

I offer these comments tentatively as the research I have done is not yet sufficient to be more positive. My view about general publications on expert systems is that they should be addressing these very real problems.

Although "The rise of the expert company" makes reference to a number of real world systems, it is anecdotal rather than explanatory. We are told how enthusiastic everyone is and, in general terms, we are told how each system works. What we are not told is the detail of the environment in which they were produced. In regard to most of the systems we are left with a host of unanswered questions such as

- Does the system merely select from a number of pre-determined outcomes?
- Does the system represent expertise that existed originally, or has the production of the system involved research into the nature of the domain?
- Could the system have been written without difficulty as an algorithm?

Some years ago perhaps, a book which described expert systems in glowing terms, as the New Jerusalem of computing, may have served a useful purpose. The research community may have needed stimulation to get started. But now surely we need careful analysis of the conditions that promote success. We need to know why such a high proportion of systems remain as fascinating demonstrators rather than real world tools. Armed with this knowledge we could move forward at a greater rate towards the exploitation of the brilliant ideas that have characterized the development of this new technology.

The rise of the expert company (3) by Edward Feigenbaum, Pamela McCorduck and H. Penny Nii, Macmillan 1988, pp 322, £14.95.

It is difficult to read this book without feeling a mixture of admiration and irritation; admiration at the infectious enthusiasm and lucid style of the authors and irritation at the understatement here and the overstatement there deftly woven to give a particular impression; admiration at the determination of individuals ("champions" as they are called here) who are chronicles in these case studies as pushing against much resistance to embrace new technology and irritation at the lack of recognition of the European contribution to the field of expert and knowledge-based systems. Therefore, on the one hand, I am inclined to recommend that every European researcher should read it in the hope that a similar reaction might inspire and galvanise them into furious and constructive activity. On the other hand, I can well imagine that the pot-boiler cover and the acknowledged business manager audience might be offputting for industrial and academic researchers who pale at the mention of such phrases as "killer technology", "return on investment" and "internal rate of return".

It will be disheartening for many to witness the authors' put-down, gentle as it is, of the European expert and knowledge-based systems scene. The classification of expert systems in use in Europe as rare and "rabbit" sized may be correct in comparison to the many "buffaloes" implemented in the USA ("elephants" are yet to evolve). Perhaps, the more reticent European style and, in particular, the British fear of overt enthusiasm—something which oozes from every page here—are restraining a number of "buffaloes" awaiting liberation. Moreover, as some of us have found when experimenting with different knowledge representation formalisms, a large knowledge base may just be a question of rabbits dressed in a buffalo's clothing. However, to be fair to the authors, they do give Ed Mahler of Du Pont considerable free rein and column inches to espouse his "small is beautiful" philosophy. Small as Du Pont's expert systems are (some are of the order of one man-month in the making), they are reputed to be over 200 in number and have an estimated "return on investment" of some ten million dollars over the past four years.

No doubt, there will be much sympathy with the view of ESPRIT expressed thus; "as usual with things European, the terms were complex". For many academic and no doubt for many industrial researchers, jumping through hoops and over hurdles while competing for European funding has

been an exhausting and thankless exercise. One extreme example of the financial hardship incurred by one British University during the preparation of applications to ESPRIT1 and ESPRIT2 is rumoured to be of the order of tens of thousands of pounds. Whereas companies frequently employ research managers and administrators to front their research groups and absorb the strain of form filling, lobbying and negotiating, University academics are wasting valuable time attempting to be entrepreneurs, something they have had no training for and probably are unsuited for in any case.

The Alvey Initiative is viewed, rightly, as something of a success, perhaps more-so in terms of market development and technology transfer. Surprisingly, though, the authors include no mention of the programme supported by the Information Engineering Directorate and British funding appears to have terminated in 1988 along with Alvey. Indeed, I wonder just how much time and energy was invested in researching British and European activity. One page devoted to a summary of expert systems in Britain is derisory. Someone, somewhere, must take up the challenge and identify where research excellence exists and where commercial exploitation is evident and publish the results, good or bad, in an accessible and inexpensive form.

The apparent paucity of detailed knowledge of European activity in expert systems is matched by some exaggerated dogma. The authors reiterate the often quoted remark (I think attributable originally to Ed Feigenbaum) that the knowledge base is paramount and the method of inference employed to solve problems is very much of secondary importance. I have always felt this to be an overstatement of the case. Admittedly, if the interest is solely in building a particular expert system then once completed its implementation language may be irrelevant. However, if the flexibility and extendibility of a particular formalism is to be further exploited beyond the typical rapid prototyping stages and into the development and later enhancement phases, then attention must be paid to the knowledge representation used as well as its underlying inference mechanism. Moreover, now that many expert system builders are investigating formal methods of specifying knowledge bases and knowledge-based software tools, representational and deductive methodologies are becoming increasingly important. More idiosyncratic is the authors' distinction between PROLOG and prolog (the latter being used to describe "any logic-based programming language") as is their *lack* of distinction between PROLOG and logic programming, a phenomenon frequently identified in the past by Professor Robert Kowalski of Imperial College.

Logic Programming undergoes some additional manhandling in the account of the Japanese Fifth Generation Project, now more than half way through its planned ten year term. The proposed Japanese Knowledge Information Processing systems are "keyed to a specific methodology, logic programming, originally developed in Europe" even though earlier we are told that "the Europeans responded (*to the Fifth Generation Project announcement*) from a position of technical weakness". Actually, the Japanese were more accurate in acknowledging and identifying the work they were influenced and motivated by. In addition, "The Fifth Generation project is widely admired, not necessarily for its technical achievements but for its boldness, its pursuit of innovation, its enthusiasm, and its drive". The Japanese companies who are showing success with knowledge-based systems are making little use of research results from ICOT, the central research institute set up in Tokyo under the umbrella of the Fifth Generation Project. Instead, they are building LISP machines (copied from the USA), selling inhouse expert system shells written in LISP (derivative of similar in the USA) and are making extensive study and use of LISP-based AI tools again from the USA. I do not discount these claims but a Japanese reaction would be very welcome.

In the USA, at least the future of expert and knowledge-based systems looks rosy and why shouldn't it with the depth of expertise and track record detailed in these case studies. The brain drain of "knowledge engineers" from Europe to the USA can only be accelerated by the wide range of interesting projects described in this book, let alone the enthusiasm with which it is imbued. In Japan, now thanks to American technology, things are improving. And what of British investment in its IT workforce? In 1986, the authors relate, the Japanese Government partly privatised its telephone corporation and invested billions of dollars of the resulting profit into a joint industry-public sector research institute in IT and managed separately from ICOT. Could the British Government have had similar foresight and confidence when selling British Telecom? No! Instead,

university research and education, in general, is being squeezed with inadequate funding, low morale and loss of highly trained and qualified staff to industry and abroad. University researchers are being encouraged in the spirit of the market economy to compete for and to attract more non-governmental funding than ever before. They will turn to British industry where according to the authors of this book they will find "company managers are simply risk-averse. . . . They're willing to experiment with a technology, but not if it costs them too much." This approach augurs even less well for the application of information technology in the non-profit oriented social and healthcare domains. If this book is drawn to the attention of Margaret Thatcher, I wonder if she will be as enthused as many others to react in a positive and constructive manner. I have recently had a recurring nightmare of the Prime Minister addressing the gathered expert systems community where she advises in her now familiar and much controlled whisper "Watch my lips! No more rabbits!".

The rise of the expert company (4) by Edward Feigenbaum, Pamela McCorduck and H. Penny Nii, Macmillan 1988, pp 322, £14.95.

The Rise of the Expert Company, according to its jacket, is a "road map to the future of business, . . . a grand story of opportunity, a report from the frontier on new paths to competitiveness and productivity". The authors believe that those companies (and nations) that efficiently manage and automate their knowledge and expertise will gain significant competitive advantages over their competitors that do not. This book validates the authors' assertion through casebook studies of over twenty companies that took the risk of leadership in knowledge automation. Their reward has been order of magnitude productivity gains, higher profits, and acknowledged industry leadership.

This book addresses three very different audiences and works well for at least two of them. First, it is a book for the executive. It speaks the language of business goals and objectives. It recognizes that a fundamental flaw in the presentation of any new technology to executives is a focus on the technology, not the business problem the technology addresses. In contrast, Feigenbaum *et al.* start with the business case, present expert systems technology as a response to the business needs, and validate the solution in terms of measurable impact on the business objectives. The theory of expert systems technology is secondary to a description of its successful application. It is not coincidental that an important factor in each case studied is the ability of the expert system's champion to present the system in the terms and values of the company's business agenda. In this respect, *The Rise of the Expert Company* serves as a primer on how to effectively sell this important technology within the corporate hierarchy.

The authors introduce the readers to systems that are solving real problems for businesses throughout the world. They show us quality control systems—systems that help plan, design, manufacture and distribute goods and services—and decision support systems—systems that automate front office activities. The executive audience is brought to the realization that a company's knowledge (its expertise, policies and practice) is an asset, and that, through expert systems, this asset can be cost-effectively brought to bear on a significant portion of the company's business.

The second audience includes knowledge engineers and would-be knowledge engineers. *The Rise of the Expert Company* is a "hidden camera" view of the politics and psychology of expert systems implementation. It is a collection of the kind of war stories that are recounted informally at professional AI conferences but are seldom presented formally in the professional literature. The book addresses questions frequently heard in the hallways during conferences: "What did you do to get management to agree to your project?" "What issues did you need to attend to?" "What did you do to convince the users that this system would be helpful?" "What would you do differently next time?" "How can we get started, and where do we look for allies?"

Feigenbaum *et al.*, recognize that there are no time-tested methodologies for expert systems development and project management, and they do not attempt to supply one. Instead, they point toward critical success factors for the champion of expert systems technology. These include having