsoft Windows. It has a *client/server* architecture, in that the additional processes act as servers for the main program. These processes include the *STATUTE* CORPORATE inference engine, Microsoft Word for Windows and the *STATUTE* CORPORATE hypertext reader and textbase. To store and manage case data, CCPS uses a GUPTA SQLBASE relational database, residing on a LAN database server. Furthermore, through a 3270 LAN gateway, CCPS utilises HLLAPI programs to invoke transactions to store and retrieve case and client information from DVA's enterprise databases residing on central Amdahl mainframes.

Interaction with mainframe systems has the dual benefit of enabling CCPS to piggyback onto legacy applications to effect claim processing tasks more efficiently handled by these applications - such as pension payment processing - as well as permitting users of other legacy applications, including MIS report generators, to consider and review CCPS case data.

Figure 1 shows these principal processes, as well as the data accessed and managed by CCPS. The processes and data elements are related in the following ways:

• The compiled CCPS executable program, CCPS.EXE, acts as the control program for all processes. It executes on users' desktop computers and initiates or establishes communication with the server processes in the system. Through these, it gains access to the data they manage. The CCPS program directly accesses data of its own, such as the medical knowledge base, the code tables, the decision advice hypertext library and the International Classification of Diseases (ICD) text database.

• The *STATUTE* CORPORATE inference engine, also executing on users' desktop computers, the *STATUTE* EXPERT, interprets the CCPS rulebase.

• The GUPTA SQLBase database program, residing on a network database server workstation, provides access to the CCPS case database. There is typically only one production case database per LAN, although CCPS supports multiple databases - enabling the use of development, test, training and production databases simultaneously.

• The IRMALAN 3270 client for Windows through the IRMALAN gateway workstation, provides both 3270 terminal emulation and acts as the HLLAPI server for the CCPS transaction subsystem.

• The CCPS IMS transaction programs and the mainframe legacy applications (including case and payment processing systems) execute on the mainframe and provide interfaces to the enterprise Client and Case databases.

• Microsoft Word for Windows, is used by CCPS for document generation, including investigative correspondence (such as questionnaires), decision advices and standard letters.

• The *STATUTE* CORPORATE hypertext reader, *STATUTE* E-PUBLISH, provides access to the CCPS research system, incorporating Departmental policy, historical documentation and all rulebase commentary.

Claims Processing with CCPS

CCPS provides support for all aspects of claims processing. A typical claim will involve the following steps:

1. recording of client details and registration of the claim;

2. validation of the claim - to verify that the legal requirements for lodging a claim have been observed, including confirming entitlement to claim (e.g. the claimant is a veteran or a dependant of a veteran) and
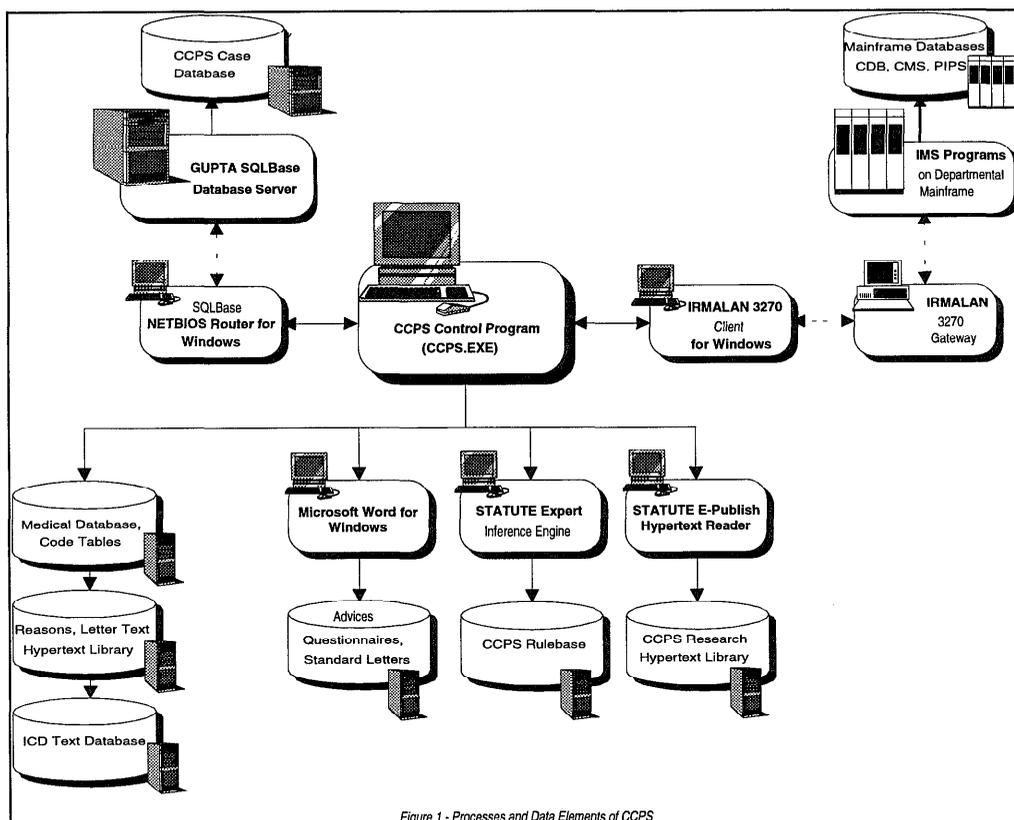
Figure 1 - Processes and Data Elements of CCPS

that the appropriate claim form has been lodged and signed;

3. recording details of the subject of the claim, that is, the medical conditions claimed;

4. confirming that the diagnosis of the condition claimed meets DVA's diagnostic criteria;

5. investigation of the causes of the conditions claimed;

6. decision on whether the conditions claimed are service related;

7. assessment of the rate of pension to compensate for conditions accepted as service related;

8. payment of pension; and

9. Notification to the client of the outcome of the claim.

This discussion concentrates on those parts of CCPS which manipulate legal and medical knowledge and which impact steps 3, 5, 6 and 9 of the claim process. These primarily involve the CCPS rulebase and the medical knowledge base. It is these components which have been responsible for the major benefits observed following the introduction of CCPS.

The implementation of CCPS required that DVA develop very detailed policy to define the circumstances under which a medical condition can be accepted as related to service. This policy forms the basis of the medical knowledge contained within the CCPS rulebase and medical knowledge base. To document this policy DVA produced Statements of Principle (SOPs) for 130 of the most commonly claimed conditions. Each Statement enumerates contentions which can be raised by a claimant, and, that will result in the condition being accepted as due to service. These Statements have been modelled in the CCPS rulebase, allowing a claims processor to test whether a claimed condition is related to service.

Figure 2 shows an excerpt from the Statement for Hepatitis B, and Figure 3 shows the rules corresponding to the third bullet point of that Statement.

DVA is legally compelled to identify and investigate all possible means of accepting a claim - it is not necessary for claimants to actually raise specific contentions. Consequently, a claim for a condition cannot be rejected until all contentions that can reasonably be raised linking that condition with service have been investigated and found not to be supported by the facts of a case. The Statements identify all contentions that can be so raised, and DVA is obliged to investigate them all in every case of a claim for a condition covered by the Statement.

In cases where subsection 120(1) or 120(2) applies, a **reasonable hypothesis**, generally, will be considered to have been raised when the veteran or member:

- was a prisoner of war of the Japanese; or

- had a blood transfusion which was not screened or adequately screened for hepatitis B as a treatment for a condition causally related to service; or

- had an organ transplant which was not screened or adequately screened for hepatitis B as a treatment for a condition causally related to service; or

Figure 2 - Excerpt from Pancreatitis Statement of Principle

Source Rule Contention 3 from module Hepatitis B

2346: The veteran's hepatitis B has been accepted on the basis of an organ transplant if:
(Used in: option 3 of rule SOP module Hepatitis B)

    2365:   The veteran has had an organ transplant at some time *(Base level fact)*; and
    2366:   The veteran had an organ transplant prior to the onset of the hepatitis B *(Base level fact)*; and
    2367:   The organ transplant was performed for an illness or injury which is identifiable *(Base level fact)*; and
    2369:   The veteran has established the causal connection between the identified illness or injury which required the organ transplant and operational service for hepatitis B *(Proved by: rule Contention 3.1 module Hepatitis B)*

2346: If this is not the case, then it will be concluded that the veteran's hepatitis B has not been accepted on the basis of an organ transplant

Source Rule Contention 3.1 from module Hepatitis B

2369: The veteran has established the causal connection between the identified illness or injury which required the organ transplant and operational service for hepatitis B if:
(Used in: option 1 of rule *Contention 3 module Hepatitis B)*

    2370:   The organ used in the organ transplant was not adequately screened for hepatitis B *(Base level fact)*; and
    2371:   The identified illness or injury which required the organ transplant is causally related to operational service *(Base level fact)*

2369: If this is not the case, then it will be concluded that the veteran has not established the causal connection between the identified illness or injury which required the organ transplant and operational service for hepatitis B

Figure 3 - Excerpt from CCPS rulebase for Pancreatitis

Development of the Statements has highlighted just how difficult this investigation can be without computer based decision support systems. The complexity of the material being dealt with and, in particular, the interaction between medical conditions (such interactions had rarely been considered in the past) meant that possible avenues for accepting a claim were frequently overlooked.

This interaction, referred to as propagation in CCPS, means that to properly investigate and decide whether a claimed condition is related to service, it may be necessary to investigate several other conditions as well, and determine whether they are service related. Propagation is best explained by example:

The SOP for Pancreatitis indicates that this condition can be accepted as service related if it is caused by cholelithiasis which is itself service related. This means that to reject pancreatitis you must also decide that the veteran did not have cholelithiasis resulting in pancreatitis, or if he or she did have cholelithiasis, that it was not caused by service. The SOP for Cholelithiasis itself indicates that it will be accepted as service related if it is caused by hepatic cirrhosis which is service related. Consequently, to conclude that cholelithiasis and pancreatitis are not service related, it is first
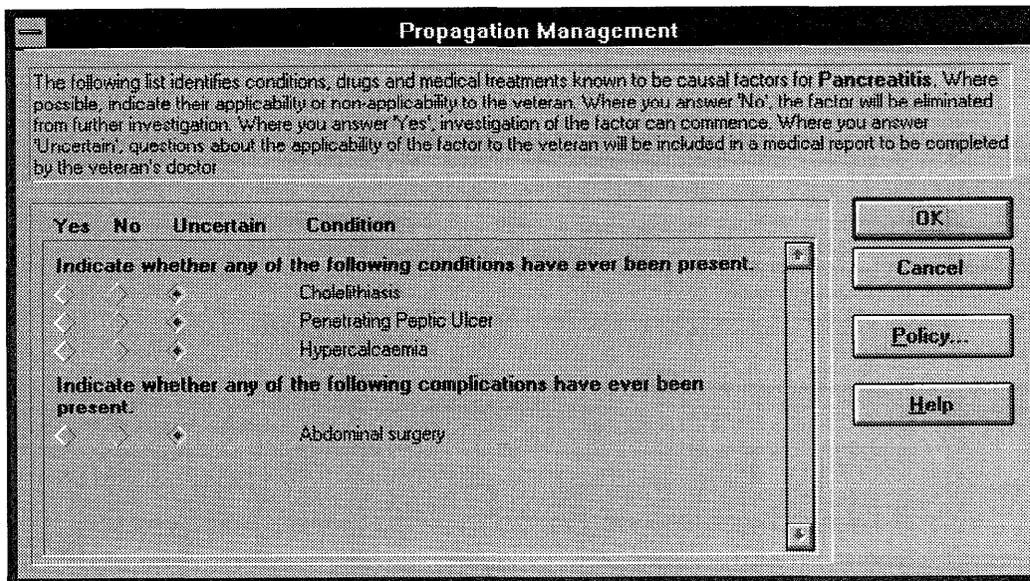
Figure 4 - CCPS propagation dialog for Pancreatitis

necessary to conclude that any instance of hepatic cirrhosis causing cholelithiasis is not service related.

This is referred to as direct propagation, and arises where a SOP identifies a specific condition that can cause the condition covered by the SOP. Direct propagation specified in the current set of 130 Statements means that for some conditions, it is theoretically necessary to investigate over seven additional conditions in order to exhaust all avenues for accepting a claimed condition.

CCPS also supports indirect propagation. This occurs when a contention in a SOP specifies a risk factor, event or medical treatment that can cause the condition, and the risk factor, event or medical treatment is a direct result of an unspecified medical condition which is due to service. To investigate these contentions, it is necessary to identify the condition or conditions (there may frequently be many conditions) representing the risk, causing the event, or for which the medical treatment was prescribed, and determine whether it or they are related to service.

For example, the SOP for Hypertension specifies that this condition can be caused by corticosteroids. If the veteran received treatment with corticosteroids for a condition which was service related and then developed hypertension, the SOP allows hypertension to be accepted as service related. To investigate this contention, the claims processor identifies the conditions for which corticosteroids were prescribed and uses CCPS to determine whether they are service related.

Similarly, the statement for Carpal Tunnel Syndrome specifies that it can be accepted as service related if it is caused by service related trauma to the wrists. If the trauma occurred during and epileptic episode, and the epilepsy is related to service, then the Carpal Tunnel Syndrome can be accepted.

The issue of propagation is so complex that when DVA issued the Statements as documents prior to the implementation of CCPS and requested that decision makers manually comply with the stated policy, the differences in acceptance rates between the claim processing centres actually increased rather than decreased.

The medical principles encoded in the CCPS expert system dictate that it is not possible to reject a claim without first investigating and exhausting all possible avenues for accepting it. This means that CCPS will identify and map out all propagation paths, and require that the claims processor consider and reject them all before allowing the claim to be rejected.

However, it is possible to accept a claim immediately, once it has been determined that the facts of a case support a particular contention. CCPS has been designed so that claims processors can nominate the order in which they wish to investigate contentions. This enables them to bypass unnecessary investigation should there be a way of quickly accepting the claim.

As an example, Figure 4 shows a dialog box allowing a claims processor to consider the propagation paths for pancreatitis. The claims processor is able to identify propagation paths that are worth pursuing (because it is

known that the veteran has or has had a propagated condition), are not worth pursuing (because it is known that the veteran has never had a propagated condition) or are potentially worth further investigation. Questions concerning these latter conditions are automatically combined into a questionnaire which can be sent to the veteran's doctor to obtain additional information.

Investigating a Claim with CCPS

The investigation of a claimed condition in CCPS typically involves the following steps:

*   the condition is ICD-9-CM encoded, based on its diagnosis, and utilising an on-line ICD-9-CM reference;
*   the SOP covering the condition is automatically identified, including those contentions which must be investigated;
*   any propagation paths are mapped out;
*   CCPS conducts a streaming interview to eliminate avenues of investigation known to be inapplicable;
*   CCPS selects questionnaires specific to each contention, to be sent to the claimant or the veteran's doctor, to gather factual information required to test the contention;
*   when enough information is available for it to be worthwhile, knowledge bases for individual contentions can be tested to determine whether they can be supported - Figure 5 shows a typical knowledge base interview dialog;
*   on completion of investigation of the claim, CCPS generates a decision advice letter to be sent to the claimant, explaining the outcome of the claim, including reasons why a condition is either accepted or rejected, advising of any pension variations and notifying rights of appeal. The decision is then recorded on the mainframe client database and, if appropriate, pension payment actions initiated.

In the past, the investigation of claims was largely ad hoc, very broad and relied heavily on advice from DVA's medical officers. As a result, investigations were expensive, tended to involve unnecessary correspondence with the claimant and produced inconsistent outcomes. The development of CCPS and the encoding of the Statements in an expert system, has enabled DVA to streamline its consideration of claims and in particular, allowed it to produce extremely specific investigative material (in the form of questionnaires and letters) targeted at the veteran and the conditions claimed. These questionnaires form the basis of the information gathering exercise associated with the determination of a claim.

Application Use and Benefits

When fully implemented in all processing centres, CCPS will be used to process all compensation claims lodged with DVA. Its implementation has involved the complete re-engineering of claims processing procedures - most significantly, the reduction in the number of people handling a claim from up to nine to down to one. It has eliminated the need for consulting Departmental medical officers in more than 90% of claims - the medical expertise is now available in the CCPS expert system and medical knowledge base.

CCPS ensures that the investigation of claims is rigorous and that Departmental policy is applied consistently in all cases.

When CCPS was first implemented in Queensland claims assessors were phoning veterans and completing the CCPS investigative material over the phone. Prior to CCPS this would have been impossible, since they would not have known which questions to ask. CCPS had finalised cases within 3 days of implementation in Queensland.

The introduction of CCPS has produced a dramatic improvement in the amount of information that is provided to the Department when the claim is first lodged. It is now common for an accurate diagnosis and supporting information to be provided with the initial claim - as clients and their representatives learn that this will lead to an early decision on their claim.

Acceptance within the veteran community is seen as vital to the success of CCPS. Veteran advocacy groups have participated in the specification of various aspects of the system, including the layout and content of the decision advice letters, and contributed significantly to the development of the Statements. Consultation has been, and continues to be, regular. This, and the stated goal of CCPS to achieve rapid, fair and consistent treatment of claims, has led to expectations of a dramatic reduction in appeals against decisions, with resultant reduction in the Compensation program administration costs.

CCPS has enabled the target processing time for compensation claims to be reduced from 180 days to 28 days, a six-fold improvement.

Staff savings in excess of A$3m a year, attributable directly to the use of CCPS, are expected following full deployment. Other savings associated with reduced medical investigation costs and pension outlays are expected to be substantial but yet to be quantified.

Application Development and Deployment

The CCPS software, expert system and knowledge base were developed by a team of seven - comprising a system architect, five software engineers and a legal and business
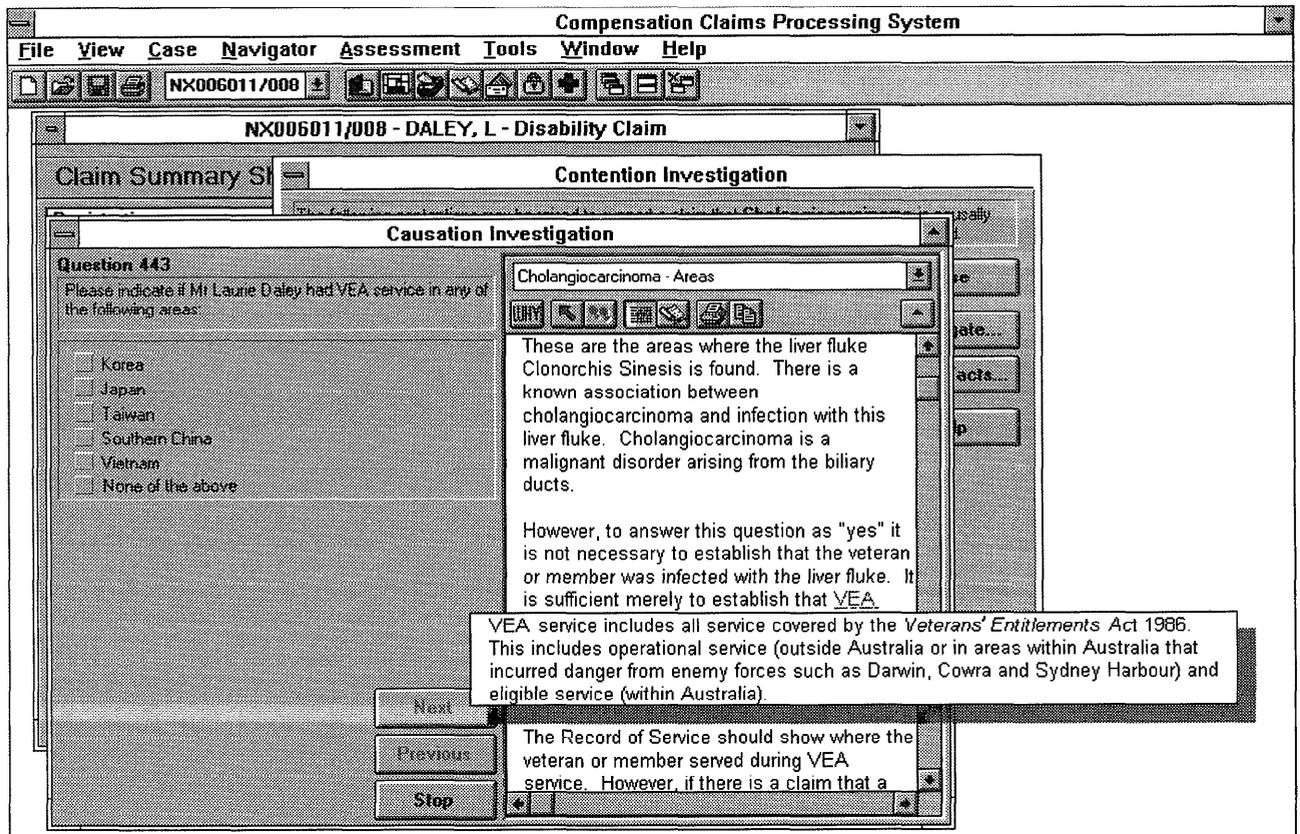
Figure 5 - Example of CCPS investigation dialog for Cholangiocarcinoma

analyst. DVA allocated five domain experts to the project, to consult in both the business process and knowledge engineering.

Prototype development commenced in March 1992, followed by a traditional period of specification and design. Specifications for such a large and complex system are inevitably incomplete, inaccurate and regularly quite wrong. Therefore, the pace of development was not especially impressive until it was tacitly agreed that the specifications would not be complete until the software itself was complete. Thereafter, development proceeded quite rapidly, with the system architect, the legal and business analyst, the lead software engineer and the domain experts resolving and documenting design and specification issues as they arose.

Once the software infrastructure was complete, providing expert system, mainframe and client/server database access, the principal claims processing and user interface elements evolved rapidly - the software engineers productively employing Microsoft Windows application development tools to model options for solutions to problems. Implementing support for

propagation, to manage risk while still observing legislative requirements, proved challenging but achievable.

The complexity involved in modelling the relationships between conditions, and in dealing with real world factors such as time (for consideration of pre-dating issues) and multiple distinct episodes of the same condition (thereby allowing a rulebase conclusion as to whether it is related to service to be both *true* and *false* at the same time, depending on the context) was especially daunting, although also eventually overcome.

Testing of the software commenced in July 1993. This was conducted by small teams in all six of DVA's processing centres. This approach, while at times difficult for software developers - in the diagnosis of problems - proved immensely successful. It not only allowed for a good cross-section of user representatives to participate in testing (and thereby contribute to the ongoing iterative refinement of system specifications), but it also dramatically increased the exposure of the system in the target user areas. This has helped to alleviate the not unexpected scepticism and even antagonism from users comfortable in their own domain, but quite unfamiliar

with the potential of the technologies employed by CCPS. As a result, the acceptance of CCPS by staff has been very good.

Deployment of CCPS has been phased, commencing with a pilot followed by full utilisation in each processing centre. It is expected that by the end of June 1994, all offices will be fully operational, with in excess of four hundred staff using CCPS to process compensation claims.

The phased implementation has provided DVA with sufficient lead time for the training of staff and also, importantly, has provided time for the negotiations with staff associations necessary to minimise disruption caused by re-deployment of displaced personnel.

Maintenance

The policy enunciated in the Statements of Principle - and therefore the CCPS medical knowledge base, its supporting commentary and investigative material - is, and will remain, extremely volatile. The Statements, and the administrative practice implementing the political goal of compensating for service related disease, injury and death, are subject to, and therefore affected by:

- changes to legislation and its interpretation;
- new evidence concerning, or interpretations of the aetiology of diseases; and
- changing case law.

Furthermore, DVA intends to continue to expand the number of conditions covered by the CCPS medical knowledge base and for which CCPS provides decision support. The architecture of CCPS can be described as *knowledge driven* - the software interprets and implements the knowledge but is independent of it. It is possible to update the knowledge base without requiring any change to the software, and new knowledge bases can be distributed to offices for immediate implementation, without the overhead and inconvenience typically associated with the installation of new versions of software. The department is in the process of developing 100 new statements of principle to add to the material already covered by CCPS.

The structure of the medical knowledge base, incorporating an expert system and a database, provides a peculiarly efficient framework for the review and maintenance of the medical knowledge (the rules and the data) it encapsulates. These can be easily displayed, updated and in some cases, verified for correctness and completeness by non-programmer personnel such as DVA's domain experts.

Conclusion

It would not have been surprising if CCPS had taken years to develop, had failed to be successfully completed, or had been completed but never deployed. Projects of its scope, complexity and technological boldness have the potential to revolutionise business practice in an organisation and to vastly improve the quality of client service. However, by their nature they can be poorly conceived or managed, or run into implementation problems that come to be regarded by these organisations as insurmountable. These problems rarely are insurmountable, but really reflect a lack or a failure of will to face and accommodate the "revolution" that the successful implementation of systems such as CCPS represent.

The success of CCPS is due as much to the audacity and stamina of DVA as it is to the enabling technologies. DVA recognised the deficiencies of its business practices, undertook to re-engineer them and persevered in spite of scepticism and opposition. The result is that DVA has been able to take advantage of expert systems, hypertext, client/server architectures and graphical desktop computing to achieve efficient and consistent administration of their compensation program.

CCPS has delivered significant savings in program administration costs running into the millions of dollars. Furthermore is has been responsible for dramatic improvements in client service.

As such, while it stands as a good example of what can be achieved with these technologies, it also clearly demonstrates what must be endured to achieve it. DVA, and in our experience, increasingly more organisations, are finding that the result justifies the effort.