Chapter 7
Understanding Based Managing Support Systems:
The Future of Information Systems

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ABSTRACT

This publication presents cognitive systems designed for analysing economic data. Such systems have been created as the next step in the development of classical DSS systems (Decision Support Systems), which are currently the most widespread tools providing computer support for economic decision-making. The increasing complexity of decision-making processes in business combined with increasing demands that managers put on IT tools supporting management cause DSS systems to evolve into intelligent information systems. This publication defines a new category of systems - UBMSS (Understanding Based Management Support Systems) which conduct in-depth analyses of data using on an apparatus for linguistic and meaning-based interpretation and reasoning. This type of interpretation and reasoning is inherent in the human way of perceiving the world. This is why the authors of this publication have striven to perfect the scope and depth of computer interpretation of economic information based on human processes of cognitive data analysis. As a result, they have created UBMSS systems for the automatic analysis and interpretation of economic data. The essence of the proposed approach to the cognitive analysis of economic data is the use of the apparatus for the linguistic description of data and for semantic analysis. This type of analysis is based on expectations generated automatically by a system which collects resources of expert knowledge, taking into account the information which can significantly characterise the analysed data. In this publication, the processes of classical data description and analysis are extended to include cognitive processes as well as reasoning and forecasting mechanisms. As a result of the analyses shown, we will present a new class of UBMSS cognitive economic information systems which automatically perform a semantic analysis of business data.

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INTRODUCTION TO COGNITIVE DATA ANALYSIS

Processes taking place in the human brain have been the subject of theoretical analyses and empirical research for very many years. However, although we increasingly frequently feel we can explain almost everything that takes place in the human brain, a closer study always reveals something to undermine this certainty we have. Among all the processes taking place there, key ones include thinking, cognitive, interpretation and reasoning processes as well as processes for the varied, complex and in-depth analysis of information received from the senses or recalled from memory. These very types of human cognitive processes were used by the authors of this publication to attempt to combine human information analysis processes with automatic, computer data analysis. This combination has lead to creating a class of IT systems whose operation is founded on a meaning-based interpretation of data and a cognitive process of analysing it. The essence of this approach to building management-support systems is that by performing an in-depth analysis of data on the basis of its semantic contents and of knowledge possessed, such a system can understand the meaning of the analysed data, so it can classify and interpret it more precisely.

This type of detailed semantic analysis of data is possible because UBMSS IT systems use a linguistic description and a characterisation of data based on knowledge. In such systems, computer linguistics is employed to ensure the appropriate semantic representation of the layer of data (information), thanks to which automatic procedures, using the appropriate resources of expert knowledge collected in the system, can make the proper (content-related) classification and categorisation of this information and data.

The proposed semantic data analysis systems have been termed UBMSS (Understanding Based Managing Support Systems) to distinguish them from other classes of cognitive data analysis systems, described in the following publications (Ogiela 2007; Ogiela 2008; Reisberg 2001; Tadeusiewicz 2003; Tadeusiewicz 2008; Tanaka 1995; Wang 2003).

So what is the phenomenon of cognitive data analysis about? To answer this question, you have to realise what the phenomenon of the human cognitive process is about. Processes that the human mind uses for various purposes, e.g. for analysing a selected phenomenon or assessing the significance of specific information, are always based on cognitive processes. They form the foundations for the stages of describing, analysing, interpreting, reasoning and classifying. It must also be borne in mind that in data analysis processes there is an unwritten doctrine of the consistency of learning, behaviour and experience which says that in cognitive processes a close and perfect consistency is noticeable between what we know, how we behave and what we experience.

In cognitive data analysis systems this rule is of utmost importance for their correct operation. In data analysis, there must be absolute consistency between the knowledge (which is input into the system as a base of knowledge obtained from experts), the behaviour (in the system this comprises recommendations given to the user as a result of completing an in-depth analysis of the current socioeconomic situation, which is automatically assessed based on the semantic content of the analysed data) and the experience (in cognitive data analysis systems this means processes of collecting knowledge using observations of recommendations given earlier and their effects). It should be added that UBMSS systems are always learning systems, with more intense learning occurring when the phenomenon analysed is new or completely unknown to the system.

So cognitive data analysis systems use a kind of computer introspection, understood as the process of acquiring (gaining) knowledge or extracting it (by deduction or induction) from system memory. The approach presented shows that it is possible to initiate an automatic process of semantic reflection