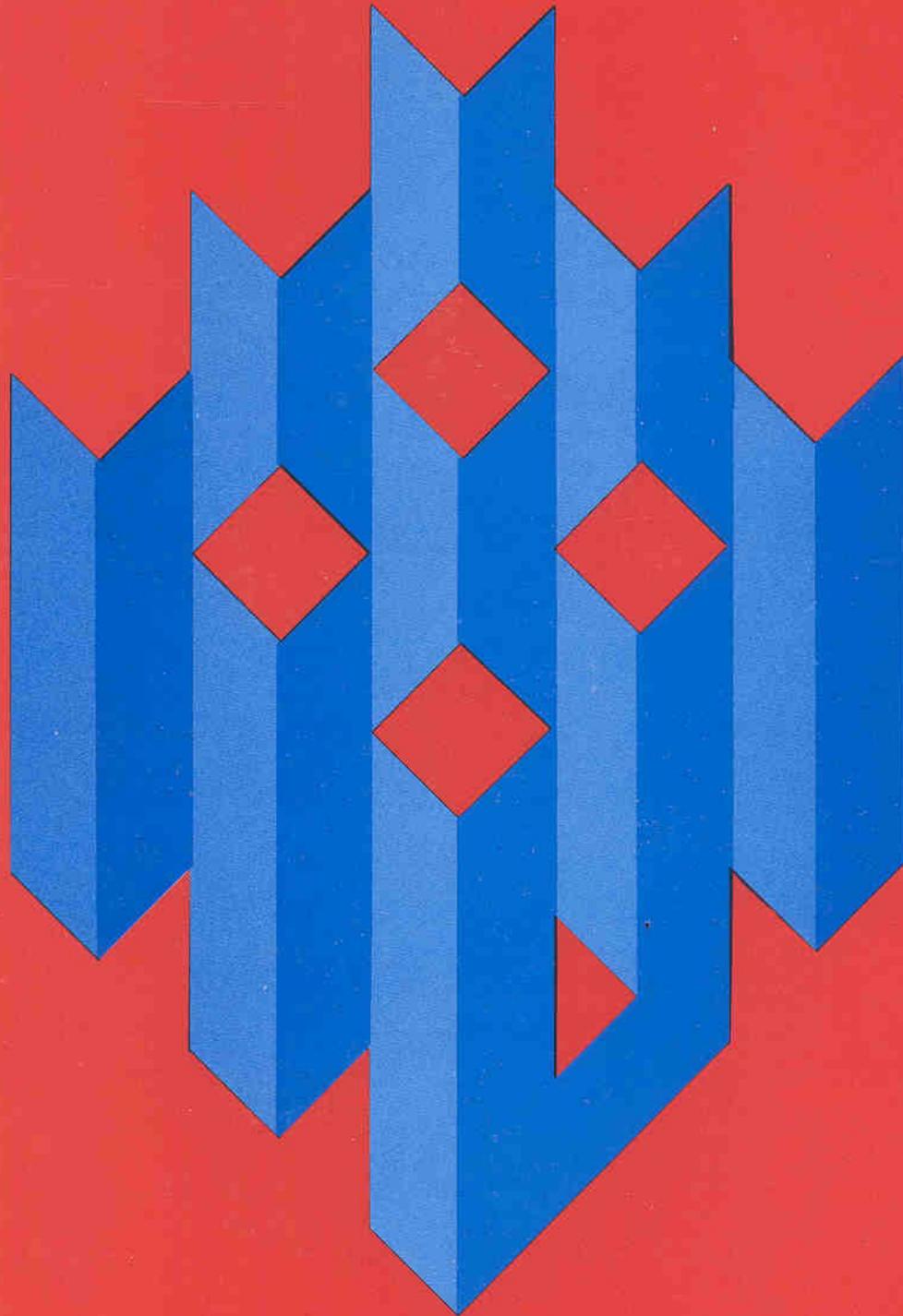


# Final Report Kansas Nonmonetary Expert System Prototype



Unemployment Insurance  
Occasional Paper 90-1

U.S. Department of Labor  
Employment and Training Administration



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**ERC GOVERNMENT SYSTEMS**

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**FINAL REPORT**

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**KANSAS NONMONETARY  
EXPERT SYSTEM PROTOTYPE**

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**March 19, 1990**

**Prepared for:**

**U.S. Department of Labor  
Unemployment Insurance Service  
Employment & Training Administration  
200 Constitution Avenue, NW  
Washington, DC 20210**

**Contract Number 99-7-4646-04-142-01**



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Unemployment Insurance  
Occasional Paper 90-1

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Employment and Training Administration  
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Geoffrey L. Hopwood  
Project Manager

## EXECUTIVE SUMMARY

In 1983, an undertaking took shape at the Department of Labor, Employment and Training Administration (ETA) to explore the application of expert system technology to the Unemployment Insurance (UI) workload process; namely, to determine whether the nonmonetary determination process could be replicated under field conditions by using an expert system to render decisions. It was hoped that improvements in the UI field could be realized in cost, quality management, and service to claimants and employees.

DOL performed an in-house study to examine the possibility of reducing costs and improving services in Unemployment Insurance nonmonetary determinations process, by using expert systems. The study dealt with a single nonmonetary separation issue (Labor Dispute). The study concluded that expert systems could potentially be developed for making nonmonetary issue decisions.

Expert system technology is presently the most commercially viable aspect of artificial intelligence (AI), where computers are programmed to think and reason like human beings. A successful example of using expert systems in the marketplace for decisionmaking is Mutual of New York's (MONY) expert system, designed to underwrite life insurance policies. This system gradually evolved from handling a small number of routine cases to handling almost all standard life applications. Success was achieved, where other similar expert system applications have failed, because its scope was intentionally limited, in that it was designed to underwrite life insurance policies rather than property insurance policies, which are more complex and have many more variables.

ETA issued a Request for Proposals (RFP) in August 1987 to "design, build, implement on a pilot basis, and evaluate a nonmonetary decision expert system... in two phases...to conceptual design, building a knowledge base and testing of an operational model expert devoted system...(and the) implementation in a SESA, (of) detailed testing and evaluation". The Human Services Center of ERC Government Systems Company, with the State of Kansas, bid on and subsequently was awarded the contract.

The State of Kansas was an excellent partner for developing the Nonmonetary Expert System Prototype because of several of its program features: decentralized issuance of nonmonetary determinations, high degree of automated processing, "canned" nonmonetary determinations, (where decisions are programmed to be generated and printed by the computer system), and a distributed processing network. Furthermore, since each State's law is unique regarding benefit criteria, and since one aim of the project was to study the transferability of an expert system from one SESA to another, a SESA had to be found which shared many common features with other SESAs. Kansas was a good choice in that regard, with features representative of many SESAs.

The issue identified in the RFP for the Expert System to test was the Voluntary Quit (VQ) laws. Kansas' VQ laws were considered generally representative of SESAs as a whole. The 11 exceptions in the Kansas VQ laws were selected for testing because the ratio of benefit allows to denials for VQ cases is equal. This tests the decision-rendering capability of the system better than if there were a high ratio of either allow or denials.

ERC determined that the use of expert systems for nonmonetary decisions, within the narrow scope of the project, was feasible, and also practical from a standpoint of reliability, validity, and time considerations.

For summary purposes, we will divide the steps completed into five tasks, with brief descriptions of each: Hardware/Software, Phase I and Phase II, Testing, Findings, and Recommendations.

1. Hardware/Software

Selecting the hardware and software for the project was the first step in the project; a major consideration in the hardware/software decisions turned out to be cost. Considering the limited budget allotment for the Project, it was decided to spend the majority of the funding on the test itself, rather than on software. Software for a PC was much less expensive than the same software for a mainframe. Also because of cost constraints, it was determined that an expert system "shell" (commercially-available software that can be easily customized) would be used, rather than programming an expert system from "scratch". With this premise in mind, various software packages were evaluated and tested in late 1987. EXSYS Professional was the one chosen for the Project.

2. Phase I and Phase II

During Phase I, the Prototype was developed and tested in four different stages. Highlights of these stages consisted of the following:

- Prototypes 1 and 2 tested the basic premise that cost-effective, valid nonmonetary determinations could be generated through the use of an expert system.
- Prototypes 3 and 4 incorporated feedback from Prototypes 1 and 2 and completed the development of the Prototype to be pretested in November, 1988.

Phase II developed the actual test environment procedures and included:

- Collecting comparison data to test for validity with the actual test data
- Sample size determination, including population size, error rates, and confidence factors
- Conducting a Pretest on-site to test the plan under "real life" conditions to gather information to be tested later for validity, and for fine-tuning the Expert System for the Testing phase
- Modifying the Prototype based on Pretest findings
- Developing user and system documentation.

### 3. Testing

The Testing phase collected data to compare the Expert System decisions with the Deputy Examiner determinations. The Kansas Nonmonetary Expert System Prototype was tested in two District Offices (Kansas City and Overland Park) in January, February, and March, 1989. The 141 interviews conducted produced the following: 64 cases resulted in decisions to be considered further; 36 cases did not proceed since there was conflicting information between claimants and employers, and weighing this information was not within the scope of the study; and 41 cases did not proceed further since the claimant had satisfied the rework (earnings) requirement and was eligible for benefits, and therefore there was no issue.

Data on the Claimstaker's ability to use the Expert system, the accuracy of the Expert System decisions, and the outcome of any decision appealed was collected. This data was gathered at the four levels of the testing process:

- Claimant Interviews, which were the actual fact gathering process
- Data Collection, which monitored the logs from the Claimstakers and Deputy Examiners cases
- Appeals Decision Review, which included review of the decision rendered by the Expert System and review of the determination rendered by appeals
- Kansas Evaluation Review Panel, which met periodically to assess overall performance of project test.

#### 4. Findings

Within the restricted scope of the Kansas Nonmonetary Expert System Prototype Project, the value of using the Expert System in the nonmonetary determination process was successfully demonstrated by this study. The central question - whether an expert system can be used in the nonmonetary determination process to gather facts and render decisions with reasonable accuracy - was answered in the affirmative.

The Expert System decisions were compared to the Deputy Examiner determinations in 64 cases. The Expert System and the Deputy Examiners agreed in 52 cases. In cases where there was disagreement, the Expert System decision was supported 8 of 12 times by the Kansas Evaluation Review Panel, bringing the Expert System accuracy to 93.8%.

Based on the evaluation of the Kansas Nonmonetary Expert System Prototype, other advantages of using the Expert System to render nonmonetary decisions were that it:

- Provides consistent, in-depth factfinding specific to the potentially disqualifying issues at hand
- Structures interviews so that only information necessary for the determination of eligibility is collected, thus excluding extraneous information

- Meeting State and Federal requirements for factfinding documentation that is complete and accurate
- Ensures that decisions reached are consistent with State law
- Can be operated by relatively inexperienced personnel and be used as a training aid.

## 5. Recommendations

The study concluded with six general recommendations:

- That additional analyses of the usefulness of expert systems in the nonmonetary area be explored, especially regarding cost, promptness and performance (Quality Performance Index) and in other UI functional areas
- That expert system application prototypes be built and evaluated for other UI programs such as DUA (Disaster Unemployment Assistance) and TAA (Trade Adjustment Assistance)
- That the Kansas Nonmonetary Expert System be incrementally expanded to include all nonmonetary issues
- That we examine the feasibility and costs of developing the Kansas Nonmonetary Expert System Prototype into an operational system to include determination of the changes necessary in current operational procedures, security considerations, system maintenance requirements, training, and hardware/software linkages to the Central Office mainframe computer system
- That a team approach be established to developing expert systems. The developmental team should consist of a Knowledge Engineer (trained in the techniques of expert system development and software), one or more Domain Experts, and a ADP Programmer (familiar with the system to which the expert system will link and interact). Domain Experts should receive sufficient training in the expert system software used in development to permit them to perform routine maintenance of the expert system itself. (Maintenance of external programs and linkages to other systems will still require ADP Programmer support.)

- That review and evaluation of currently available expert system software be made to determine the most effective and efficient product for UI applications. Specifically, examine object-oriented and frame-referenced shells to determine if shells are more useful than rule-based systems (such as EXSYS Professional, used in this project).

The Kansas Nonmonetary Expert System Prototype project showed the capabilities of an expert system in the nonmonetary decision process. The recommendations made above are necessary to implement an operational system, and to effectively continue exploration of expert system technology in UI program areas.

CHAPTER I  
BACKGROUND AND INTRODUCTION

Since 1983, the Department of Labor (DOL) has been involved with applying expert system technology to Unemployment Insurance (UI) applications. In that year, the DOL performed an in-house study to explore the possibility of reducing costs and improving services in Unemployment Insurance nonmonetary determinations, by using expert systems.\* The study dealt with a single nonmonetary separation issue (Labor Dispute). The study concluded that expert systems could be developed for a nonmonetary issue using a particular SESA's (in this case, the District of Columbia's) UI law pertaining to Labor Dispute, but that more comprehensive testing would be required to completely evaluate the original premise of using expert systems in the nonmonetary process.

In 1987, DOL allocated funds for the Kansas Nonmonetary Expert System Prototype to test expert systems in the nonmonetary determination process. Phase I developed the initial logic to encompass all viable Voluntary Quit issues. In Phase II the Prototype was field-tested; and the Testing Phase ultimately determined how the Expert System decisions compared to the Deputy Examiner's determinations.

The knowledge base and decision rules designed to handle the Labor Dispute issue in the 1983 study was relatively simple, and the test was performed under limiting conditions. By contrast, the scope of the present effort included all Voluntary Quit exceptions for a specific state (Kansas), and therefore required a greatly expanded knowledge base. In addition, testing and evaluation of the Kansas Expert System was much more rigorous regarding statistical reliability and validity.

\* T. Nagy, J. DiSciullo, and R. Crosslin, "Reducing costs and improving services in unemployment insurance nonmonetary determinations using expert systems," UI Research Exchange, Fall, 1983.

This chapter provides background on the Unemployment Insurance Program, with a special emphasis on the nonmonetary determination process, and a brief history of artificial intelligence (AI) and expert systems and their use in Unemployment Insurance (UI).

A. THE UNEMPLOYMENT INSURANCE PROGRAM

Unemployment Insurance laws were enacted in all States during 1935-37 as a result of the Social Security Act of 1935 and are administered by both the Federal and State governments. This joint administration was based on the recommendation of the Committee on Economic Security that there should be a minimum of Federal standards and maximum freedom for the States to experiment within the provisions of the law.

Since the original legislation in 1935, the UI program has reacted to a variety of economic conditions by modifying or adding Federal legislation. The majority of this legislation has been directed at four broad areas: coverage, extended benefit programs, trust fund financing, and administrative financing. In addition to the Federal legislation, a host of State legislative amendments have been passed to amend individual State Unemployment Insurance laws in order to adapt the State programs to changes in the local and national economies' labor force.

The States operate the UI program. They collect taxes, determine eligibility, pay benefits, hold appeal hearings and implement Federal UI programs by agreement with the Secretary. The States, under the broad parameters of the Act, exercise considerable flexibility in their program operations. This flexibility is particularly evident in the areas of eligibility requirements, benefit duration and rate, and the manner and degree to which taxes are levied and collected from employers. The 53 separate agencies have developed diverse procedures for administering the UI program.

The role of the Federal government, on the other hand, is one of the administration and oversight of Unemployment Insurance activities on a Nationwide basis. The principal Federal functions include:

- Ensuring that State UI laws are in conformity with Federal requirements
- Preparation of the National budget for Unemployment Insurance Program administration at the Federal and State level
- Allocation of funds to State agencies to cover the costs of administering the program
- Establishing National goals and objectives of the Unemployment Insurance Program
- Establishing program policy within the parameters of Federal law
- Providing technical assistance to State Employment Security Agencies (SESAs) that operate programs at the State level
- Evaluation of State operations through administrative oversight with quality assurance and control methodologies.

The Federal government's role of administration and oversight requires that it work with all 53 State agencies. The unique programs, which exist in these SESAs because of the program flexibility that the States are allowed, have resulted in the establishment of a diverse and complex program when viewed from a National perspective.

The UI system consists of 53 cooperating state programs. In 1988, over \$12 billion was paid to approximately six million unemployed workers. Under common Federal guidelines, State law sets forth the conditions which determine worker eligibility. In determining eligibility, an act or circumstance that is potentially disqualifying is called a nonmonetary issue. A circumstance surrounding a worker's job loss is called a separation. And, a situation where a worker chooses to leave a job when continuing employment is available is called a voluntary quit.

## B. NONMONETARY DETERMINATIONS IN THE UI SYSTEM

As stated, the individual SESAs have much latitude in operating their UI programs, especially regarding eligibility requirements, benefit limits, and taxation. Our scope in this study concentrated on eligibility criteria and how an expert system may be a valuable tool in State operations for determining claimant eligibility for payment of benefits.

Unemployment insurance benefits are paid to jobless workers only when they meet criteria established by State law.

- First, a determination of monetary eligibility must be issued. A claimant must have earned a specified amount of wages, and in some States, worked a specified length of time during a base period; e.g., the first four quarters of the last five quarters. A monetary determination is issued to the claimant establishing the benefit entitlement and benefit year or period during which he/she may file claims for unemployment compensation. Monetary determinations are relatively straightforward; eligibility is determined by a formula. They are the prerequisite to nonmonetary determinations, which are the focus of our study.
- Once established monetarily eligible, a claimant may be paid benefits if he/she was separated from employment under nondisqualifying circumstances and meets all other State requirements for maintaining eligibility. A claimant must be unemployed through no fault of his own to receive benefits; potentially disqualifying reasons for job separations include discharge for misconduct and voluntarily leaving work (quitting) without good cause. If there is evidence that a claimant was separated for potentially disqualifying reasons, additional information must be obtained and a nonmonetary determination must be issued allowing or denying benefits. Also, a claimant must meet other conditions to continue to be paid benefits. He must be able to work, be available for work, and be making a reasonable effort toward finding work; benefits will be denied for the period of time that it is determined that the claimant is not meeting these requirements. Nonmonetary determinations are issued when there is evidence that any of these conditions are not met as well as for situations that involve potentially disqualifying job separations. Nonmonetary determinations are much more subjective and open to individual interpretation than monetary determinations, and require a much more detailed knowledge of State and Federal requirements on the part of Claimstakers and Adjudicators.

The nonmonetary determination process attempts to ensure that benefits are paid only to individuals who qualify, and that appealable disqualifications are imposed on claimants who are ineligible to receive UI benefits.

The nonmonetary determination process is also concerned with ensuring that the duration and benefit payments affected by disqualifications, ineligibility, and conditions for re-qualification are appropriate to the situation. This process establishes a means by which claimants and/or employers are afforded the opportunity to present evidence related to potentially disqualifying circumstances, thereby protecting the claimant's benefit rights and the employer's rights to protest the payment of benefits to a claimant. This in turn protects the integrity of the UI program and Trust Fund.

A nonmonetary determination consists of four components: an issue, facts, reasoning, and result.

1. A nonmonetary determination issue is an act or circumstance that is potentially disqualifying. Issues can be separation-related or nonseparation-related. Separation issues pertain to circumstances surrounding the claimant's loss of job. Nonseparation issues pertain to what is required of the claimant to maintain eligibility throughout the course of his/her claim.
2. Once issues are identified, facts must be collected to determine if a disqualification should be applied. A written record of the facts must be produced, which becomes part of the permanent record of the facts on which the decision to allow or deny benefits was based.
3. Factors considered in the reasoning (rationale) for the decision include determining what provisions of State law are applicable to the situation at hand.
4. The nonmonetary determination result is the decision to allow or deny benefits. It is required that the claimant be provided a copy of the decision when benefits are denied. The result must also contain a statement of the individual's appeal rights.

It is a Federal requirement that the claimant be offered the opportunity to furnish a rebuttal to potentially disqualifying information when such information is received from other sources. If an employer is an interested party to the determination, i.e., there is a job separation issue, and if benefits are allowed and charged to the employer's account, the employer will be contacted to provide a statement.

The line of questioning that is pursued to develop nonmonetary eligibility information will, of course, vary from issue to issue and SESA to SESA. Some SESAs use a form or card as a guide for questions under each type of issue. The form identifies the basic questions that should be asked in the interview. Additionally, the information contained in the individual State's provisions for disqualification will dictate what information must be obtained in the individual State. Examples of the areas that would need to be explored for a Voluntary Quit issue follow:

- Why did you leave your job?
- Did you advise your employer you were quitting?
- What reason did you give your employer?
- Why did you feel it was necessary to quit your job?
- Was that the only reason?
- Was there a change in working conditions?
- What made your job less favorable to you?
- Could you have continued working if you had so desired?
- How long did you work there?
- When did the job become unsatisfactory to you?

Depending on the claimant's responses, questions more specific to the reason for the claimant's leaving would need to be asked. For example, a claimant who left a job because his pay was cut might be asked:

- How much was the reduction in terms of gross pay?
- What reason did the employer give for the reduction?
- Did other workers at the establishment also receive a reduction?
- Did other workers doing similar work agree to the reduction?
- Was the reduction authorized under a union contract?

The responsibility for making the correct nonmonetary determinations in some SESAs rests with the Claimstakers or Adjudicator; in others, local office staffs gather facts and Central office staff make the determination. While some States provide interview guidelines in procedures manuals or in factfinding forms for the various issues, the Claimstaker or Adjudicator decides the course of questioning to be pursued, the appropriate provision of State law that applies to the case at hand, and the pertinent facts considered in the decision. Factors which may result in an incorrect nonmonetary determination being issued include adjudicating the wrong issue or an issue that is not potentially disqualifying, incomplete or inadequate factfinding, lack of or insufficient reasoning, or ignorance of changes in State/Federal law or policy. The Claimstaker must possess interviewing skills and have the ability, in some cases, to weigh conflicting statements of fact to decide which is the more creditable.

A large concern of State agency staff is the cost involved in generating nonmonetary determinations. Claims adjudication is a labor-intensive and time-consuming process. Costly formal training sessions are often required to ensure that Claimstaker and Adjudicators understand the nuances of State laws and the disqualification provisions for the various situations they may encounter. States are increasingly concerned with finding ways to reduce costs while maintaining acceptable levels of service. In addition to the

factfinding function, the production of the decision itself is expensive in terms of staff time required to type and mail the determination. States which use "canned" nonmonetary determination systems (i.e., where decisions are programmed to be generated and printed by the computer system when the appropriate proper message code is entered by an Adjudicator) have substantially reduced costs in this area.

A third area of concern is the quality of the determinations, which are affected by the budgeting process used to allocate administrative funds for the UI program. Since budget allocations are generally tied to claims workload, experienced UI personnel may be laid off when there is a downturn in claims volume. Often agencies have to cope with sudden upswings in the volume of claim loads by hiring temporary or part-time staff and using inexperienced staff, which often results in claim processing errors.

### C. EXPERT SYSTEMS AND THEIR POTENTIAL APPLICATION TO NONMONETARY DETERMINATIONS

Expert systems consist of a particular segment of computer science that incorporates the knowledge of specialists from a given field, and are constructed so as to manipulate this knowledge in more efficient and intelligent ways than conventional computer programs, in order to produce logical decisions based on sets of "experiences" or rules. Expert systems are capable of reasoning from heuristic knowledge (knowledge that can guide us to discovery) or from a conclusion based on empirical research that is formatted and reentered into the system as a knowledge base.

There are three participant groups in the development of an expert system: Domain Experts, Knowledge Engineers, and End Users.

- The Domain Expert is an articulate, knowledgeable person with a reputation for producing good solutions to problems in the selected field. The Domain Expert uses their acquired knowledge to make the search for a solution more efficient, and the expert system models these problem-solving strategies.

Although an expert system usually models one or more experts, it may also contain expertise from other sources such as books and journal articles.

- The Knowledge Engineer is an individual, usually with a background in system analysis, computer science and artificial intelligence (AI), who knows how to build expert systems. The Knowledge Engineer interviews the experts, organizes the knowledge, decides how it should be represented in the expert system, and writes code or helps the programmers write the code.
- The End User is the human who uses the expert system once it is developed. The End User may be a scientist using the system to help discover new mineral deposits, a lawyer using it to help settle a case, or a Claimstaker gathering separation information.

Expert systems can readily be constructed to respond to a wide variety of environments to monitor, explain, instruct, interpret and diagnose. It is a system that is constructed specifically to support a narrowly defined field of interest. Thus, an expert system can best be viewed as an approach that offers the broadest range of applications across fields such as medicine, law, education, business, defense, etc., yet one which must in each instance be individually developed according to the specific set of rules that are pertinent to the narrow application within each of these areas of interest.

The reason that expert systems applications are best kept to a narrow area of interest is that the volume of knowledge required to be processed by the system logic becomes so large as to be inefficient in more general applications. The narrowness of the application will remain an important consideration for the expert system application to UI nonmonetary decisions, that is, insuring that the knowledge field required is appropriate to the applications.

## CHAPTER II EXPERT SYSTEM DEVELOPMENT

This chapter details hardware and software considerations for the Kansas Nonmonetary Expert System Prototype and the rationale for the choices made; the initial development of the Prototype through formalized procedures (Phase I); establishing Test parameters (Phase II); testing under field conditions; and statistical evaluation of the results.

In August, 1987 ERC joined with the State of Kansas to develop the Nonmonetary Expert System Prototype. Kansas UI law and operational system had representative features for the Prototype: decentralized issuance of nonmonetary determinations; a representative nonmonetary determination policy; and automated UI processing, including a canned nonmonetary determination system.

Kansas operates eight District Offices and 30 "itinerant"\* offices. The District Offices perform all claims processing functions, from accepting initial claims to making nonmonetary determinations through CRTs which are linked to the IBM mainframe in Topeka.

Each SESA is unique, and beyond certain narrowly defined, Federally mandated requirements, it is State law that determines eligibility criteria for Unemployment Insurance. In comparing State policies on Voluntary Quit issues, Kansas does have certain unique characteristics but the basic State policy differences are not extreme.

\* Itinerant - local offices not UI staffed on a full time basis.

Within Voluntary Quit disqualifications, Kansas is representative of National UI program characteristics:

- If a claimant voluntarily quits his job, most States will investigate only the most recent separation from employment. In Kansas, all potentially disqualifying base period separations are investigated. However, a decision would only be issued for other than the most recent separation if the claimant had insufficient earnings from the most recent job.
- Most States impose Voluntary Quit disqualifications where the claimant may requalify for benefits only after having earned a specific amount. In Kansas, this amount is equal to three times the claimant's weekly benefit amount from insured employment.
- Kansas has some additional provisions for allowing benefits for a Voluntary Quit other than Good Cause Attributable to Work. These include quitting to accept other work, quitting for substantiated health reasons, and quitting to join the Armed Forces. However, except as noted, good cause for a quit is restricted to those causes connected with the work or attributable to the employer, as is the case in most other States.

Kansas operates an automated nonmonetary determination system. Kansas automated its entire State UI system in the early 1970s and has continued to improve the system processes. Also, Kansas was one of the innovators in "canned" nonmonetary determination systems, where the Deputy Examiner selects the appropriate message determination and the corresponding number listed for the decision is entered into the system. The Central Office computer in Topeka then generates the determination, which is machine mailed to the claimant. The employer is mailed a copy of the decision as an interested party; appeals rights are automatic with each determination. It should be noted that the canned message cites the reason, legal basis, and appeal rights supporting the determination. The system also permits the Deputy Examiner to customize the decision as needed.

A. PHASE I

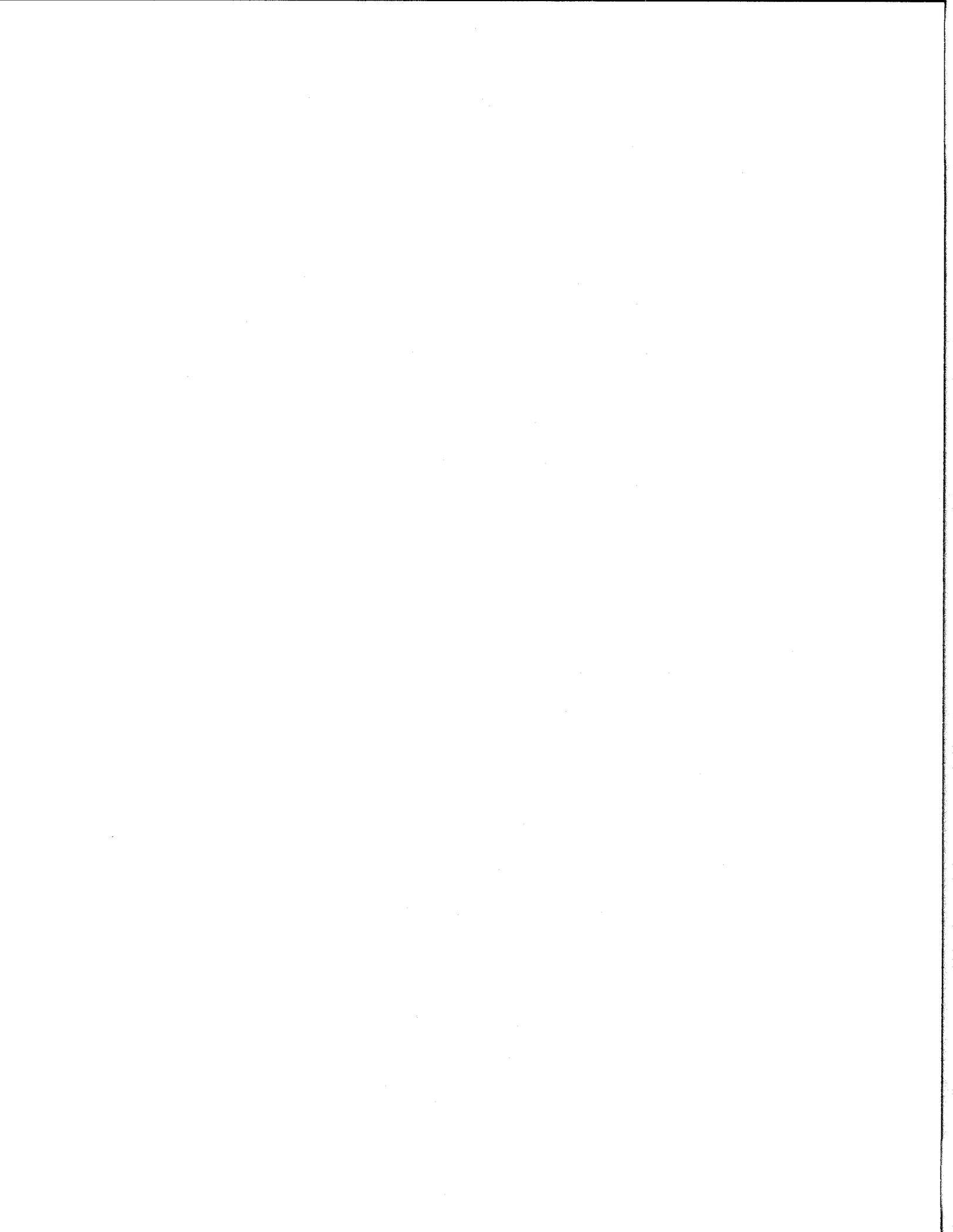
1. Hardware and Software Considerations for the Prototype

Hardware and software alternatives for development of the Expert System were evaluated between November, 1987 and January, 1988. A major consideration in all these hardware and software decisions was cost. Because the budget for the demonstration was limited, it was decided to spend the majority of the funding on developing and testing the Prototype instead of on software.\*

a. Hardware Considerations

The District Offices in Kansas are connected to the central computer by CRTs; there are very few PCs available. A mainframe Expert System shell would have offered a more practical solution to Kansas than a microcomputer because the hardware and the network are already in place. However, in the final decision, cost was the determining factor for this development project. The most competitive price found at the time for an acceptable mainframe software package was \$35,000. For a prototype application, this was considered much too expensive when compared to the \$1,200 - \$7,000 range of an acceptable software package for a microcomputer. Therefore, because of the huge differential in software packages between mainframes and PCs, PCs were chosen for the Prototype.

\* For a more detailed discussion of the hardware and software considerations, see Appendix A: Analysis of Alternative Software and Hardware Approaches to UI Expert Systems. The three Appendices are included together in a separate volume.



Development Capabilities. Products were also reviewed to determine the degree of flexibility for the Expert System's design, along with the types of design features.

Capabilities considered here were:

- Ability to support other external user procedures
- Ability to write rules to specify a series of preparatory actions before premise testing
- Ability to develop each set of rules as an individual module and test each module separately
- Type of debugging facilities available
- Ability to assign priority levels to rules to control their order in the inference process
- Ability to handle applications containing elements of uncertainty
- Ability to set default attributes.

Operational Features. Those aspects of the user interface which affect ease of use and user understanding of the underlying decision processes were considered. Issues in this area included:

- Number and type of user interfaces supported
- Availability of rerun capabilities
- Ability to trace the logical flow of an interview
- Ability to record a set of responses during a consultation session and playback the previously stored set later
- Extent of user help facilities available on-line
- Level and types of reasoning provided.

Dr. Thomas Nagy, a nationally noted authority on expert systems, was retained by ERC to perform an evaluation of 11 shells available in 1987. These were:

- Rulemaster
- Rulemaster 2
- 1st Class
- 1st Class Fusion
- EXSYS
- Level5
- GURU
- TWAICE
- CULLINET
- KES
- KEE.

The evaluation resulted in the selection of EXSYS as the development shell. The updated version of EXSYS (called EXSYS Professional) was used when it became available in September, 1988. CLIPPER, a database management system, was later incorporated into the system to handle data storage and retrieval functions.

EXSYS Professional is menu-driven, which allows the system developers to use the shell with relative ease. Editing functions allow system developers to quickly change rules and immediately view the results of that change. Ease of use and ability to quickly change rules and view the results were both important factors in the development process.

In initially developing the Kansas Nonmonetary Expert System Prototype, it was necessary to use two types of staff: ERC Data Processing staff, who served as the Knowledge Engineers, and ERC Program staff, who served as the Knowledge Engineer/Domain Experts. These ERC Knowledge Engineer/Domain Experts trained the Kansas Domain Experts in the fundamentals of programming logic required to assist the Knowledge Engineers. (This training of Domain Experts to assist the Knowledge Engineers provides a potential for a cost savings by combining some of the Domain Expert and Knowledge Engineer functions).

Once the Kansas Nonmonetary Expert System Prototype was functional, there was a need to store specific claimant and District Office information for later retrieval. The data had to be retrievable in order to make any necessary changes to information from the claimant or the employer. EXSYS Professional has a utility for directly accessing a database for storing and retrieving information, but this utility is not designed to store, manage, or maintain the amount of data generated by this type of Expert System in a manner consistent with accepted data management practice. To compensate for this weakness and to achieve optional data automation, it was necessary to find a database management system (DBMS) to work in conjunction with EXSYS Professional for efficient manipulation of data, report generation, and potential transfer of data without compromising the integrity of the Kansas Expert System Prototype. CLIPPER, a compiler version of dBASE III+, was the database management system selected.

Therefore, EXSYS Professional is the data processor for the Kansas Nonmonetary Expert System Prototype and CLIPPER is the data manager. The CLIPPER application initiates each Expert System run because it allows for the development of a user-friendly, menu-driven system, and easily displays and sorts information already stored in the database. Once a user has been guided through the menus to the proper issue, CLIPPER passes control of the system over to EXSYS Professional for the processing of information. When EXSYS Professional has processed the supplied

information and provided a decision, this data is then passed back to CLIPPER for the proper storage of information and report generation.

With CLIPPER, the Prototype gained additional database storage, data transfer, and report generation capabilities lacking in EXSYS Professional. The use of CLIPPER requires either additional training for the Domain Expert/Knowledge Engineer in programming, or a Programmer to build and maintain CLIPPER. However, only changes involving information passed between EXSYS Professional and CLIPPER would require the combined efforts of the Domain Expert/Knowledge Engineer and the Programmer.

Again, a more detailed discussion of the hardware and software selection criteria is found in Appendix A in a separate volume. This study, however, was conducted in 1987, and Expert System shells have progressed rapidly since then. EXSYS was determined to be the best product in 1987; if the decision were made today, evaluation would include new software and new versions of expert systems unavailable then.

## 2. Prototype Development

In the initial phases of the Expert System development, different alternatives were considered regarding which issues to develop and demonstrate. The decision was finally made to use the 11 exceptions in Kansas' Voluntary Quit law for two reasons: they are structured and discrete, and they have ample supporting documentation for establishing eligibility.

The 11 exceptions to Voluntary Quit disqualifications are:

- Illness or Injury
- Leave Temporary Work to Return to Regular Employer

- Delayed or Rejected Entry Into the Military
- Transfer of Spouse
- Hazardous Working Conditions
- Approved Training
- Unwelcome Harassment
- Better Job
- Requested to Violate a Statute or Ordinance
- Violation of Work Agreement
- Personal Emergency.

During FY '87, the State of Kansas processed 16,457 nonmonetary determinations for Voluntary Quits. Fifty-three percent (8,657) fell within the 11 exception areas, and 47% (7,800) were Voluntary Quits that were not within the exception areas. (The FY '88 statistics were unavailable at the time the data was being counted, since Kansas' fiscal year runs from July through June. They have since been reviewed along with FY '89 figures. In no respect do they differ in any significant way from the FY '87 figures used throughout this study.) Furthermore:

- Within the Voluntary Quit law excluding the 11 exception areas, only 5 percent were allowed and 95 percent were denied. This suggests that generally there was no issue to be resolved in the majority of these cases, and that an expert system would be of only limited test value.
- Within the exception area, 51 percent of the determinations were allowed and 49 percent were denied. This suggested to the planners that the initial Expert System application would be more useful in the exception area than in the Voluntary Quit mode as a whole, and would provide a greater opportunity to compare the accuracy of the decisions produced by the system with the determinations issued by Deputy Examiners.

The development of the Kansas Prototype itself was broken down into nine phases. The phases were to: define the initial portion of the knowledge base, develop and test Prototype 1, modify Prototype 1 based on findings, develop and test Prototype 2, modify Prototype 2 based on findings, develop and test Prototype 3, modify Prototype 3 based on findings, develop and test Prototype 4, and to modify Prototype 4 based on findings. These four prototype versions were developed, tested, and modified before the final prototype was built.

a. Define the Initial Portion of the Knowledge Base

State and ERC staff began their development by reviewing Kansas' nonmonetary determination laws and regulations. The current procedures for processing a nonmonetary determination are described in Exhibit A on the following pages.

Also at this time a flow chart was developed which highlighted certain procedure changes which the demonstration would need to accommodate PCs in the District Offices to process claims. This chart is shown in Exhibit B.

It was decided that the Expert System software would be used to develop 2 of the 11 exceptions to the Voluntary Quit law for Prototypes 1 and 2: Better Job, and Delayed or Rejected Entry into the Military. They were selected because the laws pertaining to them are part of Kansas' law, rules, or regulations and, as a result, are more clearly defined.

**EXHIBIT A**  
**CURRENT PROCEDURES FOR PROCESSING**  
**A NONMONETARY DETERMINATION IN KANSAS**

Current Processing Procedures: The following flow chart describe the procedures that are followed in Kansas' District Offices relative to processing a nonmonetary determination.

The numbered items listed below correspond to the numbered action blocks indicated on the flow chart that follows.

1. The Claimant (new or returning with a potential problem) enters the District Office and goes to the reception desk.
2. The Receptionist determines the type of claim or problem.
3. The Receptionist provides the claimant with the appropriate forms to complete.
4. The Claimant completes the forms.
5. The Claimant returns the completed forms to the Receptionist. The Receptionist then refers the claimant to Claimstaker.
6. The Claimstaker then conducts a seated interview of the claimant. During this interview, the basic facts entered on the claim form (K-BEN 10) by the claimant are reviewed and any additions and corrections are made.
7. The Claimstaker then completes the claim document and has the claimant sign the document. The Claimstaker then performs one of the following two functions:
  - a. If there are no issues (the claimant was laid off due to lack of work), then the Claimstaker has the claimant read and sign the Benefits Rights Explanation. The Claimstaker then starts the process to get benefits paid to the claimant.
  - b. If there is a potential issue, the Claimstaker refers the claimant to step 8.

EXHIBIT A (Cont.)

8. A Claimstaker reviews all potential issues, conducts the necessary factfinding, and completes appropriate forms. The Claimstaker then performs one of three functions:
  - a. The factfinding documents are placed in temporary suspense pending receipt of the separation information from the employer. This situation occurs when the claimant has been discharged for misconduct or has voluntarily quit their job.
  - b. The factfinding documents are placed in temporary suspense as the claimant must provide additional documentation concerning their eligibility to claim benefits. This normally occurs when there is Disqualifying or Deductible Income, in some Able and Available situations and in certain Refusal of Suitable Work situations.
  - c. The factfinding documents are forwarded to a Deputy Examiner (Claimstaker 3) for determination. This situation normally occurs when there is a simple eligibility issue; i.e., can the claimant continue to receive their benefits? These issues are Able and Available, Refusal of Suitable Work, and Reporting Requirements.
9. The factfinding documents and/or additional claimant documentation are forwarded to the Deputy Examiner for a determination.
10. The Deputy Examiner then makes the determination and fills out the data entry sheet (K-BEN 38). The data entry sheet lists the claimant's SSN, BYB date, issue code, issue numbers, the date the issue begins and ends and the employer number. When appropriate, a charge/non-charge to the employer's account is made.
11. The Data Entry Clerk enters data.
12. The information is received by the main State system in Topeka. Each night the central system produces the appropriate canned nonmonetary determination based on the issue code, with the required appeal rights.
13. The determination is then mailed to the claimant the following day. When appropriate, a copy of the determination is mailed to the interested employer.

# EXHIBIT A

## CURRENT PROCEDURES FOR PROCESSING A NONMONETARY DETERMINATION IN KANSAS

II-13

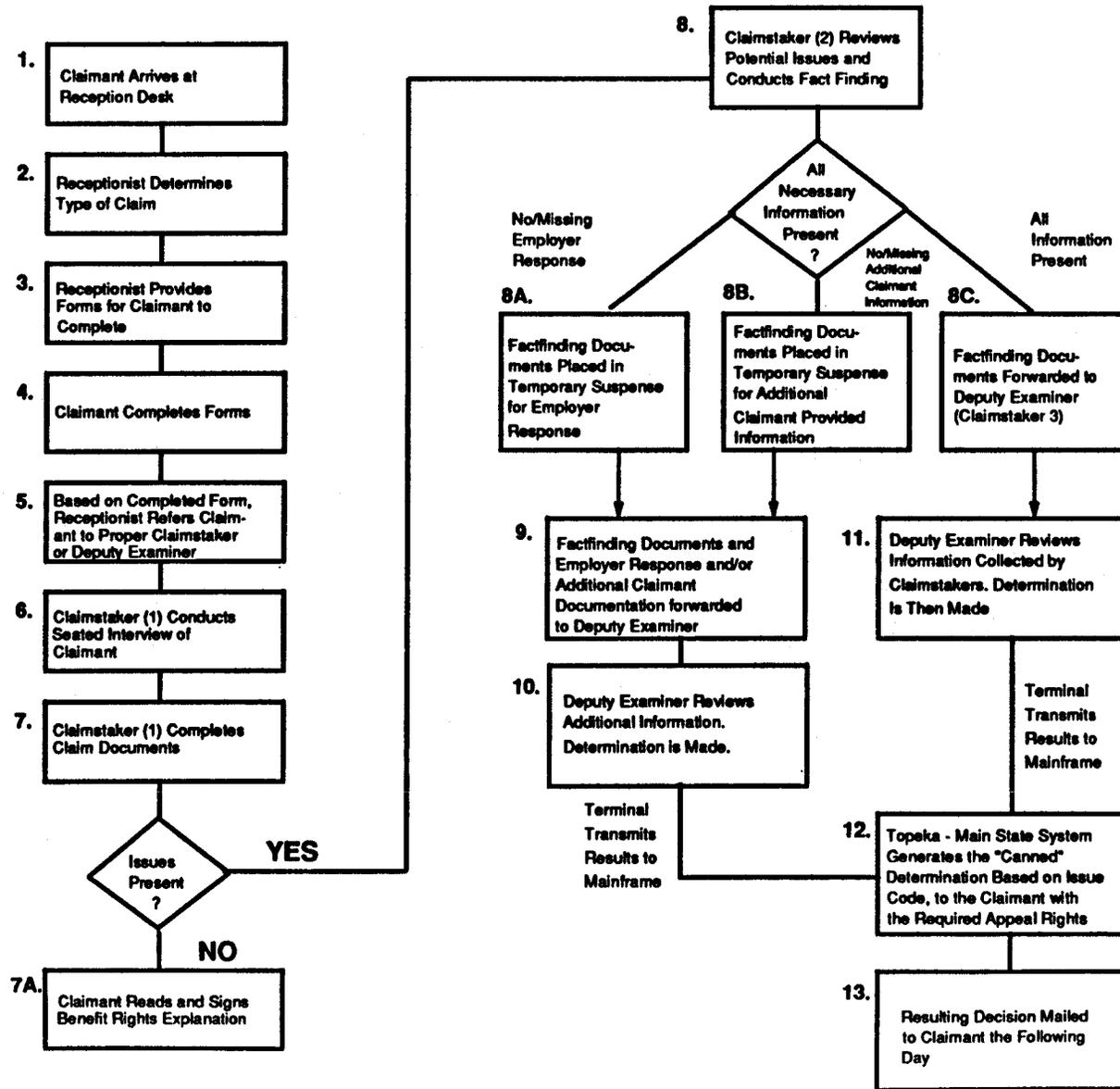


EXHIBIT B  
PROCEDURES FOR PROCESSING  
A NONMONETARY DETERMINATION USING  
THE EXPERT SYSTEM PROTOTYPE

The following flow chart describes the procedures followed in the Kansas District Offices for processing a nonmonetary determination using the Expert System Prototype during the test period. These test procedures were not designed to integrate the Expert System into the existing environment, but simply to modify existing District Office procedures for test purposes.

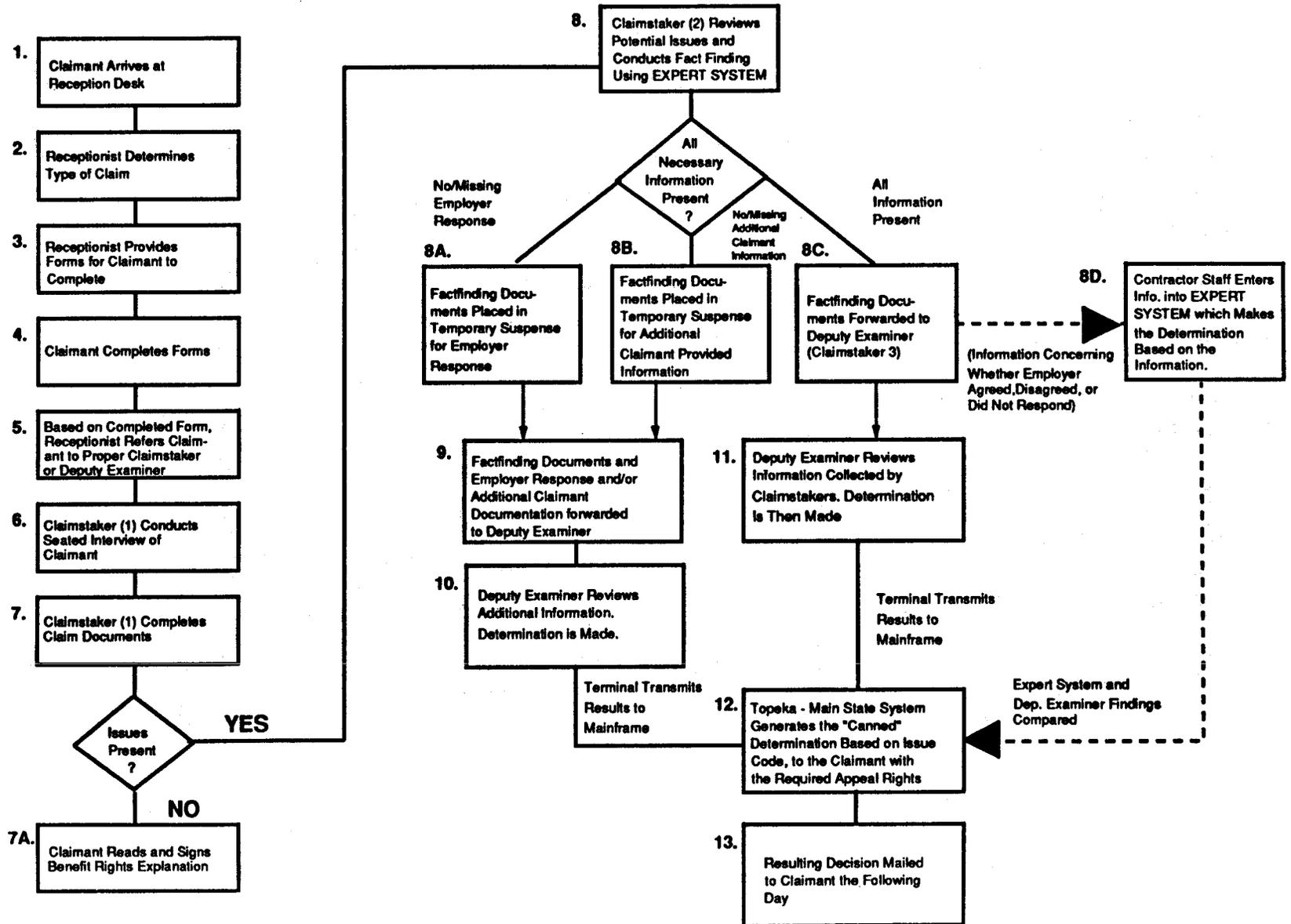
The only two changes involved the following steps:

8. The Claimstaker did not question the claimant using standard procedures. Instead, the Claimstaker brought the claimant and the claimant's Voluntary Quit statement to the Expert System workstation to gather and print the necessary separation information. After this modification in standard operations procedures, the normal adjudication process was resumed.
  
- 8D. This step does not normally exist in a District Office. In this step the employer response (or lack of response) was entered into the Prototype and the outcome was compared to the Deputy Examiner's determination. It should be emphasized that this step was not performed by the Claimstakers, but by ERC staff to monitor and test the accuracy of the Prototype.

# EXHIBIT B

## PROCEDURES FOR PROCESSING A NONMONETARY DETERMINATION USING THE EXPERT SYSTEM PROTOTYPE

II-15



b. Develop and Test Prototype 1

In this stage the basic premise was tested - that an Expert System could produce valid nonmonetary decisions. While this testing involved only a small portion of the Kansas Voluntary Quit law, Expert System technology did prove adaptable to nonmonetary determination law.

The Prototype 1 system was very small (with 18 rules). It was constructed quickly to test the feasibility of implementing the Voluntary Quit law segment as an Expert System.

Voluntary Quit for a Better Job and Delayed or Rejected Entry into the Military were selected as the issues for developing Prototype 1. The development of Prototype 1 started with the gathering of information, provided by the Kansas staff, pertinent to the Voluntary Quit for Better Job issue and Delayed or Rejected Enlistment. This information was then outlined with assistance from the Kansas staff in order to establish the various questions that would need to be answered to properly address the Voluntary Quit for a Better Job issues. This assistance included information/questions that were contained on the "guide cards" that are currently in use in the District Offices. This outline of the various parameters and questions was then reviewed by the Kansas staff to ensure the logic was complete. Upon completing this outline, the actual development of Prototype 1 was initiated. Throughout the development of Prototype 1, Kansas staff was consulted whenever a question concerning the interpretation of Kansas law arose.

c. Modify Prototype 1 Based on Findings

At this stage, Prototype 1 was demonstrated to the ETA Project Officer and the Expert System Advisory Panel. Based on results of that demonstration, modifications were made to the files to enhance user friendliness. Prototype 1 was then presented to the Kansas staff during a two-day trip in early March, 1988. Kansas staff suggested that modifications be made to some questions, and in general felt that the Expert System:

- Was user friendly
- Addressed the majority of the questions necessary to determine if the claimant quit to accept better work
- Arrived at the correct decision
- Would potentially be an asset to District Office staff (Claimstakers and/or Deputy Examiners)
- Would help solve the present situation where not all necessary information was being recorded when making a determination
- Would promote consistency and continuity in the enforcement of State laws by all Deputy Examiners.

d. Develop and Test Prototype 2

Prototype 2 modified Prototype 1 to be more user friendly. Prototype 2 was basically a refinement of Prototype 1, although it contained a larger knowledge base. The Prototype 2 system was enhanced to contain additional user friendly features. It was explained to the users that Prototype 2 represented a partial prototype

of the planned system. Additional exception issues were added to the knowledge base at this time:

- Voluntary Quit Due to Transfer of Spouse
- Voluntary Quit Due to Unwelcome Harassment.

The added exception issues were then tested in Kansas by Central Office staff during the week of May 9, 1988. In addition to testing the issues already developed, Kansas and ERC staff developed the Voluntary Quit for a Personal Emergency issue during the week of May 9, 1988.

e. Modify Prototype 2 Based on Findings

As a result of the information obtained during the trip to Kansas in May, a series of modifications to the Voluntary Quit exception files was generated. Most of the modifications related to the wording of questions and to the addition of new questions, to ensure that all critical elements of the various issues were addressed by the system.

f. Develop and Test Prototype 3

For the Prototype 3 stage, the feedback gained from the Prototype 1 and Prototype 2 stages was incorporated into the Prototype. During Prototype 3, a majority of its files dealing with the 11 exceptions to the Voluntary Quit cases were developed.

Prototype 3 also contained three enhancements to the user friendliness of the system:

- Development of a main menu
- Development of a bounce mechanism, which returns the screen to the main menu
- Revisions to the decision screen.

To assist the Claimstakers and Deputy Examiners, a main menu was developed. This main menu lists the various types of Voluntary Quit issues for which the Expert System is available. Each Voluntary Quit exception has a generic description which is displayed when the issue is highlighted by the cursor. Each generic description carries a number code which is used to access the correct Expert System file.

The bounce mechanism can work in one of two ways: either as a response to a system question that sends the Claimstaker back to the main menu, or as a result of "interaction" between the Claimstaker and the claimant, where the Claimstaker can determine that the wrong issue has been selected and can return to the main menu. In either case, the initial claims information that supports all situations is forwarded to the new issue being established; this information would include claimant name, SSN, and any necessary employer information.

After completing the seven issue files and modifications, the Expert System was taken to Kansas in late June, 1988 to be tested in the Topeka District Office. The results of this field test showed that, while Prototype 3 had some areas that required additional modification, the Expert System was essentially sound. The two Claimstakers and the Deputy Examiner in the Topeka District Office agreed that all pertinent questions were being asked by the Expert System within those issue areas already developed, but that the wording of the questions was too complex and needed to be simplified, and that

certain questions needed to be rewritten to enhance their ability to interact with the system.

g. Modify Prototype 3 Based on Findings

The information gathered in field test was used to design modifications to all the exception files developed for the Voluntary Quit issue. The knowledge gained about the wording of questions simplified the development of remaining issues.

h. Develop and Test Prototype 4

Prototype 4 was the last stage in the Prototype development. The user friendliness and technical enhancements of Prototype 3 were used to develop Prototype 4. Prototype 4 continued development of the remaining Voluntary Quit exception issues, and also involved migration and testing of the Voluntary Quit files from EXSYS to EXSYS Professional software. In early November, 1988, Prototype 4 was tested for two weeks in the Kansas City and Overland Park District Offices. The CLIPPER screens had been developed and were added to the Prototype at this time.

i. Modify Prototype 4 Based on Findings

In late November and early December, 1988, the final modifications to Prototype 4 were completed. These modifications completed Phase I. The Kansas Nonmonetary Expert System Prototype was then ready to be field tested.

B. PHASE II

During Phase I, ERC took its knowledge and Kansas' knowledge of nonmonetary determinations and expert systems, and applied it to writing the Prototype for the 11

Voluntary Quit Exceptions for Kansas. The four-step Prototype development discussed on the preceding pages brought the Expert System to the point where it was ready for full-scale field-testing. At this stage, it was necessary to establish parameters within which the testing would take place. This was the task of Phase II.

During the first week of Phase II, ERC met with the ETA Project Officer and the ETA Expert System Advisory Panel to review the methodology and logic of the Phase II plan. The key points and schedule associated with the plan were reviewed and enhanced to ensure a successful Phase II.

Phase II consisted of five separate, interrelated tasks which had been established during meetings in May, June, and July, 1988 with ERC, the technical consultant, and the ETA Expert System Advisory Panel. Each of these steps was designed to produce an expert system that could be field tested and produce statistically valid and verifiable results.

The five tasks in Phase II plan were:

- Collecting Comparison Data
- Sample Size Determination
- Pretesting
- System Revision and Modification
- User Documentation and System Documentation.

These tasks are described in detail below.

## 1. Collecting Comparison Data

Comparison data was collected from the Kansas City Overland Park Offices during October and November, 1988, to compare with data to be collected later during the field testing of the Expert System. The data included cases per exception area, processing times and the ratio of appeals, and appeal reversals by exception area. The comparison data cases were drawn before the start of the actual test; in the Test phase, however, the comparison of accuracy between the Deputy Examiners and the Expert System was based on the same cases.

Exhibit C illustrates the number of VQ cases per exception area for the comparison cases and total caseload.

A data collection log was utilized to record all Voluntary Quit exception information (see Exhibit D). The log was attached to the determination at the time the case was initiated and posted during the processing. When the nonmonetary determination was made, the log was removed from the folder and retained. Appeals information for the comparison group cases was collected by Kansas by ERC staff.

## 2. Sample Size Determination

For any test to be statistically valid, a sufficient number of items must be sampled; if a proper sample size is not selected, then the outcome of the study becomes questionable. To maintain statistical validity for the Expert System Prototype, the sample size required a number of considerations:

- Population size
- Estimated population error rates

# EXHIBIT C

## THE NUMBER OF CASES PER EXCEPTION AREA COMPARISON DATA

ILLNESS/INJURY	12
TEMP. WORK	3
DEL/REJ. MILITARY	2
TRANS. SPOUSE	8
HAZ. WORK COND.	3
APP. TRAINING	—
UNWEL. HARASS	8
BETTER JOB	10
VIOL. ORDINANCE	1
VIOL. WORK AGREE.	25
PERSONAL EMERG.	25

TOTAL

98

Exhibit D

**VOLUNTARY QUIT LOG**  
**(COMPARISON DATA)**  
**(COMPLETE FOR THE 11 EXCEPTION ONLY)**

**CLAIMANT'S NAME:**

**SOCIAL SECURITY NUMBER:**

**ISSUE/SUBISSUE:**

**DATE INITIATED:**

**DATE COMPLETED (DECISION DATE):**

**FACTFINDING TIME (EACH OCCURRENCE IN MINUTES):**

<u>CLAIMSTAKER</u>	<u>DEPUTY EXAMINER</u>
1.	1.
2.	2.
3.	3.

**DECISION (CODE):** ALLOW \_\_\_\_\_ DENY \_\_\_\_\_

---

**APPEAL DATA (TO BE COLLECTED BY STATE OR CONTRACTOR STAFF)**

**APPEAL:** YES \_\_\_\_\_ NO \_\_\_\_\_

**APPEAL DATE:**

**APPEAL DECISION DATE:**

**DECISION:** AFFIRM \_\_\_\_\_ REVERSE \_\_\_\_\_

**IF REVERSAL REASON:**

- Maximum difference allowable between the true population rate and the sample rate
- The confidence factor of the actual size.

Historical data had been obtained on Voluntary Quit exception and non-exception issues for Kansas. This information was used to project the daily and weekly workload for the test period. Based on this data, it was expected that a sufficient sample size of exception issues could be obtained in a two-month time period. However, fewer Voluntary Quit exceptions were taken in January and February than anticipated; consequently, the test period was extended through the third week in March.

Before the end of the extended test period, it became apparent that the desired sample size would not be obtained. However, initial test findings exhibited a high correlation of agreement (over 80%) between the determinations being made by the Deputy Examiner and the Expert System. Based on this general finding, a statistical analytical tool called the Kappa statistic was run. It showed that a sufficient sample had been obtained for purposes of comparing the Expert System decision-making capability to that of the Deputy Examiners. (For a complete discussion of the Kappa statistic and the complete test findings, refer to Section II.D.5, "Statistical Analysis of Results" on page II-50.

### 3. Pretesting

The Pretest was performed in the Kansas City and Overland Park District Offices over a two-week period beginning November 1, 1988. The purpose of the Pretest was to ensure that the final Expert System would be as complete as possible.

The Pretest was designed to:

- Test the completeness and accuracy of data collection procedures
- Test the evaluation plan. Kansas and ERC staff would be able to determine if data being collected would meet the evaluation requirements and identify additional evaluation data requirements and sources
- Test the system completely under "real life" conditions
- Familiarize Overland Park and Kansas City staffs with system operation and data collection procedures
- Review the testing procedures to ensure normal District Office operations.

Manual factfinding interviews were conducted following normal operating procedures. Claimants were then asked to participate in the Pretest by repeating the process using the Expert System; most agreed to participate. The Claimstaker selected the appropriate exception issue file and entered the claimant's responses to questions asked by the system.

Decisions generated by the system were reviewed with SESA staff. However, the primary purpose of the Pretest was to ensure that all necessary questions were incorporated into the issue files, and that the questions were easy to understand. Discussions were also held with SESA staff concerning data collection procedures for test period cases.

#### 4. System Revisions and Modifications

During the System Revision and Modification step, all final necessary changes and enhancements to the Expert System were made to produce an Expert System that would be user friendly and free of any problems.

The Pretest was completed by mid-November, 1988, although collection of appeals data continued for several more months. Upon completion of the Pretest, modifications to the wording of questions were made and the sequences of questions were rearranged for some files. The system was also modified to provide a means to store collected information, retrieve a case, and add or change information on a case at a later date. A procedure was also developed whereby information on more than one issue for a single claimant could be established in the system. A screen which summarized information on cases contained in the system was developed which was also used to retrieve previously entered records. Also, the system was programmed to delay generating an eligibility decision until the employer response time had elapsed.

#### 5. User Documentation and System Documentation

User Documentation and System Documentation was the last implementation step in Phase II. During this period all preliminary user documentation and system documentation for the Kansas Expert System Prototype was finalized.

User documentation consists of documentation that supports both the EXSYS Professional shell and the operation of the Kansas Expert System Prototype. User documentation addresses the EXSYS Professional's capabilities and operation. The documentation is organized into a user manual that provides system log-on/data entry information, menu information, and system navigation instructions. The user manual was used to train District Office staff involved in the test.

System documentation was provided to support that portion of the Kansas Expert System Prototype that was developed during the contract. System documentation details the development of the Expert System software. The documentation was developed to meet Kansas and ETA specifications and to provide the State with the

information required to support and enhance the system. System documentation consists of:

- Software development guide
- Logic files (rules)
- Attribute hierarchy charts.

### C. TESTING

Testing was designed to provide the data by which the accuracy of the Expert System decisions could be compared against the accuracy of the Deputy Examiner determinations. During this Test, data on the Claimstaker's ability to use the Expert System, the accuracy of the Expert System decisions, and the outcome of any appealed decisions were collected.

ERC staff installed IBM-compatible PCs in the Kansas City and Overland Park District Offices in January, 1989. Testing began the first week of January and ended in March, 1989.

The four levels of the Testing process included:

- Claimant Interview
- Data Collection
- Kansas Evaluation Review Panel
- Appeals Decision Review.

## 1. Claimant Interview

For the claimant interview the initial claimstaking process functioned as normal. The claimant entered the District Office, received the proper forms from the Receptionist, completed those forms and proceeded to the assigned Claimstaker. The claimant interview then proceeded as follows:

- (1) The Claimstaker accessed the appropriate exception file to ask the designated questions of the claimant (factfinding). The sequence of questions depended on a claimant's previous responses; some questions in the issue file were skipped over by the system if they were not applicable to the claimant's case. The claimant's responses were entered into the system.
- (2) The Claimstaker was able to add additional information necessary for the documentation of the facts. (The last question in all files before decision generation provided the opportunity to enter additional information narrative form).
- (3) Questions and answers were then printed out. The claimant reviewed and signed the printout in the space provided.
- (4) The Claimstaker attached a Voluntary Quit log sheet to the case documentation and posted information to the log (see Exhibits E and F).
- (5) Upon receipt of separation information from the employer, the Deputy Examiner reviewed all data, issued a determination, and completed a data entry form for the decision. The separation data was then reviewed by ERC and entered into the system. If the claimant's and employer's statement agreed, a system decision was generated and compared to the Deputy Examiner's determination. If there was no response from the employer, a system decision was generated. If the employer's and claimant's statements disagreed, no system decision was generated, since evaluating conflicting statements was not within the scope of this study.

EXHIBIT E

VOLUNTARY QUIT LOG  
(TEST DATA)  
(COMPLETE FOR THE 11 EXCEPTIONS ONLY)

CLAIMANT'S NAME: \_\_\_\_\_

SOCIAL SECURITY NUMBER: \_\_\_\_\_

ISSUE/SUBISSUE: \_\_\_\_\_

DATE INITIATED: \_\_\_\_\_

FACTFINDING TIME (EACH OCCURRENCE IN MINUTES):

TIME CLAIMSTAKER INITIALS                      TIME DEPUTY EXAMINER INITIALS

1.	1.
2.	2.
3.	3.

DATE COMPLETED (DECISION DATE): \_\_\_\_\_

EMPLOYER STATEMENT:

AGREED WITH CLAIMANT \_\_\_\_ DID NOT RESPOND \_\_\_\_  
DISAGREED WITH CLAIMANT \_\_\_\_

DECISION (CODE): ALLOW \_\_\_\_ DENY \_\_\_\_

CONTRACTOR STAFF ONLY

REVIEW DATE:

SYSTEM DECISION: ALLOW \_\_\_\_ DENY \_\_\_\_

WAS SYSTEM DECISION: SAME \_\_\_\_ DIFFERENT \_\_\_\_

EXPLANATION OF DECISION DIFFERENCE:

EXHIBIT F

VOLUNTARY QUIT LOG

(TEST DATA)

(TO BE FILLED OUT WHEN CLAIMANT INTERVIEW IS COMPLETED)

1. WAS THE SEQUENCE OF THE QUESTIONS:

GOOD \_\_\_ FAIR \_\_\_ POOR \_\_\_

EXPLAIN FAIR OR POOR

2. WAS THE LOGIC OF THE QUESTIONS:

GOOD \_\_\_ FAIR \_\_\_ POOR \_\_\_

EXPLAIN FAIR OR POOR:

3. WERE ALL NECESSARY QUESTIONS ASKED OR WERE ADDITIONAL QUESTIONS REQUIRED?

NO ADDITIONAL \_\_\_ ADDITIONAL QUESTIONS REQUIRED \_\_\_

IF ADDITIONAL QUESTIONS WERE REQUIRED WHAT WERE THESE QUESTIONS:

4. DID THE CLAIMANT HAVE ANY CRITICISMS OF THE EXPERT SYSTEM?

NO \_\_\_ YES \_\_\_

IF YES, WHAT WERE THEY?

## 2. Data Collection

Data collection was performed on-site by ERC staff; all Voluntary Quit issues and determinations processed by the District Offices during the test period were collected and reviewed. ERC also periodically reviewed Claimstakers and Deputy Examiner logs to assess the progress of cases and identify any problems that arose.

Total cases listed by exception area and collected from the Kansas City and Overland Park District Offices are displayed in Exhibit G. This data includes all determinations processed by the Expert System during the course of the test. These numbers also include those determinations in which the employer did not agree with the claimant and no Expert System decision was produced.

The team also collected District Office and State historical and test period data to assess the likelihood of errors being introduced due to seasonal and unemployment fluctuations. The data collected at this stage included:

- Voluntary Quit Exception Decisions
- Voluntary Quit Non Exception Decisions
- Voluntary Quit Appeals
- Voluntary Quit Appeals Reversals.

Exhibit H shows the nonmonetary determination Voluntary Quit workload for the State of Kansas for the test period, and the Voluntary Quit appeals activity at the two District Offices.

# EXHIBIT G

## THE NUMBER OF CASES PER EXCEPTION AREA TEST DATA

ILLNESS/INJURY	15
TEMP. WORK	1
DEL/REJ. MILITARY	—
TRANS. SPOUSE	4
HAZ. WORK COND.	3
APP. TRAINING	—
UNWEL. HARASS	26
BETTER JOB	18
VIOL. ORDINANCE	1
VIOL. WORK AGREE.	23
PERSONAL EMERG.	9
TOTAL	100

**EXHIBIT H**  
**VOLUNTARY QUIT/APPEALS ACTIVITY**  
**JANUARY - MARCH, 1989**

**STATEWIDE**

	VOLUNTARY QUILTS	DENIALS	APPEALS OF DENIALS
JANUARY 1989	1439	944	379
FEBRUARY 1989	1561	1018	352
MARCH 1989	1601	1050	475

**KANSAS CITY/OVERLAND PARK**

	VOLUNTARY QUILTS/ % OF STATEWIDE VQs	APPEALS/ % OF STATEWIDE APPEALS
JANUARY 1989	255/17.5	82/21.6
FEBRUARY 1989	300/19.2	75/21.3
MARCH 1989	312/19.5	91/20

### 3. Kansas Evaluation Review Panel

To monitor the study and ensure accurate decisions, an Evaluation Review Panel was established, consisting of Kansas management staff, nonmonetary determination specialists, and ERC personnel. The Panel met periodically during both the Pretest and Test phases and reviewed results, procedures and problems, and determinations where the system decisions and Deputy Examiner's decisions disagreed. The Panel made recommendations for system modifications as well as recommendations for future system development.

When differences occurred between the Expert System decision and the Deputy Examiner's determination, the case was reviewed by senior Kansas staff and ERC personnel. This review included:

- A review of the Expert System decision
- A review of the determination and the logic used by the Deputy Examiner
- A review of the logic used by the Expert System, including the identification of any system weaknesses.

### 4. Appeals Decision Review

When decisions were appealed by the claimant or the claimant's employer, the Appeal Review Log (Exhibit I) was attached to the claimant's case documentation. Attaching this form to the claimant's folder enabled Kansas and ERC staff to:

- Track the decisions through the appeals process

Z

EXHIBIT I

APPEAL REVIEW LOG

APPEAL DATA  
(TO BE COMPLETED BY THE STATE OR CONTRACTOR STAFF)

APPEAL: YES \_\_\_ NO \_\_\_

APPEAL DATE:

APPEAL DECISION DATE:

DECISION:

IF REVERSAL, GIVE REASONS:

PLEASE EXPAND ON THE ABOVE QUESTIONS OR MAKE ANY ADDITIONAL  
COMMENTS AND SUBQUESTIONS ON THE BACK OF THIS FORM.

---

- Determine how well the Expert System decision test data fared in the appeals process relative to the comparison data and the Deputy Examiner determination.

#### D. EVALUATION OF FINDINGS

The Evaluation of the Kansas Nonmonetary Expert System Prototype involved five separate areas. The five areas and the questions examined were:

- Decision Accuracy - Did the system produce decisions that concurred with the Deputy Examiner's determination? If the Expert System disagreed with the Deputy Examiner's determination, was there agreement with the Central Office interpretation of Kansas law and policy?
- Time Factors - How did the amount of time for interviews using the Expert System compare to the amount of time for interviews following normal operational procedures?
- User Friendliness of the System - Were Claimstakers able to operate the system with minimal assistance from contractor staff? What changes were made to the system to enhance user friendliness?
- Claimant Confidence in the System - Were claimants favorable, neutral, or resistant toward the system?
- Statistical Analysis of Results - Was the number of cases available for analysis sufficient in size to assess the accuracy of the system and draw conclusions?

1. Decision Accuracy

The accuracy of the Expert System was measured in three areas:

- Coverage by the Expert System of the total number of cases processed at the two District Offices within all 11 exception issue areas.
  - Percentage of agreement between decisions generated by the Expert System and determinations issued by the Deputy Examiner.
  - Percentages of nonmonetary determinations appealed, the appeal decisions, and the impact of the appeal decisions on the system accuracy levels.
- a. Number of Issues Processed by the System

Statistics were collected on the 141 Voluntary Quit exceptions processed in the two District Offices during the test period. The 141 claimant interviews conducted produced the following outcomes: 64 cases resulted in determinations which were compared between the Deputy Examiner and the Expert System; 36 cases were not reviewed further because the claimant's statement and employer's statement did not agree (weighing conflicting information was not in the scope of the study); and 41 cases were not reviewed because it was determined that the claimant had sufficient earnings to satisfy the earnings requirement (and thus there was no issue to adjudicate). Seven Voluntary Quit exceptions were not processed through the Expert System for the following reasons:

- Claimant refused to participate. The incidence of claimants refusing to participate was low, although on two occasions the computer was in use by another Claimstaker and the claimant did not wish to wait.

- System would not accept case information. There were two cases received early in the test period in which a specific combination of answers resulted in the system terminating the interview prematurely. Modifications were made to these issue files so that they were operational throughout the remainder of the test period.
- Claimstakers experienced difficulty operating the system when contractor staff were not on-site. This problem resulted in a loss of three cases for analysis early in the test period. However, Claimstakers quickly found the system easy to operate with little practice. One type of case, however, did present problems. If a single claimant had more than one exception issue, a different sequence of commands had to be used to establish additional records. This procedure was simplified and the user menus were redesigned.

The chart on Exhibit J indicates the percentage distribution of determinations for the 11 Voluntary Quit exceptions in three categories:

- Annual Statewide
- Comparison Period
- Test Period.

While there are differences between the percentages among the three categories, there is a consistent enough similarity between the three categories to indicate the test and comparison period were a valid test period.

b. Agreement Between System/Deputy Examiner Determinations

The following documentation was collected for each issue processed by the system:

- Voluntary Quit Statement (K-BEN 31) completed by the claimant
- Printouts generated by the Expert System, containing the signed claimant's statement

# EXHIBIT J

## DISTRIBUTION OF VQ EXCEPTION ISSUES

(IN PERCENTS)

	ANNUAL* STATEWIDE	COMPARISON	TEST
ILLNESS/INJURY	13.9	12.2	15.0
TEMPORARY WORK	.5	4.1	1.0
MILITARY	.3	2.0	-
TRANSFER SPOUSE	12.9	8.2	4.0
HAZARDOUS WORK COND.	9.6	3.1	3.0
APPROVED TRAINING	-	-	-
UNWELCOME HARASSMENT	2.9	8.2	26.0
BETTER JOB	17.6	10.2	18.0
VIOLATION ORDINANCE	.3	1.0	1.0
VIOLATION WORK AGREEMENT	20.1	25.5	23.0
PERSONAL EMERGENCY	21.8	25.5	9.0

\*

July 1, 1986 - June 30, 1987

- Employer's statement regarding the reason for the claimant's separation
- Data Entry Worksheets (K-BEN 38) which contained the decision code used for the nonmonetary determination which was assigned by the Deputy Examiner
- Printout generated by the Expert System containing the result (allow or deny benefits), generated after the record was updated with the employer's information
- Voluntary Quit Log completed by the Claimstaker, Deputy Examiner, and ERC staff.

The Voluntary Quit log was attached to the printout and the claimant's written quit statement. (A decision of eligibility was not generated by the system at that point because the employer's statement regarding the separation had not yet been received.) Claims documents were then forwarded to the Adjudication Section, to await the employer's statement. When the employer's statement was received (or when 10 days had elapsed), the Deputy Examiner issued a determination. The completed documents, including the employer's statement and Data Entry Worksheet (K-BEN 38), were then returned to ERC staff. ERC staff updated information, reran the decision with the employer information, and copied and returned all documents to the clerk to mail to the Central Office.

One item was added to the Voluntary Quit log to monitor test case activity. Deputy Examiners were asked to indicate if the employer's response agreed or disagreed with the claimant's statement or if the employer did not respond within the allowable timeframe. If there was agreement between the claimant's and employer's statement or there was no response from the employer, contractor staff reran the case and obtained a system decision. If the claimant's and employer's statements disagreed, the case was eliminated from testing, since the parameters of the Expert System Prototype did not extend to weighing conflicting testimony. There were 36 case eliminated for this reason.

Expert System records were established for a number of cases for which a decision was not issued by the Deputy Examiner because the claimants had earned more than three times their weekly benefit amounts in most recent employment; if a claimant has sufficient earnings from more recent employment, separation issues pertaining to previous employment have no bearing on eligibility for benefits. Deputy Examiners typically dispose of these issues by entering Code 03101 (No Issue) on the separation. There were 41 cases eliminated for this reason.

While "no issue" cases and employer/claimant disagreement cases were eliminated from further consideration by the Expert System, data was still retained for these cases regarding user friendliness and time required to conduct interviews.

Expert System decisions were compared to determinations issued by the Deputy Examiners. If the Expert System disagreed with the Deputy Examiner, the program logic for that exception issue was examined (and modified if appropriate). In all cases where there were no problems with the Expert System program logic, the decisions were reviewed by Central Office staff.

c. Appeals and Decision Reversals

Appeals data was collected for both the comparison group and the test group. The data for the groups was compared first to determine if there were differences between the percentage of exception issues appealed between the two groups. Because of the difference in the rate of appeals filed between the two groups (29% for test group cases and 19% for comparison group cases), the percentage of appeals filed for each of the 11 exception issues was also compared within the two groups. The results of this analysis are displayed in Exhibit K.

# EXHIBIT K

## RATIO OF APPEALS FILED BY EXCEPTION AREA

### COMPARISON GROUP

	CASES	APPEALS	PERCENT APPEALED
ILLNESS/INJURY	12	3	14.2
TEMP. WORK	4	1	4.8
DEL/REJ. MILITARY	2	-	-
TRANS. SPOUSE	8	-	-
HAZ. WORK COND.	3	1	33
APP. TRAINING	-	-	-
UNWEL. HARASS.	8	2	25
BETTER JOB	10	-	-
VIOL. ORDINANCE	1	-	-
VIOL. WORK AGREE.	26	8	30.8
PERSONAL EMERG.	24	6	25
<b>TOTAL</b>	<b>98</b>	<b>21</b>	

### TEST GROUP

	CASES	APPEALS	PERCENT APPEALED
ILLNESS/INJURY	15	2	13.3
TEMP. WORK	1	-	-
DEL/REJ. MILITARY	-	-	-
TRANS. SPOUSE	4	-	-
HAZ. WORK COND.	3	-	-
APP. TRAINING	-	-	-
UNWEL. HARASS.	25	12	48
BETTER JOB	18	6	33.3
VIOL. ORDINANCE	1	-	-
VIOL. WORK AGREE.	23	7	30.4
PERSONAL EMERG.	10	2	20
<b>TOTAL</b>	<b>100</b>	<b>29</b>	

For the comparison group, the issue most appealed was Violation of Work Agreement. The issue with the highest appeal rate for the test group was Unwelcome Harassment. However, there were more than twice as many Unwelcome Harassment cases in the test group as in the comparison group; this was reversed in the Personal Emergency issue, with more than twice as many cases in the comparison group as in the test group. The ratio of allowed to denied claims does not appear to be a determining factor in the ratio of appeals filed. The percentage of cases appealed in the Violation of Work Agreement, Personal Emergency, and Illness or Injury issues were comparable for the comparison group and test group. The difference in the rate of appeals was substantial for the two groups for the Better Job issue. Findings from the analysis of appeals results were inconclusive. However, the number of decisions that were reversed in the appeals process were higher for test cases (38%) than for comparison cases (29%). It is possible that the high incidence of Unwelcome Harassment cases in the test group could account for some of this difference and indicates that this issue is less clear cut than the other issues.

Copies of appeals decisions were obtained for cases in which the Deputy Examiner's determination was reversed. The appeal decision contains a restatement of the pertinent facts of the case and the rationale for the decision. Appeals decision documentation was reviewed for those cases whose final outcome was in disagreement with the system decision. The review was performed to determine if system logic lacked necessary questions or the assigned probabilities for outcomes for the various responses to questions required adjustments. In two cases, reversals by the appeals unit supported the decision produced by the Expert System, and in the other two, the Expert System decision was reversed.

## 2. Time Factors

Claimstakers recorded the amount of time required to conduct a claimant interview using the Expert System. Data was also collected on the amount of time required to conduct a claimant interview for the comparison cases. Averages were computed for both comparison and test cases.

Also, claimstaking time required was computed by exception issue. Since some issues are more complex than others, additional time may be required to collect facts. If a sample contains a disproportionate number of the more complex issues, the interview time would be greater than that of a sample with less complex issues. Consequently, conducting a claimant interview using the Expert System for a Transfer of Spouse issue, which has less complex rules, took less time than for a Better Job issue, which has a more complex set of rules.

Data was collected on both comparison and test interview times. Using the Expert System proved slightly more time consuming than the manual factfinding process. The difference in the average interview times required was increased by the fact that the Expert System was an entirely new procedure, the PC a new piece of equipment to the office staff, and that formal training could not be conducted prior to the start of the test period. It should also be noted that certain minor logic problems in the Expert System caused problems in the early stages of the test until they were corrected.

Exhibit L displays the distribution of cases into five-minute intervals. In the comparison group there were 11 cases in which the interview took five minutes or less; there were no test cases that took five minutes or less. Conversely, there were only two cases in the comparison group that took more than 20 minutes, while there were eight test group cases in this category.

# EXHIBIT L

## CLAIMANT INTERVIEW TIME

		MINUTES					
		0-5	5-10	10-15	15-20	20-25	25+
COMPARISON		11	34	39	9	1	1
TEST (Kansas City and Overland Park)		0	31	33	16	6	2

<b>TOTAL CASES</b> COMPARISON 95 TEST 88	<b>AVERAGE INTERVIEW TIME</b> COMPARISON 12.8 minutes TEST 15 minutes
--	---

Exhibit M shows the average time required for each of the 11 exception issues for both the comparison and test groups. (Note: For this portion of the analysis, all cases were included, even those which were later excluded).

Claimstakers indicated that they did not feel the time required to use the system was excessive; some even felt that the system speeded up the interview, since the use of structured questioning reduced time spent obtaining irrelevant information. Since responses are standardized for most questions, time spent will not vary as much using the Expert System as it would with the manual interview process. The Expert System has the potential to improve productivity while ensuring that all necessary facts are obtained and considered in the decision process.

### 3. User Friendliness

The user friendliness of the system was evaluated in the following areas:

- Was the system easy to operate?
- Were the questions easily understood by the claimant?
- Did the questions follow a logical order?
- Were all necessary questions asked?

Claimstakers were asked to complete a questionnaire (Exhibit F) for each case, which concerned wording and sequence of questions, and to record questions the system did not ask that were necessary for factfinding as well as comments received from the claimant. Contractor staff monitoring the Expert System also recorded observations about difficulties encountered in entering case information. District Office staff were again interviewed midway through the test period regarding system strengths, weaknesses, and recommendations for improvement.

# EXHIBIT M

## AVERAGE INTERVIEW TIME BY EXCEPTION ISSUE

	ILL/INJ	TEMP WORK	DEL/REJ ENT. MIL.	TRANS SPOUSE	HAZ W.C.	APP TR	UNWEL HAR	BETTER JOB	VIOL OR	VIOL W.A.	PERS EMER
<b>CONTROL GROUP</b>	11.1	11.2	10	7.2	10	0	13.5	14.1	8	14.4	11.6
<b>TEST GROUP</b>	13.2	10	0	16.7	20	0	15.8	14.2	20	16	13.1

II-48

During Phase I, menus were developed to assist users in selecting options for system navigation. Initially, users selected an exception issue file by entering a number. This selection process was later simplified to highlighting the appropriate file and pressing the ENTER key. A short explanation of each exception issue was displayed as each issue was highlighted. Menus were revised and enhanced in response to the recommendations by Kansas staff. Screens used to display the facts collected and the decision generated were also revised to improve their legibility. A bounce capability was added to the system, which returns the user to the main menu when claimant responses to questions indicated that the wrong file had been selected. This mechanism provided the user with a means to access a different issue file without losing basic claimant and employer information already entered.

Claimstakers agreed that the system's coverage of the factfinding process was good. They did suggest that the wording be simplified, and that specific questions be added to issue files to develop information further; these suggestions were incorporated into the system throughout the course of the test period. If Claimstakers indicated that some questions displayed did not apply to a particular case, the rule order hierarchy of that issue file was modified to eliminate unnecessary questions generated by a set of responses.

#### 4. Claimant Confidence in the Expert System

Two sources of information were used to evaluate claimant confidence in the system:

- Ratio of appeals filed for the test cases to appeals filed for comparison cases. It was hypothesized that claimants might be more likely to appeal decisions they believed to be generated by the Expert System than those decisions issued manually. This hypothesis did not prove correct; the Expert System had no bearing on appeals filed.

- Claimstaker's observations on claimant's reactions to the Expert System. Claimstakers were asked to record comments made by claimants about the Expert System. Anecdotal responses from claimants were either favorable or neutral; only one was unfavorable ("too time-consuming").

## 5. Statistical Analysis of Results

Two questions had to be answered concerning the validity of the test: how the decisions of the Expert System compared with the determinations of the Deputy Examiners, and were the determinations by the Deputy Examiner or the decisions by the Expert System supported by the Kansas Evaluation Review Panel.

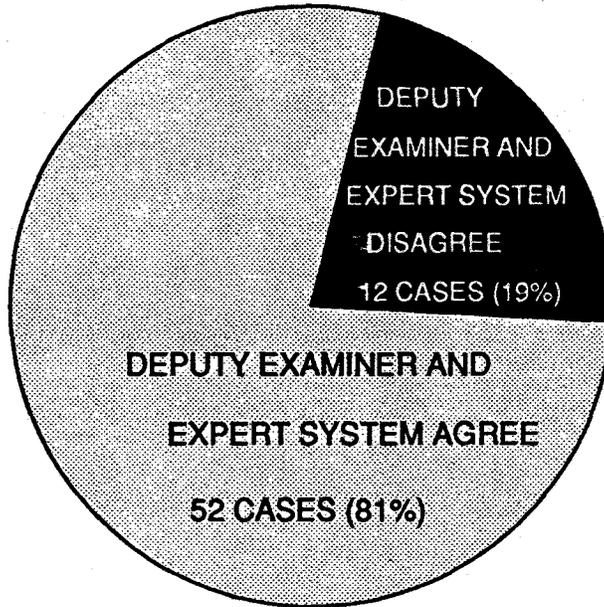
A total of 141 cases were initially processed by the Expert System. Forty-one of these cases were dropped from the sample when it was determined that the claimant had satisfied the rework requirement. An additional 36 determinations were eliminated since the separation information from the employer disagreed with the claimant's statement. These deductions resulted in the 64 cases which were analyzed.

Both Deputy Examiners and the Expert System made decisions in these 64 cases. In 52 of the 64 cases, the Deputy Examiner and the Expert System reached the same conclusions. The Kansas Evaluation Review Panel reviewed the 52 determinations on which the Deputy Examiner and Expert System agreed and found no errors with any of the decisions.

In the 12 remaining cases, they reached different conclusions. Each of these cases was reviewed by the Kansas Evaluation Review Panel to determine the correct decision. Exhibit N shows the decisions reached on these 12 cases by the Deputy Examiner, the Expert System, and the Kansas Evaluation Review Panel. In 4 of the 12 cases, the

# EXHIBIT N

## DEPUTY EXAMINER VS. EXPERT SYSTEM



### 12 CASES WHERE DEPUTY EXAMINER AND EXPERT SYSTEM DISAGREE

CASE	DEPUTY EXAMINER	EXPERT SYSTEM	KANSAS EVALUATION REVIEW PANEL
1	A	D	D
2	D	A	A - PANEL AGREES
3	D	A	A - WITH
4	D	A	A - EXPERT SYSTEM
5	A	D	D
6	A	D	D - 8 CASES
7	A	D	D
8	D	A	A
9	D	A	D - PANEL AGREES
10	D	A	D - WITH
11	D	A	D - DEP. EXAMINER
12	D	A	D - 4 CASES

**A = TO ALLOW BENEFITS    D = TO DENY BENEFITS**

**PANEL AND EXPERT SYSTEM AGREE = 8 CASES**

**PANEL AND DEPUTY EXAMINER AGREE = 4 CASES**

Kansas Review Evaluation Panel agreed with the decision of the Deputy Examiner while in 8 of the 12 cases, the Kansas Evaluation Review Panel agreed with the Expert System.

Should these differences in accuracy on the disputed cases be attributed to chance or to real differences in accuracy based on agreement with the judgment of the Kansas Evaluation Review Panel? A tool called the Kappa statistic was developed specifically for quantifying the level of agreement between two "judges" and for calculating the probability the agreement level is due to chance.\* The sign and magnitude of the Kappa statistic indicate whether the degree of the agreement between two judges is greater than, less than or equal to chance. The interpretation of Kappa is shown below:

<u>Magnitude of Kappa</u>	<u>Interpretation</u>
Greater than .75	Excellent reproducibility
Between .4 and .75	Good reproducibility
Less than .4	Marginal reproducibility
0	Less agreement than expected by chance alone

Each value of Kappa can be used to predict the probability that it arose from chance alone. The Kappa for judgments of the Deputy Examiner and the Kansas Evaluation Panel is -.5, indicating less agreement than would occur by chance alone on these 12 disputed cases. The probability of a Kappa as low as -.5 arising by chance alone is 0.04. The Kappa statistic for the judgment of the Expert System and the Kansas Evaluation Panel is .4, indicating good reproducibility between the two. The probability of a Kappa as high as .4 arising by chance alone is 0.04. Based on statistical decision criteria, it is concluded that in the 12 disputed cases, the Expert System accuracy or agreement with the Kansas Evaluation Panel was significantly high while the agreement or accuracy of the Deputy Examiners was significantly low.

\* For additional information on the Kappa statistic see T. L. Gustafson, TRUE EPISTAT Manual, Richardson, TX: Epistat Sigma Services, 1987.

Of the 12 disputed cases, 4 were appealed. It was anticipated that the results of these 4 cases might affect final conclusions about the relative accuracy of the Deputy Examiners versus the Expert System. No adjustment, however, was called for, because in 2 of the 4 cases, the result of the appeal agreed with the Expert System and in two cases the result of the appeal disagreed with the Expert System.

The analysis of agreement between the Kansas Expert System Prototype and the Kansas Evaluation Review Panel shows opposite results. The Kappa statistic between Deputy Examiner and the Kansas Expert is .4 and the associated probability is .04. This result indicates "good agreement or reproducibility" between the Expert System and the Kansas Evaluation Review Panel on the 12 cases. The agreement is so strong that it is unlikely to be attributable to chance ( $p = .04$ ) alone.

Based on judgments from Kansas, the accuracy percentage rate of the Expert System and the Deputy Examiner can be adjusted. The adjustment to the accuracy percentage rate involves the eight cases in which the Kansas Evaluation Review Panel agreed with the finding of the Expert System and disagreed with the Deputy Examiner. When these decisions are subtracted from the 12 cases in which the Expert System and Deputy Examiner disagree, the number of Expert System decision errors drops to four. This produces an adjusted Expert System accuracy percentage of 93.8%. This adjustment is detailed in Exhibit O.

EXHIBIT O:  
ADJUSTED AGREEMENT/DISAGREEMENT BETWEEN  
DEPUTY EXAMINER AND EXPERT SYSTEM

	<u>CASES</u>
Deputy Examiner and Expert System Agree	52 (81%)
Deputy Examiner and Expert System Disagree but the Kansas Evaluation Review Panel Agrees with Expert System	<u>8</u> (12.5%)
Subtotal	60 (93.8%)
Deputy Examiner and Expert System Disagree	<u>4</u>
Grand Total	64

Inspection of Exhibit P shows that in two cases the verdict of the Appeals Referee was different from that of the Deputy Examiner, the Expert System, and the Kansas Evaluation Review Panel and that in two cases the verdict of the Appeals Referee was the same as that of the Deputy Examiner, the Expert System, and the Kansas Evaluation Review Panel. Therefore, the previous results based on the 12 cases are not affected by the four decisions that were appealed.

EXHIBIT P:  
DECISIONS MADE BY DEPUTY EXAMINER, EXPERT SYSTEM, KANSAS PANEL,  
AND REFEREE IN THE FOUR CASES APPEALED

<u>Case #</u>	<u>Deputy Examiner</u>	<u>Expert System</u>	<u>Kansas Evaluation Review Panel</u>	<u>Appeals Referee</u>
2	D	A	A	D
4	D	A	A	A
10	D	A	D	A
11	D	A	D	D

D = Denied  
A = Allowed

The findings were striking. Not only did the Expert System reach the same conclusion as the Deputy Examiners in over 80% of the cases, but in the 12 cases where the Expert System and the Deputy Examiner disagreed, the Expert System was proven correct twice as often as the Deputy Examiner and, following standard statistical practice, these results cannot be dismissed as chance fluctuations.

The findings show the ability of the Kansas Nonmonetary Expert System Prototype to render decisions consistent with nonmonetary determinations rendered by the Deputy Examiner in the State of Kansas.

CHAPTER III  
FINDINGS AND RECOMMENDATIONS

A. FINDINGS

Within the restricted scope of the Kansas Nonmonetary Expert System Prototype Project, the value of using the Expert System in the nonmonetary determination process was demonstrated by this study. The central question - whether an expert system can be used in the nonmonetary determination process to gather facts and render decisions with reasonable accuracy - was answered in the affirmative. A statistically impressive 93.8% of decisions produced by the Expert System were affirmed by the Kansas Evaluation Review Panel.

During the course of the demonstration, other advantages of an Expert System were identified:

- The Expert System provided in-depth factfinding specific to the potentially disqualifying circumstances. The questioning structures the interviews such that extraneous information is excluded.
- The Expert System generates factfinding that is complete and accurate, meeting State and Federal requirements.
- The Expert System ensures that the decisions issued are consistent with State law and policy. The system allows any changes to State law or policy to be easily incorporated into the systems logic structures.
- The Expert System can be operated by less senior personnel.
- Finally, the Expert System can be used as a training aid.

The Expert System was also successful in other areas. Initially it was anticipated, because of the complexity of nonmonetary determinations in general, that the Kansas Expert System would only be able to handle 80-85% of all the Voluntary Quit exceptions taken by the two test offices. However, when the test was completed, it was

determined that, except for a few non-system error situations, the Expert System processed all the Voluntary Quit exception issues taken at both test offices. (Voluntary Quit issues account for 30% of all nonmonetary determinations filed in the State of Kansas. The 11 exceptions account for about 50% of all the Voluntary Quits. Thus, the Prototype processed fully 15% of all the nonmonetary determinations filed in the two test offices).

Interviews with District Office personnel by ERC during the Test and by Kansas State staff after the Test produced a number of general impressions. The Expert System had gained acceptance by the District Office Claimstakers. Initially, the attitudes of the Claimstakers ranged from indifferent to openly hostile, because of fear of staff reductions and of removing the "people factor" from the determination process. During the Pretest and at the start of the field test, ERC and Kansas staff attempted to calm these fears with little success; it was only as the testing period progressed, that Claimstakers in both District Offices realized that the Expert System was not designed to replace any staff, nor did it remove the "people factor" from the claimstaking process.

Discussions with the Deputy Examiners, on the other hand, indicated that acceptance of the Expert System did not come as quickly as it did with the Claimstakers, again due to the fear that the "people factor" was being removed from the determination process. However, as the study progressed, the Deputy Examiners began to see some of the obvious benefits of the system: the ability to gather all the necessary facts required for a valid nonmonetary determination, consistency in the application of laws and precedent, and no need to decipher handwritten fact-finding documents.

There were several points that the Deputy Examiners, Claimstakers, and Kansas staff agreed on:

- The Expert System increases consistency in factfinding.
- It ensures that the same questions would be asked regardless of the District Office or the Claimstaker.
- It was also believed that the depth of factfinding incorporated into the design aids Claimstakers and Deputy Examiners even in those cases where the Expert System is used only to collect information. Thus, the Expert System acts as a trainer and consultant in that users become familiar with questions that must be answered in order to resolve eligibility issues.

## B. RECOMMENDATIONS

The findings of the Kansas Nonmonetary Decision Prototype have provided six recommendations:

- Additional analysis of the viability of expert systems in the nonmonetary process should be conducted in the following areas:
  - Cost analysis of the use of an expert system in the nonmonetary process
  - An expert systems effect on promptness and performance measures. The system should be evaluated in accordance with the Quality Performance Index (QPI) currently in use
  - The maximum extent to which a expert system can be used in specific UI functional areas
- The U.S. Department of Labor, ETA should build and evaluate expert system in other areas of UI and in particular such programs as Disaster Unemployment Assistance and Trade Readjustment Allowance.
- Development of the Kansas Nonmonetary Expert System Prototype should be continued on an incremental basis; consideration should also be given to expanding the system to cover all determination issues.

- The U.S. Department of Labor, ETA should examine the feasibility and costs of developing the Kansas Expert System Prototype into an operational system. This should include an evaluation of the changes in current operating procedures, security considerations, system maintenance requirements, training, and hardware/software linkages to the UI mainframe computer.
- A team approach to developing expert systems should be used. The developmental team should consist of a Knowledge Engineer (trained in the techniques of expert system development and software) one or more Domain Experts (program staff that have an in-depth knowledge of the area being developed) and an APD programmer (familiar with the hardware and software systems with which the expert system will link and interact). Domain Experts should receive sufficient training in the expert system software to assist in the development of the system and permit them to perform routine maintenance on the expert system. Maintenance of the external programs and linkages to other systems will still require ADP programmer support.
- Because advances have been made in expert system software since the beginning of this project, the U.S. Department of Labor, ETA should review and evaluate currently available expert system software to determine the most effective and efficient product for UI applications. Specifically, examine object-oriented and frame-referenced shells to determine if these Professional shells are more useful than rule-based systems (such as EXSYS Professional used in this project).

The Kansas Nonmonetary Expert System Prototype project proved the capabilities of an expert system in the nonmonetary decision process. The recommendations made above are necessary to implement an operational system, and to effectively continue exploration of expert system technology in UI program areas.

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