Do we really want knowledge based systems in the real world?

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Application de systèmes à base de connaissance dans la pratique

Zur Anwendung von Expertensystemen in der Praxis

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SUMMARY
This paper draws attention to the important differences between academic and commercially based knowledge based systems. It provides advice to developers of knowledge based systems who wish to see their systems exploited in the real world.

RESUME
Cet article porte l'attention sur les différences importantes entre les systèmes à base de connaissance commerciaux et académiques. Il procure des conseils aux développeurs de systèmes à base de connaissance qui veulent voir leurs systèmes utilisés dans la pratique.

ZUSAMMENFASSUNG
Dieser Beitrag zeigt die wichtigen Unterschiede zwischen akademischen und kommerziellen Expertensystemen. Es werden Hinweise gegeben, wie Expertensysteme für die Anwendung in der Praxis aussehen und entwickelt werden sollten.

1. INTRODUCTION

Experience in developing ten KBS and reviewing seventy KBS has revealed an unfortunate gulf between the academic's approach to the development of systems and that of people who plan from the start to produce cost effective systems for use in the real world. What is often overlooked is that KBS in the real world are usually management systems which, either directly or indirectly, are intended to influence important decisions. Although people in the management world appreciate that systems must be designed around the intended users this simple fact often escapes academics who are developing KBS.

This paper therefore starts with a perspective on management systems. It continues with a review of KBS in construction with particular reference to project management. From these sections conclusions are drawn on the approaches to the development of KBS that are likely to prove useful in the real world.

2. MANAGEMENT SYSTEMS

In seeking to improve management procedures there are two alternative approaches.

- Identify and sharpen up one or more techniques and seek relevant applications
- Identify problems in the management procedures and attempt to solve them using common sense supported by available techniques

Once the alternatives have been set down in these stark terms most people, taking a broad perspective, would have no doubt that the second alternative is by far the better. Despite this there are many examples in industry and in management consulting of attempts to push selected techniques. In the 1960's and 70's strong efforts were made to sell the use of network analysis techniques (PERT CPM etc). These were motivated by commercial interests, particularly those of the computer industry which was trying to sell its hardware and software. (In those days the costs were such that hardware sales usually preceded software sales). The result was that network analysis became over-sold and many in the construction industry became dis-illusioned. It has taken a further ten years for the techniques to move into an appropriate niche and to be used effectively in appropriate circumstances.

During this period a study was undertaken at Loughborough University England (ref 1). This explored by statistical means, the factors that are associated with successful applications of network techniques. A follow-up study was made to explore the causal relationships that underlay the statistical associations. One of the interesting findings was that computer programs written by user companies were far more successful than commercial programs that had been well developed and strongly promoted. The detailed follow up revealed important managerial differences. In particular the circumstances which caused a user company to develop its own software were those in which management problems had been identified and tackled whereas the commercial software was usually found where a company had rather shallowly decided to apply the technique often under pressure from the computer salesman.

3. THE HISTORY OF KBS

The author was commissioned in late 1983 to study the potentials of KBS in construction management including project management (ref 2). Since then he has had a continuous involvement in this subject and has attempted to keep abreast of developments world-wide (ref 3).

It is clear that there are two main thrusts. One is an academic approach which attempts to harness the latest technology and push back frontiers of knowledge. A good example of this, despite its industrial funding is the PLANIT community club. This consisted of about ten companies whose financial contributions were matched by the British government's Alvey Directorate.

The software developed by this club is an Inter-active Planning Assistant. As this name implies its objective is to provide assistance to a project manager during the implementation of a project. A closely related development is Stanford's PLATFORM. Both were developed using a computer "tool-kit" called KEE. The kind of assistance these products will offer is to examine the productivity achieved so far in particular classes of activity, e.g. those that involve the placing of concrete, and to factor up or down the time estimates for future activities in the same class. They will also assess the phasing of activities in relation to expected weather conditions and make

appropriate adjustments; and recommend that an alternative plan should be adopted by practising project managers. One can speculate on the reasons for this as follows.

- The managers do not consider that the effort in using these more complex systems is justified by the benefits
- Re-assessment of productivity will usually involve other factors than records of past performance
- The facility to change automatically to a new strategy requires that the alternative has been pre-planned but this is extra effort at the start of the project that most managers would consider unjustified

The other approach is much more pragmatic and is eptiomized by the work of Stone & Webster inc. of Boston Mass. Their approach is to take relatively simple problems such as the selection of suitable tests for newly recruited site welders and to produce uncomplicated systems that can be used by managers in the field. Their commercial literature lists also

- Centrifugal pump diagnostics
- Rotating equipment vibration diagnosis
- Weld defects diagnostics
- Welding procedure selection

It is significant that systems of this type are currently working not only on Stone & Webster's sites but are also available through remote terminals to their clients. It is significant also that they are all diagnostic or selection systems as these are the simplest to develop.

The systems developed by the author have revealed similar charcteristics. For example an early demonstration system was developed to select appropriate mechanical handling equipment on construction sites. When described to George Wimpey & Co (a large British contractor) it was judged to be impractical as it did not adequately reflect the diversity of shapes of buildings in the real world. This prompted the development of an entirely new approach which includes an inter-active graphics facility to enable users to explore the full implications of the geometry. A system commissioned by the (British) Building Research Establishment is designed to diagnose the cause of dampness in buildings. Its ultimate purpose is to reduce the work load of its Advisory Service. Having these laudably practical aims ensured that its development proceeded smoothly towards a product that can be used in the real world (ref 4).

So the general experience of management techniques is being repeated. On the one hand we have well sharpened techniques, with impecable credentials, that are not used while on the other we have pragmatic solutions that have been developed in response to a perceived need.

4. LESSONS FOR KBS

The author's experience with management systems and more recently with KBS leads to some clear conclusions. If we do really want to see expert systems working in the real world we must first address the management issues. Any executive who plans to authorize the development of a KBS should be quite clear about the objectives for the system. It is of course quite valid to have as an objective the demonstration of relevance of KBS technology within a particular domain. But the author knows of no demonstration system that has been directly exploited in the real world.

So the objective from the start must be to have a system that people are going to use in the real world. The authorizing executive must therefore address, in advance, such questions as "How will the system be used?" "Who will use it?" "Will prospective users understand the messages on the screen?" "Will the system solve problems more quickly and ensure that all relevant aspects are explored?" "Will the system be cost effective?".

Another important question is "Will people feel threatened by the system?". All management systems affect people's lives. Some people feel threatened by proposed changes and this is particularly the case with KBS. An effective KBS is capturing and exploiting someone's expertise. He may react favourably if he judges that it will relieve him of unwanted chores. On the other hand he may fear that he will become redundant when the system is in use. So the executive in charge must judge the extent and form of the threat and take whatever steps he can to alleviate the damage.

5. SUMMARY OF ADVICE

In summary, an executive planning a real world KBS should

- Know its basic objectives
- Know how it will be used and by whom
- Ensure that it will be understood by prospective users
- Assess and mitigate the possible threat generated by the system
- Assure himself in advance that the benefits from the system will justify its cost.

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