THE BLACKWELL ENCYCLOPEDIA OF MANAGEMENT

About the Editors

Cary L. Cooper is Professor of Organizational Psychology at the Manchester School of Management (UMIST), UK. He has also been appointed Pro-Vice-Chancellor at the University of Manchester Institute of Science and Technology (UMIST). He is the author of over 80 books, has written over 250 scholarly articles and is editor of *The Journal of Organizational Behavior*. He is also the Founding President of the British Academy of Management.

Chris Argyris is the James B. Conant Professor of Education and Organizational Behavior at the Graduate School of Business, Harvard University. He has written many books and received numerous awards, including the Irwin Award by the Academy of Management for lifetime contributions to the disciplines of management. Recently, the Chris Argyris Chair in Social Psychology of Organizations has been established at Yale University.

About the Volume Editor

Gordon B. Davis is the Honeywell Professor of Management Information Systems at the Carlson School of Management, University of Minnesota. He is recognized internationally as one of the principal founders and intellectual architects of the academic field of Management Information Systems. He has authored 21 books and over 150 scholarly articles. He has been involved in establishing academic journals, scholarly conferences, and model curricula for the field of information systems.

The Blackwell Encyclopedic Dictionary of Management Information Systems

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make decisions regarding corrective actions that may be needed.

WILLIAM D. NANCE

ACM The Association for Computing Machinery is the largest, broad-based international computer and information system society (*see* ASSOCIATIONS AND SOCIETIES FOR INFORMATION SYSTEMS PROFESSIONALS).

ADA A general purpose programming language sponsored by the United States Department of Defense. It is especially suited for the programming of large, long-lived systems with a need for ongoing maintenance. It supports modern programming structured techniques and concurrent processing.

agency theory applied to information systems Agency theory examines the contracts between a party (the principal) who delegates work to another (the agent). Agency relations become problematic when the principal and agent have conflicting goals and when it is difficult or costly for the principal to monitor the performance of the agent. When goals are incongruent, the agent is assumed to have a different set of incentive structures from the principal; the agent will consume perquisites out of the principal's resources and make suboptimal decisions. These activities produce efficiency losses to the principal. To counter these losses, the principal designs contracts to align the goals at the lowest possible costs. Costs can arise from providing incentives and from monitoring to ensure that the agent is acting for the principal's interests.

Agency theory can offer insights for information systems. First, principals can design information systems to monitor the actions of agents. Electronic communication systems, electronic feedback systems, and electronic monitoring systems are examples of monitoring devices that can be implemented to ensure that agents' behaviour is aligned with principals' interests.

Secondly, information systems professionals themselves often enter into agency relationships with other stakeholders in organizations and agency problems can arise. Important examples of such agency relationships include systems development, outsourcing, and end-user computing.

Systems Development

As principals, users often engage information system (IS) professionals as agents to develop information systems on their behalf. Due to a lack of understanding and knowledge of each other's domain, goal conflict may arise between the two parties. To reduce agency costs, one or both parties must try to narrow goal differences. IS professionals can invite users to participate more actively throughout the development lifecycle. This gives the users more opportunities to verify requirements and ensure that the final system is aligned with user needs. Further, users may request that the information system produce information-rich documentation so that monitoring is made easier and more readily available to users.

Outsourcing

In any outsourcing arrangement, the client company (principal) is usually motivated to shift its IS operations to external vendors who can carry out the work at the lowest possible cost. The vendor, on the other hand, may be looking for high profit in the arrangement. There is thus an economic goal conflict. To protect its interests, the client will increase its monitoring of the vendor. This can be achieved by requesting regular operational performance measures from the vendor, frequent meetings with the vendor to review progress of outstanding projects, and independent auditors to review benchmarks and internal controls of the vendor.

End-user Computing

Agency theory can help explain the dynamics of end-user computing. End users develop information systems themselves with little IS involvement. End-user computing, interpreted in agency theoretic terms, is a mechanism for reducing agency problems by eliminating the agency relationship between the user and IS professional.

SOON ANG

AIS The Association for Information Systems is an international society for information system academies (*see* ASSOCIATIONS AND SOCIETIES FOR INFORMATION SYSTEMS PROFESSIONALS).

artificial intelligence The attempt to program computers to perform tasks that require intelligence when performed by humans is known as *artificial intelligence*. Examples of such tasks are visual perception, understanding natural language, game-playing, theorem-proving, medical diagnosis, and engineering design.

Beginning in the late 1950s, AI researchers have modeled a variety of problems (such as playing checkers or proving theorems in mathematics) in terms of state space search. A *state* denotes a particular configuration of the components of a problem. The position of pieces on a chess board and the structure of terms in a mathematical expression are examples of states (for the problems of chess-playing and theorem-proving, respectively). The application of a permissible operator (such as a legal move in the game of chess or an expansion of terms in a mathematical expression) alters the state of a problem. The set of all possible states, together with the operators that enable transitions among them, constitutes the *state space* representation of a problem.

The solution of an AI problem consists of a search through the state space, i.e. the successive application of operators until the final state of the problem matches the desired goal state (a checkmate in chess or the simplest expression of a theorem). Unless the problem is very limited in scope (e.g. playing tic-tac-toe), the state space is hopelessly large for an exhaustive search (the game of chess has more than 10^{120} states). Additional knowledge (beyond the rules of the game) is required to guide the state space search in promising directions. This search control knowledge is commonly called *heuristic knowledge*. The process of problem-solving in AI described above is called *heuristic search* (Newell & Simon, 1976).

Chess-playing and theorem-proving ar[e] examples of tasks where the careful applicatio[n] of logic has to be supplemented by heuristi[c] knowledge to produce an efficient solution. A[s] AI research progressed, it was discovered tha[t] specialized tasks, such as diagnosis, design, and planning, require even more knowledge to formulate (in state space terms) and solve (through heuristic search). In order for knowledge to facilitate the solution of an otherwise intractable problem, the knowledge must be represented in a suitable form for use by a computer program. Methods of reasoning about the knowledge to apply it to a particular situation must also be specified. The representation of domain knowledge and efficient methods of reasoning with it have become central concerns of AI since the 1970s (Feigenbaum & McCorduck, 1983). Certain formalisms, including if–then rules, semantic networks, frames, and predicate logic, have been developed to represent and utilize knowledge efficiently in problem-solving.

AI methods have been successfully applied to problems in computer vision, robotics, knowledge-based systems (*see* EXPERT SYSTEMS; KNOWLEDGE BASE), understanding natural language and machine learning (the extraction of patterns from large volumes of data). AI-based computer systems have been successfully deployed in manufacturing to support the design and diagnosis of products and processes. In services, AI has been applied to a variety of tasks, including medical diagnosis, financial statement analysis, and logistics management. In addition to dedicated AI systems, AI techniques have also been used to improve the user interfaces of conventional information systems.

See also Cognitive science and information systems

Bibliography

Newell, A. & Simon, H. A. (1976). Computer science as empirical inquiry: symbols and search. *Communications of the ACM*, 19 (3), 113–26.

Feigenbaum, E. A. & McCorduck, P. (1983). *The Fifth Generation: Artificial Intelligence and Japan's*