Chapter 8
Development Trends of Information Systems

ABSTRACT

The goal of this chapter is to discuss development trends of information systems. The chapter begins by discussing a framework known as the semantic ladder. This framework provides an overview and shows relations between data, information, concepts, knowledge, and wisdom. The chapter then discusses three domains of scientific activity: data science, knowledge science, and wisdom science. Next, the chapter considers how we can move from a science of information to a science focused on informing. Ways of measuring the quality of information is then considered. The chapter concludes by examining the latest trends in designing information systems during the past century.

INTRODUCTION

Since the golden age of science fiction books, the development of computerization has increasingly brought the *fictional* ideas closer to reality. The initial dominance of computer science *syntax* has given way to the *semantics* of these applications, i.e., applications are now designed to use ICT with increasing amounts of cognitive content about the situation to make wise decisions based on knowledge and wisdom. It has led to a *pragmatism* about these applications, that is, an effort to answer why these systems are implemented. It is a question about the *wisdom* of the system being undertaken.

Over the last 100 years of mechanization, automation, and computerization, the design of ICT applications has evolved (a) from partial systems to enterprise-wide systems and (b) from internal ICT services to outsourced services, either to those domestic or abroad (where it is cheaper) or to a digital cloud service with an unknown location to reduce the cost of the service. These are at present urgent digitalization-oriented dilemmas, which will be discussed in this chapter.

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FROM DATA TO WISDOM IN A COMPLETE CYCLE OF COGNITION

Presently in the 2020s, there is a great interest in data science, which is often treated as the first of two phases of cognition. It is followed by the conversion of data into knowledge based on techniques of data mining, categorizing, and grouping and, subsequently, correlating, calculating, and presenting of proposals for decision-making. Unfortunately, data and knowledge are only two phases of the process of thinking, problem-solving, and deciding. In modern data engineering, there is no room for other units of cognition, like information, concepts, and wisdom.

What is information? The term is mostly used in formal and popular publications and discussions when it comes to concrete matters. For example, there is talk of the Information Wave that dynamizes civilization. So why is "information" not defined?

Information is a product of human thinking that expresses our insights, opinions, suggestions, communication, decisions, relationships, and reporting. Information is a "bullet" (message) that we send through a communication channel, such as personal conversation, phones, letters, the press, radios, televisions, books, and others. So, information is a description of the material world and is the product of our brain/mind. Without information about the world and the environment, we would be blind and deaf. Communicating with information makes us active and conscious.

For a long time, information as knowledge, culture, and infrastructure (e.g., education, power, communication, etc.) has helped develop civilization. This has occurred through papyrus, books, inscriptions on buildings, libraries, school and university textbooks, constitutional documents, the Bible, the Koran, the Talmud, songs, music, scientific ideas, social and political ideas, and in other formats. This was already the case about 100 years ago, for in 1928, the information theorist Ralph V. R. Hartley published an article in which he proved that "the total amount of information that can be transmitted is proportional to the transmission frequency range and transmission time." Hartley's law eventually became one of the elements of *white noise.* Claude Shannon's (1948) theory of communication, formulated 20 years later in 1948, provided the following formula: (however the formula is about the size of information, not about its meaning):

$$I = - \text{Log}_2 \, p \, (\alpha)$$

where I –information; the negative sign indicates a reduction in entropy (chaos); p – the probability of event α

It follows from this information formula that if it is Monday today, the statement that tomorrow is Tuesday is not information because the probability of this statement p=1 means that…

$$I = - \text{Log}_2 \, 1 = 0 \text{ because } 2^0 = 1$$

In other words, that after Monday is Tuesday is not information because everyone knows it. In this way, we assume that information is one of the units of cognition that indicates a change in the situation, e.g., that the stock exchange has gone down by 10%.

To distinguish all the units of cognition, the Semantic Ladder will be used as a model that organizes cognition units from data to wisdom. This explanation of what information is (as a carrier of cognition)