

Preface

This book is largely the result of research undertaken in the University of Birmingham, UK, and in the Humboldt University of Berlin in between 2001 and 2005. It also embraces extensive research that has been carried out and published in a number of research papers by the authors elsewhere, and papers presented at conferences internationally. Its contents can be taught in undergraduate and graduate courses which span the social sciences, business administration, computer sciences, and engineering.

From a macro perspective, this book is about organizations, cognitive machines, and the environment. It is concerned with the relations between them. It relies on the premise that the technology of cognitive machines can improve the cognitive abilities of the organization; it also relies on the proposition that an increase in organizational cognition reduces the relative levels of uncertainty and complexity of the environment with which the organization relates. Moving further, such a proposition opens new perspectives to the study of the implications of cognitive machines for organizations, especially organizational design, behavior, cognition, learning, and performance. From all these concepts, this book proposes new organizations whose structure and processes are based on computational organization management networks and whose main participants (or agents) comprise cognitive information systems and cognitive machines.

From a micro perspective, this book is concerned with theories of organizational cognition and cognitive machines. It proposes concepts towards a theory on organizational cognition which contribute to improve the capability of the organization to manage and to process information. It also proposes the design and analysis of cognitive machines and it investigates the participation of these machines in dysfunctional conflicts resolution in organizations. It introduces premises and propositions about organizational cognition, cognitive machines, and the participation of these machines in organizations.

It assumes that cognition involves processes which provide individuals, groups, and organizations with the ability to learn. It focuses on premises and propositions about organizational cognition rather than organizational learning. Therefore, special attention is given to the implications of cognitive machines for organizational cognition. Its content is chronologically described in the following.

Firstly, it presents a broad overview on key concepts of organizations and technology in order to provide the reader with the scope of the main disciplines of this research.

Secondly, it presents rationale for, and it proposes principles towards a theory about organizational cognition. The new concepts describe relations between organizations and the environment, and they are based on principles of contingency theory, administrative behavior (decision-making and bounded rationality), open systems, socio-technical systems, organizational learning, and computational organization theory. In such a perspective, the organization is viewed as a cognitive system whose cognitive processes are attributes of the participants within the organization and the relationships or social networks which they form. These cognitive processes are supported by the goals, technology, and social structure of the organization. Moreover, organizational cognition is also influenced by inter-organizational processes and thus by the environment. The participants within the organization comprise agents in the form of humans and cognitive machines, and they are supposed to act in the name of the organization.

Additionally, it presents a methodology of organization design in order to support the choice of strategies which increase the degree of cognition of the organization and thus its ability to manage and to process information. It selects the technology and the participants in the organization as the elements of design since they comprise cognitive machines.

Thirdly, it presents the design and analysis of a framework of cognitive machines. The design comprises theories of cognition and information-processing systems, and also the mathematical and theoretical background of fuzzy systems, computing with words, and computation of perceptions. According to the theory of levels of processing in cognition, it advocates that the ability of these machines to manipulate a percept and natural concepts in the form of words and sentences of natural language provides them with high levels of symbolic processing, and thus with high degrees of cognition. Hence, they mimic (even through simple models) cognitive processes of the human mind. The analysis of these machines comprises theories of bounded rationality, economic decision-making, and conflict resolution along with perspectives about their participation in the organization. From the results of the analysis it advocates that such machines can solve or reduce intra-individual and group dysfunctional conflicts which arise from decision-making processes in

the organization, and thus they can improve the cognitive abilities of the organization.

Fourthly, this book provides evidence by indicating the alignment of its premises and propositions with results of an industrial case study. Its central point of contribution is concerned with the development of approaches and measures to evaluate the degree of organizational cognition. For this purpose it looks carefully at three complementary activities.

The first activity is about processes of organizing. It presents an evolutionary process improvement model - The Capability Maturity Model - which was implemented in the organization of study. In this part, we contribute by defining correlations between measures of organization process improvement and degree of organizational cognition. Among the measures of process improvement are included organization process maturity, capability, and performance. From such correlations, we also derive conclusions about the association between organizational cognition and organizational learning.

The second activity is about the evaluation of the process of organizing and it proposes the design of a management control system which performs the tasks of measurement, analysis, and control of the organization process performance. The computation of process performance indexes is performed by a cognitive machine which is engineered with criteria of analysis and design.

The third activity is concerned with data analysis, results, and conclusions about the industrial case study. In this part, findings indicated that improvements in the level of organization process performance were correlated with improvements in the level of organization process maturity. Such improvements received major contributions from The Capability Maturity Model guidelines. Additionally, improvements in the levels of organization process performance and maturity were associated with improvements in the degree of organizational cognition. These improvements could be measured in two ways. Firstly, on an integer scale [1, 5], which indicated the level of organization process maturity associated with the degree of organizational cognition. Secondly, on a real scale [0, 10] which indicated the level of organization process performance correlated with the level of organization process maturity, and thus associated with the degree of organizational cognition. A very important implication and contribution of these correlations is that they open new directions to the development of methods to assess, to evaluate and to measure the degree of organizational cognition from appraisal methods of The Capability Maturity Model, and also from other organization process improvement models. We also outline the main contributions and limitations found with the implementation of The Capability Maturity Model in the organization of study.

Macro results of the industrial case study showed that the Capability Maturity Model (CMM) provided the organization with improvements in its process matu-

rity level. However, despite improving engineering and management processes for complex software projects at the technical level in the organization, the progress of the CMM in those areas of higher hierarchical levels (such as managerial and institutional levels) was slow and poor due to lack of commitment of the organization to the CMM policies at those higher layers.

Fifthly, it contributes by outlining the implications of cognitive machines for organizations and it derives concepts of new organizations. It analyses the impact of cognitive machines on organizational design and on the elements of the organization which subsume goals, social structure, technology, participants, inducements, and contracts. It also examines limitations of past and current manufacturing organizations and it proposes new features for their future through perspectives of management, socio-technology, and organizational systems theory. From these perspectives, it introduces the concept of customer-centric systems - which represent a new organizational production model with capabilities to manage high levels of environmental complexity, to pursue high degrees of organizational cognition, to operate with high levels of mass customization, and to provide customers with immersiveness. From all this background, and most important, this book proposes the definition, the structure and the processes of Computational Organization Management Networks (COMN) which are new organizations whose principles of operation are based on the concepts of Organization Functional Layers, Hierarchic Cognitive Systems along with those of Telecommunications Management Networks of the International Telecommunication Union. Structured with functional layers and the cognitive roles which range from technical and managerial to institutional levels of analysis, and also equipped with technological, operational, managerial and business processes, the concept of Computational Organization Management Networks (COMN), as proposes in this book, plays an important part in the developments of future organizations where cognitive machines and Cognitive Information Systems (CIS) – that is information management systems with high degrees of cognition, intelligence and autonomy - are prominent actors of governance, automation and control of the whole organization. Additionally, it introduces the concept of immersive systems in order to provide the new organization with the capability of immersiveness.

The authors hope that their contributions in this book will provide signposts for future research and at the same time provide practical guidelines for practicing managers in today's competitive global markets.

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