Improving Recruitment And Selection Decision Processes With An Expert System

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This paper discusses how a knowledge-based system can improve decision processes in the area of recruitment and selection, which is one of the most important functions of Human Resource Management (HRM). There are high costs to an organisation for using poor techniques to either select someone who leaves soon after joining, or even worse, employing an unsuitable person who stays. The development of "CHAOS" (Computerised Helpful Advice on Selection) is provided as an example of an expert system to improve the processes of recruitment and selection. CHAOS was tested with both multiple Experts and Managers in the Sydney Institute of Technology who all agreed that the decision aid was a useful tool in the recruitment and selection process. The conclusion is that expert systems can be useful for decision making in difficult areas such as HRM.

The aim of this research is to determine the potential for the use of Knowledge Based Systems (KBS) technology to assist Human Resource Management (HRM) decision making processes in the area of recruitment and selection. In order to determine how relevant KBS is to HRM a literature review revealed that limited work had been carried out in the HRM area. One possible advantage of applying KBS to any form of decision making is that all knowledge embedded in it is declarative. Presumably, if the specific results of the decision making by management are immediately observable, then it is possible to inspect the reasoning processes and determine their validity. Consequently any heuristics ('rules of thumb' that Managers may rely on) that contravene legislation such as the N.S.W. Anti-Discrimination Act (1977) can be studied and avoided.

Need For KBS In HRM

HRM is recognised as a specialised field with expert practitioners operating within the context of 'organisational behaviour'. It covers a wide range of management activities that can be controlled centrally with a degree of professional accountability, or devolved down the 'line' necessitating rigorous control methods. In either case, control methods are used to avoid unfortunate consequences that could result from the normal behavioural limitations we associate with human frailties. The contention is that this field of HRM seems an ideal domain to build an Expert System (ES) to assist managers' decision processes, and acceptance of the technology may have implications for other ES applications in management. The questions that need to be considered are whether an ES can be reliable in reproducing experts' decisions with the same data, and whether the ES can assist in improving the validity of the 'recruitment and selection' processes. Although the later would be difficult to test in the short term, it is possible to determine some degree of acceptance among users, the reliability of producing similar responses amongst users, and the validity of reproducing the experts' judgments. This paper therefore concentrates on an ES application that involves the HRM department to test the assumption that decision making directly affecting organisational behaviour can be assisted by ES.

It could be argued that the processes of recruitment and selection are some of the most important of HRM. It is necessary to undertake a systematic analysis of the job and to determine the type of person who can do the job. The information derived from such an analysis can be used to assist with the reliability and validity of the processes used to recruit and select a 'competent' employee, who will be able to do the job at an
acceptable level, and will stay. The cost to organisations of using poor techniques and selecting, someone who leaves soon after joining, or worse still, an unsuitable person who stays, is extraordinarily high in terms of morale, cost and potential loss of revenue.

Development

Recruiting involves the process of attracting a pool of suitably qualified candidates so that the organisation can acquire the personnel it needs. Selection includes the processes that are used to determine the most suitable person for the job. It is an expensive exercise that takes time and effort and may be more costly if the wrong person is chosen. The techniques used must be valid in assessing aspects that are necessary for the job, and reliable so as to produce results that are consistent among instruments and also when used by different raters. According to Cascio the best predictor for job performance is 'testing' at .53, while the 'interview' is rated at .14, and 'education' is rated at .10 (Cascio, 1989, p.207). The challenge is to assist in the collection and use of valid and reliable information about the job and the ideal person for the selection process.

The research resulted in CHAOS being developed using the shell XiPlus which provides dynamic forms, as well as backward and forward chaining of rules. The advantage of the forms was that they could be used effectively in a number of ways to interact with the user and present and capture information for later use. The rules were easy to encode because they represented the experts' reasoning in a form that was easy to check and maintain during the building process by adding or pruning where necessary. This method was an acceptable way for the user to interact with CHAOS by viewing information in 'output fields' and adding data in 'input fields'. Fields could also be designated as 'input/output fields' to build up dynamic documents as captured data lead to further questions for the user to answer, or to prompt the user to check or change existing information previously derived.

The model for the prototype system of CHAOS takes into account the processes as outlined by DeCenzo and Robbins (1988) and is fitted to the experts' requirements. Only those processes that the experts suggested as critical were added to the model for the system that was built for the research purposes. To do otherwise would not have been a faithful reproduction of the experts' knowledge and may have confused the outcomes. However, it should be kept in mind that CHAOS is modular and allows additional modules to be added to the system if required before a commercial package would be produced.

The CHAOS system modules include:

- **Introduction Menu** to explain the options available;
- **Overview** introduces the legislative requirements and record details of panel members and candidates;
- **Records** of similar jobs previously completed that can be used to guide the current exercise;
- **Job Analysis** to determine the requirements of the job and the qualities of the ideal candidate;
- **Job Description** to prepare the details of job requirements in a standard format based on the previous step;
- **Person Specification** to explain the qualities of the individual that would be required to do the job;
- **Advertisement** preparation based on a standard successful format that uses the data gathered so far;
- **Assessment Method** is established taking the critical items from the Job Description and Person Specification that need to be assessed for importance;
• **Interview Structure** setting out the important items to be covered based on all the above steps;

• **Decision** stage uses an algorithm with weights (put in by the user or default weights previously set by the organisation) and scores for assessing candidates;

• **Letters** of follow up are generated at different stages or stored to be modified later if required; and

• **Reports** such as details of the job, person, organisation, and for 'equal opportunity purposes'.

**Testing**

The CHAOS system was tested using six expert HRM professionals (Experts) and six non-HRM Professionals (Managers) who were not often involved in recruitment and selection decision making. A case study, describing candidates for part-time teaching positions, was used so that each user could run through the entire system and see how it could be applied. In an attempt to determine the validity of the reasoning process used by CHAOS it was decided to get the Experts to run through the system and determine the extent of their agreement with the system. A suggested method for validation is provided by O'Leary (1991) which attempted to determine whether the 'right' system was being built, and is closely associated with knowledge acquisition. The process involves the testing of the system to determine: the degree of 'content validity' and learning from feedback during elicitation stages; using 'different people' to test the system such as the expert, other experts, and others who are not experts; and, 'reliability' as determined by sensitivity analysis to determine how the system responds to small variations.

'Content validity' can be established using feedback to compare the experts' decisions with the system. This becomes part of the acquisition process and enables an assessment of how well the system compares with the experts. If there is a disagreement then that may mean, that the knowledge base is faulty and needs to be adjusted, or it may mean, that on reflection the expert(s) may have changed their mind(s). This latter possibility did occur during the process of checking with the other experts on a few occasions when they were able to see the initial prototype in action.

'Different actors' can be involved at different stages. If one expert is used then the validation may indicate that the knowledge is incorrect, was implemented incorrectly, or that it has changed. However, the acquisition process may involve many actors who may differ to some extent (this occurred to a limited extent and a compromise was achieved in all cases) and if the disagreement can't be solved then the domain may not be appropriate. Initially, some of the users who trialed the system took longer to accept the reasoning process than others, but by the second time they used the system (the last of the three phases of the decision making exercises), they had 'learnt' to accept it.

'Reliability' tests using small variations in information presented may cause unusual behaviour. If the system can cope with variations in the variables this will support the quality of the system (the case studies provided support for this). The assessment of all the five candidates in the case study was done by the Experts and Managers manually. They were then required to use the computer to enter factors that they as users wanted to assess and determine the relative weights of these factors against which they were expected to score the candidates. Once they had completed this they then used the computer with weights and factors that had been previously entered by the Experts.

**Results**

Decisions by Experts and Managers (summarised in the following table) about the candidates were made during the first decision making phase Manually (stage 1) and then during the second phases with the Computer (stages 2 & 3) applying user definitions and weights for factors, and the in last phase with the Computer applying ES factor definitions and weights (stages 4 & 5). Only after the first phase when users had assessed the candidates manually were they required to use the ES to assess them again using the
structure that the ES provided. The second phase required the users enter a two stage process of decision making while they used the ES but relied on their own judgment to answer questions (supplied by CHAOS) on the factors to rate the candidates against. After the users had entered the factor information required and then scored each candidate, the decision making was done by the ES at the first stage, and then users were allowed to overrule this at the next stage. The final phase was also done in two stages by allowing the ES to supply all the information on the factors to be assessed by the users and then control the decision making at the next stage, after which the ES could be overruled in the last stage by the users.

<table>
<thead>
<tr>
<th>DECISION Stages 1 - 5</th>
<th># of Overrule</th>
<th>W (concordance)</th>
<th>Chi-square</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Manual</td>
<td></td>
<td>.7763</td>
<td>6.2105</td>
<td>.1804</td>
</tr>
<tr>
<td>2 Comp/(User)</td>
<td></td>
<td>.9103</td>
<td>7.2821</td>
<td>.1217</td>
</tr>
<tr>
<td>3 Comp/(User) Overruled</td>
<td>Experts = 4</td>
<td>.9605</td>
<td>7.6842</td>
<td>.1039</td>
</tr>
<tr>
<td></td>
<td>Managers = 14</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 Comp/(ES)</td>
<td></td>
<td>.9605</td>
<td>7.6842</td>
<td>.1039</td>
</tr>
<tr>
<td>5 Comp/(ES) Overruled</td>
<td>Experts = 2</td>
<td>.8816</td>
<td>7.0526</td>
<td>.1331</td>
</tr>
<tr>
<td></td>
<td>Managers = 5</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

The highest level of agreement between Experts and Managers according to Kendall's coefficient of concordance was after the Computer decision (based on user input) was overruled $W = .9605$). More decisions were overruled by Managers (14) then Experts (4) to achieve this result. However when the Computer was used with the ES input on factor definitions and weights, the level of agreement was just as high ($W = .9605$) according to Kendall's coefficient of concordance. Although less Experts (2) than Managers (5) overruled the Computer's decisions, the level of agreement dropped slightly ($W = .8816$) when the computer decisions were allowed to be overruled. These findings suggest that both Experts and Managers were more confident with the Computers decisions (less overruled decisions) when the ES knowledge was applied. If it is assumed that the Experts who were used to build the system will make better decisions in this domain, then the conclusion follows that the ES with expert knowledge should produce better decisions by Managers ($W = .9605$) and should not be changed. This approach to decision making will also provide more reliable decisions based on the consistency of factor definitions and weights. However if Line Managers prefer to use their own input on factor weights and definitions, they will be expected to have to second guess the Computer's decisions more often to get as good results.

The implications for ES to be applied to other areas of HRM appear to be promising. The recruitment and selection area of HRM is notorious for decision making which is unreliable and often invalid, and is well documented in the textbooks and literature. Therefore, the results of this research has demonstrated that it is possible to successfully apply an ES to a domain of decision making within HRM that is considered difficult because of possible biases and prejudices. This system may also have introduced threatening feelings of loss of control that could have resulted in resistance by users, but the reverse was true. However, the success of CHAOS in being able to reproduce the Experts intentions, as well as supporting and educating the end users (Managers), has demonstrated that there may be many less problematic areas of behavioural decision making in HRM that would be suitable fields for ES applications. The results from the tests carried out with users provide support for the research that ES can assist HRM in 'recruitment and selection' and has potential in other areas as well.

References available upon request