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Expert systems in business: a Japanese experience

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1. Introduction

This paper gives the personal view of a Japanese knowledge engineer, concerning the present status of the evolution of knowledge engineering in Japan, especially its applications in the business field, user evaluation and acceptance, problems, and future prospects.

1.a Business applications of knowledge engineering

Although industrial application of knowledge engineering has a rather long history, with a number of successful systems, it seems that very few people had thought of its application to business systems, until the summer of 1985, when a couple of application systems in banking first appeared. One of them was a prototype of a loan authorization expert system developed by Hitachi in co-operation with a major bank. After that, people suddenly became aware of the fact that the new technology, knowledge engineering, can bring new and different approaches to system building, new ways to increase efficiency, and new business opportunities [1].

In the two years since then, a number of trial applications have been reported. In most of the early cases the primary objective of the development project was to become acquainted with the new technology, to educate both computer department and top management, and to evaluate the true efficacy of knowledge engineering in the business field. At present, however, the emphasis has shifted to the development of live, rather than toy, systems.

At several major banks expert systems give various types of financial advice to their customers, translate telex messages and generate the appropriate slip, and authorize credit applications. Mitsui Bank and Sumitomo Bank are reported to have developed such "machine translation" systems for telex messages. In the distribution and retailing industry, expert systems developed jointly by Kasumi-Store and Hitachi help store managers plan daily work schedules and give advice on store layout and facing control, to cite just a few examples of successful developments.

1.b User awareness

These, and many more, successful systems have affected user awareness of knowledge engineering. A major bank has organized a special task force to explore the potential of knowledge engineering technology in future banking systems. Knowledge engineering is regarded as one of the key technologies for the banking business; as important as networking, distributed processing, and data base. Other banks are enthusiastic in selling the application systems they have developed to other banks. In short, they see in knowledge engineering new challenges for system development and new business opportunities.

1.c Tools

In order to meet the new market, computer makers introduced various generic tools for expert system development as well as new languages such as LISP and Prolog. Early tools tended to be nothing but an inference engine plus some debugging facilities. However, new generation tools are beginning to appear in the market, with various knowledge acquisition support functions. For

example, a tool, called ES/KERNEL offered by Hitachi, features a knowledge base editor which can be tailored for specific application by utilizing the meta-knowledge, or the structure of the knowledge, in the domain.

2 Application fields

Application fields can be generally classified into the following three categories:

1 decision support
2 advisory systems
3 planning

The first category, decision support, includes systems to automate or semi-automate decision making tasks. In order to build a successful system, it seems that, at present, the tasks should be well-structured and repetitive to some extent. Daiichi-Kangyo Bank has developed an expert system to make to-buy-or-not-to-buy decisions on equipment for its branch offices. When a request from a branch is input, the system decides whether or not the request should be complied with. More than 300 cases were tested, and the decisions given by the system and those given by human decision makers showed 93% agreement. The system also "knows" when it should let the human decision maker do the decision. So the 7% mis-match does not cause any practical problem. Other examples in this category include credit authorization systems for banks and credit card companies.

A number of advisory or consultation systems have been developed and successfully implemented in Japan. In the banking industry, expert systems are helping customers make personal financial planning and retirement planning. For instance, Sanwa Bank has developed a system called Bestmix which gives advice about personal financial decision making. Tokai Bank has developed an advisory expert system for optimal use of real estate. Nomura Securities has also developed a system called Personal AI which gives customers advice on personal investment planning. An expert system developed by Hitachi gives someone near retirement advice on the annuity, he or she can receive and when, and what procedure should be followed to secure the eligibility to receive the annuity. In the insurance industry, expert systems are helping customers to assess their risks and to select the most appropriate insurance policy. Another application investigated heavily in the insurance industry is risk assessment and diagnosis.

The third category, planning, includes various scheduling systems. Scheduling expert systems are used in various industries including the transportation industry, the retail industry, and hospitals [2]. Layout expert systems can also be classified in this category. Expert systems are used to design store layouts, factory layouts, and computer room layouts [3].

3 User evaluation

Users generally give favourable evaluation to the expert systems developed for them. Most frequently they are impressed by the following:

1 semantic aspects of the application made possible by the knowledge-based approach: expert systems behave as if they understand the concepts and meaning of the language within a limited domain—for most people this is a novel experience;
2 ease of, and shorter time requirement for, system development: in our experience, using tools, an application system can be developed and delivered in 3–6 months. For EDP people under the pressure of perennial backlogs this is quite a surprise.

Users also become aware that they now have at hand a tool by which they can give a machine-readable representation of their knowledge and know-how, and that they can commercially exploit these.

The experts are interested in the development process, and generally very co-operative in the work, including the interview sessions and verification process.

In a journalistic sense "business AI" has been something of a fashion in Japan, as in other parts of the world. Until very recently, newspapers reported every new application. The scene, however, has changed now. Publicity seekers would be disappointed; the media no longer give free space to "yet another new application", but only to truly innovative ones. This calmer atmosphere has, in turn, made some EDP managers who have been skeptical of AI, develop a new interest in AI technology.

4 Problems

4.a Shortage of knowledge engineers

Shortage of knowledge engineers can be a major obstacle for the exploitation of the technology. In spite of a large number of application systems developed so far, experienced knowledge engineers are still rare. A knowledge engineer needs to have the skill of a good system engineer, plus the intellectual ability to understand the nature of, and expert solution strategies for, the problems in the specific application field. Although there are a number of training courses offered by various institutions, in essence these abilities are not something which can be taught easily.

As many organizations, including computer makers, users, and software houses, become aware of the opportunity, they are trying to train engineers by courses and on-the-job training, the latter being the better way.

4.b Tools

A solution for this problem is to develop sophisticated tools for building expert systems, which enable experts to write their own expert knowledge themselves. However, at present there are no such generic tools available commercially.

Currently, however, "domain specific shells" are heavily used. These shells can be used to develop applications without the participation of the computer specialists.

4.c Development methodology for knowledge-based systems

One of the necessary conditions for the successful commercialization of a new technology is standardization. No standard expert system building methodology is well developed yet. Several attempts have been made based upon a mixture of prototyping and a phased approach to system development. For instance, Hitachi has developed an expert system development procedure, called ESGUIDE. The ESGUIDE offers a standard procedure plus various worksheets to define rules, frames, and other components of an expert system.

However, compared to conventional system building, expert system building is difficult to standardize. In general we have not yet accumulated a sufficient body of experience to truly generalize and standardize development methodology.

Another reason is inherent in the nature of expert systems. A great benefit of an expert system is its flexibility in application system development. The prototyping approach enables the trial and error method in system building. But how do you "standardize" the prototyping approach? What more can you say than "build, evaluate, and refine"? The diversity of potential application fields of knowledge-based system is also a hinderance to the standardization of expert system development methodology.

4.d Testing and validation

Testing an expert system also poses a serious problem. Currently, we do not have any proven methodology for testing and validating expert systems. This may damage the credibility of expert systems.

Nishinihon Bank has developed a financial advisory system. Expert advisors were very co-operative and supplied a number of test cases, actual and imaginary, to test the system. The cases

were intended to invoke every one of the more than 100 different types of advice stored in the system. When expert co-operation cannot be expected, testing can be a very difficult problem.

4.e Maintenance

Although not clearly recognized yet, maintenance of an expert system can be a problem serious enough to hinder the widespread use of expert systems. Especially in the business field, maintenance of a knowledge base becomes necessary when laws and/or regulations relevant to the problem are changed. For example, next year a tax reform is expected to be enforced in Japan, which will make it necessary to change the contents of the knowledge base of a number of financial adviser expert systems currently used by banks and securities companies.

However, under normal business conditions the knowledge engineer who developed the particular system may not be easily available when the system needs to be modified. This means that the system ceases to be usable the moment it becomes necessary to change its knowledge base.

One way in which to solve this problem is to let the experts themselves assume the responsibility of "up-keeping" the knowledge base. In order to do so, the knowledge engineer must clearly define the part of the knowledge base which the experts can and should modify, and the part which they should not attempt to modify. The knowledge engineer must also develop an application specific knowledge base editor.

4.f Social consensus

At present we lack the social consensus on the issue of the role of expert systems in our society. How far can an expert system go, with respect to giving medical diagnosis, or advice concerning law, tax, accounting and other regulations? The issue has hardly attracted the attention of professionals and law-makers.

5 Future prospects

Notwithstanding these problems it seems that knowledge-based systems have secured the position of a major stream in information processing technology. The future of business systems, including banking, financial, retailing, and other industries, cannot be envisioned without full exploitation of expert system technology.

Just as data base technology introduced the "data resource management" or "information resource management" concept in the EDP profession, the advent of knowledge-based systems will bring about the concept of "knowledge resource management" in the way business system developers think and talk. By knowledge resource management I mean all the activities in business organizations that are aimed at accumulation, standardization, distribution and effective use of knowledge, the fourth and probably the most important management resource in the business organization.

References

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[3] Watanabe, T et al., 1985. "An Expert System for Computer Room Facility Layout" *5th International Workshop: expert systems and their applications* Agence de l'Informatique, France.