Simplifying Complex Regulatory Compliance and Business Policy Requirements Using EXSYS Technology

The Problem – Information Overload & Confusing Interpretation

Businesses in the US have a wide range of regulatory requirements placed on them by many government agencies. Being aware of all the compliance responsibilities is difficult, and fully understanding the details and specifics is not only very time consuming but almost impossible. It is no wonder there is so much confusion, error and delinquency, plus non-compliance can carry substantial fines. Lawyers and other experts that can assist a company in meeting requirements are an expensive option, and can sometimes even make a complex situation worse.

The traditional government approach has been to provide information through various pamphlets, brochures and often slow "help lines". More recently, Web sites have been used to present and explain the regulations to the public. In theory, all the information needed is available. But actually finding it, reading it, understanding it and acting on it is still a daunting task.

This is a classic example of the difference between **"information",** and **"knowledge"**. What has been made available is "information", and the Web has made access to information and data easy. The government has many Web sites that provide a wide array of informative resources, and search engines allow access to vast amounts of information on any subject, from many sources, to be found quickly.

So, with all the regulatory information readily available, the problem is solved - right? Unfortunately - NO. Instead of being able to get specific answers that business owners need, they become overwhelmed with information, opinions and "guidance". They must consider:

1. Is the source of the information is authoritative?
2. Is the information up-to-date?
3. Is the information complete and consistent?
4. Does the information actually address their questions?
5. Does the information consider their special situation?

Even if they can answer, "Yes" to those questions, they then have to read and understand the information well enough to feel comfortable acting on it. For the typical businessperson this may be confusing, as regulations are likely to be written in legalistic terminology that the reader may not be familiar with. Even "simplifications" of the regulations tend to use technical terms, since official government documents must convey the same meaning as the regulations. Non-government "explanations" while easier to understand, but may not be authoritative, and may even be inaccurate.

Compliance errors can expose businesses to potential fines for not following regulations. Also, assuming the requirements have a valid reason for being on the books (and most do), non-compliance can lead to issues with health, environment, worker safety, and even national security. There is a huge cost incurred by government in attempting to "educate" the public on regulations, and answer questions in a correct and consistent way. What makes this even more challenging is employee turnover, new regulations with varied interpretations that require continual retraining, production of new documents, and the effective promulgation of any changes.

In large companies the problem is compounded by internal regulations and company policies, which can either expand on government requirements or require implementation of unique company conditions.

The Solution - Knowledge Automation Expert Systems

Government agencies are well aware of the problems that businesses face in dealing with the myriad of regulations. Hiring outside experts can be expense and difficult to locate. Training staff to handle compliance issues and documentation can also take its toll, especially if there is a high turnover or employee retirement. Rapidly changing regulations further complicate things.

Forward-thinking organizations have found it far more effective to distribute "Knowledge" rather than "Information". This is a very important distinction, and a great step forward in bringing usable, practical problem-solving knowledge to the public.

Information and data can be viewed as a source of knowledge. However, it requires analysis, usually in a formal learning setting or through years of experience, to generate understanding and knowledge. Even though all the information is widely available, few people have the time and inclination to study it thoroughly enough to convert it to knowledge - even for one regulatory area, much less all of them.

Using interactive online systems, many government agencies, and companies as well, are using well-proven EXSYS technology and services to encapsulate the “know-how” needed to comply with various regulations. Now, instead of business owners searching the Web and reading page after page of data, they simply answer questions presented by the systems, through the user’s Web browser. They are only asked relevant questions that the user can easily answer. At the end of the session, the user is presented with situation-specific recommendations and answers. The entire process emulates a consultation with a human compliance expert to get their questions answered – available over the Web, 24/7, having all the latest regulatory expertise.

For over 22 years, EXSYS knowledge automation expert systems have proven to be the most efficient and effective way to represent human decision-making processes. Other AI technologies such as neural nets, fuzzy logic, genetic algorithms, etc., have worked for some problems where "guessing" an answer is adequate (or the best that can be done). However, for problem-solving tasks that are well understood and documented, nothing beats rule-based expert systems. And now, Web-enabled expert systems allow 24-hour access and interactivity with automated online knowledge.

Regulatory compliance is ideal for online deployment via Exsys CORVID® expert systems. Most regulations are written in a form that easily converts to rules, and are stated in terms of "If … Then…" statements. However, there is an important and fundamental difference between just providing the user with the If/Then statements as "information", and putting the same If/Then statements in an expert system.

The difference is the Exsys CORVID "Inference Engine". This is the “brain” of the expert system that interprets, analyzes, sorts and makes sense of the various rules, rather than relying on the user to do this. The inference engine determines what rules are relevant to the problem being solved, what facts are needed to determine if those rules are true, and how to derive or ask those facts. If the needed facts are available from other rules, the inference engine will automatically use those rules, allowing even complex problems to be broken into small maintainable pieces.

The user is only asked relevant, focused questions that relate to their situation. Since the inference engine looks at all the rules, no relevant regulations are overlooked, but no unnecessary questions are asked of the user. At the end of the session, the user is presented with an answer or recommendation based on their specific input and the rules in the system. The user never needs to see, read or understand the rules (regulations) - that is done by the inference engine and allows "knowledge" rather than "information" to be delivered. The user is given their answer in the fastest and easiest way - similar to a quick conversation with a top expert.

Exsys CORVID software development tools capture the logic of decision-making rules in an easy to follow intuitive way, and present systems to end users in attractive and interactive interfaces. Systems can be delivered over the Web, using Java runtime programs that are portable across operating systems – or they can be downloaded as stand-alone applications. These deployment options bring a huge advantage to disseminating expert systems. Now a system can be fielded on a Web page and made available 24/7, around the world – even on palmtops! Updates need only be made to one location on the server, and all users will be running the latest version. If a regulation changes, the relevant rules are easily modified and propagated throughout the system, and the change is provided to everyone running the system - without requiring notification, reeducation or retraining.

Proven Results

OSHA, SBA, Homeland Security, EPA, USDA, FHA, the Military and many other agencies recognize the usefulness and practicality of using Exsys CORVID expert systems to deliver regulatory advisory knowledge to businesses and users via the Web. In addition, various state, local, Indian tribal organizations and government agencies worldwide have fielded regulatory expert systems. They are also widely in use for regulatory purposes in many industries to assist companies in complying with government and internal policies.

OSHA has very successfully used expert systems for many years to help companies understand and comply with OSHA regulations. (See http://www.osha.gov/dts/osta/oshasoft/index.html and scroll down to the "Expert Advisors" section). OSHA's Permit Required Spaces Advisor alone has saved businesses more than $100 million per year in consultants and attorney fees.

> *"OSHA has 11 expert systems on its Web site. In 18 months there were 70,000 downloads. This represents 70,000 users that did not have to read complex regulations. Hundreds of thousands of questions were automatically answered, rather than trying to get an answer from OSHA. And an unknown number of safety problems were detected and fixed, preventing injuries and perhaps saving lives."*
>
> **Federal Computer Week**
>
> *"Industry and military users have reported that the Asbestos Advisor has been used by up to 80,000 businesses in the first year it was put on the Internet. The Asbestos Advisor was honored with the **NPR Hammer Award,** presented by former Vice President Al Gore".*
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> **From BEST IT PRACTICES IN THE FEDERAL GOVERNMENT**

Seeing the large number of systems already in use, government agencies and industry do not view this approach as high risk or "cutting edge". The systems created by OSHA and other agencies received high praise from Congress and the Secretary of Labor, and they were awarded the prestigious NPR Hammer Award presented by former Vice President Al Gore's Best IT Practices in the Federal Government – A Joint Project of the Chief Information Officers Council and the Industry Advisory Council.

More recently expert systems in general and OSHA's systems in particular were singled out for praise in William Eggers book Government 2.0" – Using Technology to Improve Education, Cut Red Tape, Reduce Gridlock and Enhance Democracy. "Thanks to the software they can forgo the costs of hiring compliance consultants. Businesses would have to spend up to $4,000 for a written equivalent of the reports that the [expert system] advisors generate in minutes. OSHA estimates savings to small businesses from the Hazard Awareness Advisor alone amount to around $272 million over five years."

" 'I was horrified that we as a huge regulatory agency weren't able to do the first duties of a regulatory agency: Provide easily understandable information to business about what they needed to do to comply and then help them comply,' states now retired Roland Droitsch, Labor's Deputy Assistant Secretary. The expert systems solve this problem in a way that can be even better than talking to a 'live' customer services representative on the phone. Why? Because expert systems can tailor information to the particular circumstances and characteristics of the firm…they always give consistent answers…and are available 24/7."

Using expert systems has become the clear choice for delivery of knowledge.

Implementation

Building a regulatory compliance expert system is conceptually very simple. Just convert the individual steps in a regulation to the If/Then rule form of the expert system, and let the Exsys CORVID inference engine process the rules to ask focused questions and present recommendations. That is always the core of the logic in a regulatory system and many systems really are that easy to build.

However, regulations are often not written in exactly the correct form, have procedural operations that are not based on logical operations, or have complex interface requirements. This requires some skill in building the system and integrating it into a Web site. EXSYS offers several options to assist in system development – from determining best approaches, knowledge engineering, interface design, training and integration. Several discounted packages are available including a very popular Pilot Project/Prototype Package designed to get a system(s) built and deployed in a very time/cost efficient manner.

Many regulations have associated forms and documentation that must be filled out. An additional, substantial benefit of the knowledge automation approach is that the system can ask all the needed questions and options, and generate a completed form in PDF format ready to be printed, signed and filed. These systems can even run within emails.

Case Studies

Several specific systems will be examined in detail below illustrating many of the issues in building various types of regulatory systems.

OSHA's Compliance Advisors

In 1993, the Occupational Health and Safety Administration (OSHA) began developing Expert Advisors, a series of expert systems based on Exsys software. The Advisors address health and safety issues in areas such as asbestos and fire safety. Impetus for the initial product originated from the Small Business Administration's Office of Chief Advocacy, which urged OSHA to find new ways to help small businesses in interpreting government regulations. OSHA has worked with trade associations, unions and government agencies to respond to suggestions for expert systems in a variety of fields.

Users of the Advisors answer questions about their work place, practices, materials and other topics. Advisors determine the hazards that are present and the OSHA regulations that apply. In addition, the Advisors can generate legally sufficient plans of action for implementing appropriate procedures and handle administrative tasks such as preparing required letters. Some advisors are on very specific items such as the regulations regarding asbestos or working in confined spaces. Others cover a very wide range of compliance issues in one system, and allow a complete survey of OSHA requirements across many business practices.

When OSHA started building these systems, the expert system approach was considered rather avant-garde and they had to address the question of "why use an expert system tool rather than programming the decision tree?" "A key reason," says Ed Stern, OSHA's driving force behind their Advisors, "is that an expert system shell allows us to lay out the logic of the regulations so anyone can see it clearly (without having to learn programming code). When we issue an Advisor, we need to get approval from a range of people, from technical staff to lawyers. Without a clear presentation of the underlying rules on which the system is based, it would be virtually impossible to get concurrence from the various parties. In addition, an expert system tool allows the subject matter experts, rather than programmers, to control the development of the product and to change it. The series has attained the hoped-for goals by capturing the knowledge of the most experienced staff even after they have changed positions. (This way) we have not lost their insights and understanding of the regulations." The OSHA Expert Advisors program was a recent finalist in the *Innovations in American Government Awards*, which is recognized as one of the most prestigious public-service awards programs in the country.

Selecting a Visa Classification for Foreign Workers

The SBA Visa Classification system is a prime example of a set of regulations that are complex and difficult for humans to work with, but was quite easy to solve using an expert system. There are dozens of categories of visa that can be used when entering the US. Each has specific requirements, limitations and conditions for use. Selecting the correct type of visa is important since an error can have serious consequences and require returning to the country of origin to correct. Each applicant has to consider each type of visa independently, look at the many regulations that apply to them, select or exclude appropriate categories, and then analyze and classify all of them to select the best ones overall. Most of the rules are independent of each other, meaning there is no underlying tree structure or organization to help the applicant quickly find the correct category - just a large number of regulations and categories.

This is the type of decision-making problem that is difficult to explain or "teach" to new people. It requires understanding and remembering a large number of factors, and correlating them across several dozen possible categories in order to find the best solution. However, having many independent rules that need to be combined logically is what an inference engine is designed to do. It automatically and rapidly does the complex logical sorting and organizing that the human mind has great difficulty doing.

Building the system was simply a matter of inputting the specific rules for each category, describing under which conditions a category is a good recommendation, and when a category is excluded. Each of the rules was independent of the others, though they used the same terminology. The Exsys CORVID inference engine was then instructed to find all acceptable categories for a user. It automatically used the rules to determine what questions to ask the user, and combined the input to select or eliminate categories.

The results are displayed in a table on a Web page.

BusinessLaw.gov SBA

Legal and Regulatory Information for America's Small Businesses

Alien Employee Visa Classification Wizard Results

Comparison of Selected Classifications

Based upon the input, the following visa classifications may be appropriate for the alien employee. Each classification has associated costs and requirements. The table below has a side-by-side comparison of the classifications that could be used with their associated requirements.

Classifications	Cost US$	Procedure and Processing Period	Maximum Duration of Employment	Dual Intent	Comments
Q-1	130	Form I-129 ; 60 - 90 days	15 months	no	
EB-1b	135	Form I-140 ; 90-180 days	permanent	N/A	
EB-2b	135	Form ETA 750 ; Form I-140 ; 90 days to 3 years	permanent	N/A	Processing time depends upon eligibility for national interest waiver that replaces labor certification process.
H-1B	1130	Form ETA 9035 ; Form I-129	6 years	yes	

Restart

Since the rules in the system are just English “If/Then” statements, they are easy to maintain and update as regulations change. Also, and this is of key importance, they can be read by the approval staff at BCIS (Bureau of Customs and Immigration Service), which had to approve the system for fielding. Some expert systems, developed using other tools, are written using complex and difficult to read syntax that may make sense to the programmer, but will not be readable by the approving authorities. If a system cannot be understood and validated, it will not be fielded. It is important to build a system that can be easily understood.

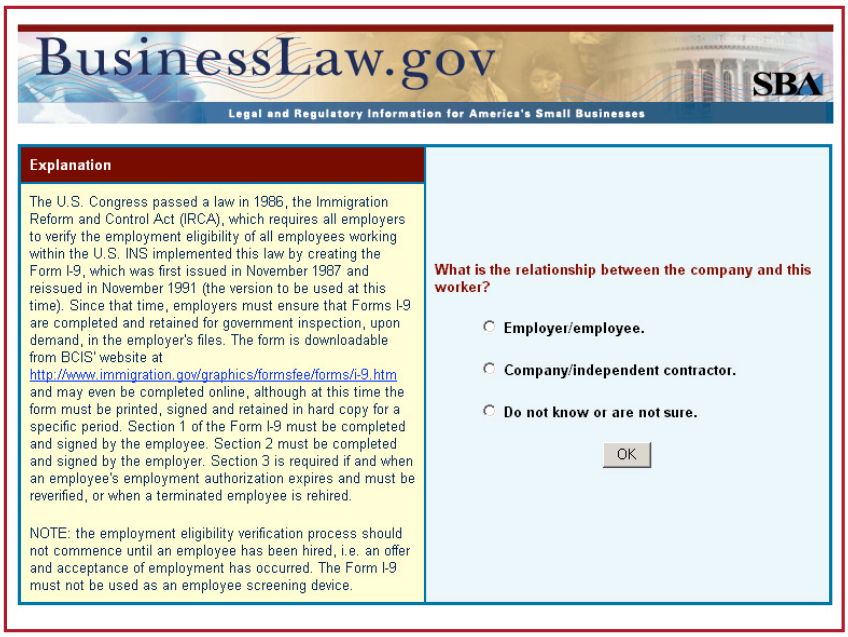
The Visa Classification system was an ideal expert system project. It was built quickly and at a very low cost. It handled an important and complex problem that humans have great difficulty solving. Attempting to solve this problem with just information and data provided through Web pages would have been virtually impossible due to the complexity and scope of information required to make a decision. It is unlikely that users could have been effectively educated at the level required to make valid decisions, and the "educational" materials would certainly have cost far more to develop and maintain than the expert system. The Exsys CORVID expert system approach allowed the core knowledge to be directly delivered in a way that made it easy to use without requiring that the user learn or understand this complex regulatory area.

I-9 Employment Eligibility Verification Form Wizard

The SBA’s I-9 Eligibility Verification system was created to help companies fill out an I-9 form for foreign workers. This is a form that verifies that each worker has the correct documents and credentials to work in the US, and that the company has this information on file. This seems like a simple problem and one that should be able to be handled without an expert system. The form is not long or complicated and has reasonably clear instructions. However, it applies to millions of workers and, in practice, many errors are made in understanding and filling out the form.

One of the goals of the system was to produce a completed I-9 form in PDF format that could be printed, signed and filed. Generating a form is not a logical decision, but rather a procedural operation. Purely procedural functions can be done using an expert system inference engine, but they are not the normal mode of operation, which is more oriented toward logical processes. However, within the procedural operations were logical ones. For example, the correct documentation must be supplied and verified. In some cases, combinations of items are required. If the documentation is not correct, the employee needs to produce an alternative. In addition, before the system even starts to fill out a form, a determination has to be made if the form is necessary. This is based on if the worker is an "employee" or "contractor". For many workers this is a straightforward determination, but that is not always the case and the Exsys CORVID system can lead the employer through the steps to make the determination.

In addition, the I-9 system makes a special point of providing a detailed explanation of its steps. Most questions have an explanation box that educates the user about that part of the regulation. This can be used to help the user understand the questions, or better understand why this fact is important in the system. Since the explanation is associated with the question, it is only displayed if the logic of the system requires the question to be asked.



Using an Exsys CORVID expert system for the procedural steps allowed the logical portions and explanations to be easily added. Using other approaches, such as HTML forms and Java script, while perhaps suitable for the procedural part, would not have allowed the logical portions to be added easily and seamlessly. In the end, the Exsys CORVID expert system approach was the best option to handle the overall problem. As with the Visa Classification system, the fact that the system rules can be easily read simplified the review and approval process.

Even though the process of filling out the I-9 is not difficult and could be solved with "information", delivering it via an Exsys CORVID expert system makes it far easier and more foolproof. The employer does not have to follow written instructions - which have proven to be prone to errors, misunderstanding or just ignored. Employers simply open a Web page, answers a few questions, and the completed form is printed out – all that's needed is a signature. Building this system was more complicated than the Visa system, but this was largely due to the procedural operations clarification by the expert, and the need to build a completed I-9 form in PDF format. The system was still built quickly and at low cost. It would have cost as much, or more, to build a Web-based solution using non-expert system techniques, which might have provided the procedural completion of the I-9 form, but without logical validation or analysis of the need for the form in the first place.

Nestle Foods Corporation Pension Fund Advisor
Nestle Foods has developed a knowledge automation system which provides information on an employee's pension fund status. The corporation made certain modifications to the original pension fund plans to bring it into conformance with new standards. Understandably, these changes created a considerable amount of confusion for the participants as well as additional work for the personnel departments fielding questions from all concerned.

This knowledge automation system is not intended to be the official pension “calculator”, but rather a means of giving participants the ability to conduct private interviews with a pension fund expert and ask “What-Ifs”. By providing this knowledge automation system to all of the personnel departments, a participant may become far more confident in personal financial planning decisions and the personnel department may focus on other pressing issues.

They have also built Smart Questionnaires, which produce customized contracts, which meet environmental compliance. The system results deliver PDF reports ready for completion and signatures.

Sandia National Laboratory - Interactive Technology Distribution System (ITDS), Materials and Process Characterization Questionnaire (MPC)
Innovations in American Government Award Winner
The ITDS/MPC is an expert system designed to perform environment, safety and health (ES&H) regulatory compliance assessments of manufacturing processes. Users respond to a series of questions posed by the knowledgebase. Based on user input, the MPC result is a listing of applicable regulatory references, some brief explanation, and a relative priority ranking of issues identified. This output may be general to very specific depending on the user input. The MPC is distributed to users on disk, and upon completion, users return data files for uploading into the Interactive Technology Distribution System, ITDS database. The ITDS contains more detailed information about materials and processes. The interaction of the MPC (containing the user profile) and the ITDS results in a far more comprehensive analysis of the users’ compliance condition including references and resources to correct compliance deficits. Solutions currently offered by the ITDS include process and material alternatives, compliance program templates, pollution prevention and waste minimization strategies, safe operating procedures, and material attributes such as physical properties. The ITDS is used to monitor user profiles over time to report the impact of changing and new ES&H regulations.

The expert system differs from commercially available regulatory databases in several important ways. It is designed for users not familiar with ES&H regulatory compliance issues linked to materials and processes. The user is not asked to make any determination of “hazard”. Individuals not familiar with ES&H regulations very often use subjective criteria when making a “hazard” determination. The MPC/ITDS makes hazard determinations for the user based on expert regulatory criteria. These features help ensure that relevant regulatory compliance issues are considered and addressed by each individual user. Getting from materials and processes to regulatory compliance issues frequently requires some professional judgment and interpretation. This expertise and analysis ability is contained in the system.

The ITDS/MPC is both a Performance System and a Model. As a Performance System, the ITDS/MPC teaches the user about regulatory compliance issues. The MPC may be used to model changes in regulatory compliance issues with changes or additions of new materials and

processes. The ITDS/MPC is a tool to assist the user in determining compliance requirements, prioritizing those issues and solving compliance problems. It is a training tool, which teaches the user to think in terms of their regulatory compliance obligations. This tool may not address all detailed facility or process specific compliance issues, but will train the user on when and how to seek more information as appropriate. This tool will be most useful to organizations without access to Environmental, Safety and Health professionals. The ITDS operates in a Windows environment, and may be networked for broad access within an organization.

Conclusion

Knowledge automation technology is a proven and highly effective way to implement compliance regulations in a way that vastly simplifies the process of compliance and helps to insure that all requirements are met correctly and fully. The systems can provide anything from simple advice to fully completed forms and documentation.

It is much better to deliver knowledge rather than just information. It takes less time and expense to build an Exsys CORVID expert system that delivers knowledge, than to build an effective Web-based "Information only" system, which will actually deliver adequate information. There are many proven benefits to using this technology:

1. Exsys CORVID expert systems have a high R.O.I. - both in terms of improving user efficiency and reducing errors. Regulatory compliance expert systems provide the public with the answers they need to comply with the law and help to implement the policies that underlie the regulations.

2. Using Exsys CORVID expert systems, both internally and externally, allows new or changed regulations to be rapidly disseminated without re-training.

3. Using Exsys CORVID expert systems allows the public to get the answers they need in the fastest most effective way.

4. Once a system is fielded it is available 24/7, has minimal maintenance costs and is highly scalable.

If you build them, they will come. The public and your employees want answers - not data. Once they find a Web site that can quickly and reliably answer their questions, they will use it.

EXSYS Inc
+1(505)888-9494
info@exsys.com
www.exsys.com

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