such IN has its own characteristics. Here one should note that only a user can be the bearer of an IN, and a collective need can be considered only as the sum IN of a collection of users.

Thus, in concluding our discussion of IN, we should emphasize the importance of its further study, because the methods and forms of its satisfaction must take into account, as much as possible, the nature of its origination as well as its characteristic properties. In discussing IN, we have also made more precise the "product" of its satisfaction—that is, information. We have also made more precise the sense in which the concept of information will be used later in this chapter. However, in view of the importance of this concept, we shall present several additional explanations concerning it.

2.4 Information

The role of information in the life of an individual human being, as well as for society as a whole, is simply enormous. In our analysis of vital activity, we showed that information is one of the main resources for man's survival. It would seem then that there should be, if not complete, at least significant clarity about the notion of information. However, in reality this is not so. It is a fact that in recent decades, both in popular and in specialized literature, a great deal has been written about information. But the descriptions were often so contradictory that the combined efforts have succeeded in thoroughly confusing the reader. It cannot be said that we suffer from insufficient commentary and definitions of this concept. On the contrary, rarely has any concept had such a number of explanations. However, in science the following law often holds: the more points of view there are on a problem, the more unsuccessful one may be at understanding the situation.

We see our task not in formulating yet another, this time "correct" definition encompassing all sides of so multifaceted an object as information, but just the opposite. We want to show that, depending on the goals and the problems lying before investigators in various areas of knowledge, the use of the term "information" becomes so multidefined and contradictory that a single definition would be impossible to develop. In this present discussion we will narrow the application and utilization of the concept of information to the framework of information science, and we will describe its most significant characteristics and properties for a given area. Of course, this will not add clarity to the use of this concept in other areas.

In analyzing the concept of information, it is difficult to find any major description with which all investigators would agree. For example, some investigators consider information a material phenomenon, others an ideal one; some suggest that information can be only comprehended (that it is semantic, i.e., it has meaning, sense), others are sure that information cannot carry any meaning; some consider information as existing objectively, whereas for others it is subjective, some consider information to be a form of relationship between the user and the signal or signals, implying, consequently, that information does not exist without a user, others assert that information existed before the appearance of man and that it can exist by itself. In spite of the presence of diametrically opposed views, one should recognize that all are right. But are they right within the framework of the axiomatics, the initial concepts, the points of view, the goals and the problems, the areas of use for which they have chosen? This lack of a clear definition causes well-known difficulties, because today the term "information," used without any reservations or explanations, is in some cases the source of misunderstandings or an incorrect understanding of what has been said.

The term "information" comes from the Latin word *information,* and it traditionally denotes explanation, notification, or communication about some event or activity. This concept was closely connected with meaning and entailed its use. In the mid-20th century, mathematicians began to apply new meaning to the term "information" that differed from what this term meant in everyday life.

It should be said that mathematicians quite often resort to such crafty devices. In this way they are fundamentally distinguished, for example, from chemists. A chemist, after developing a new compound or preparation, immediately contrives a simple and clear name for it: for example, "metoxychlorodiethylaminomethylbutylaminoacridine" or "4-oxy-3-metoxy-benzaldehyde." For a chemist, 30 to 40 letters are usually sufficient for this.

The mathematician does not trouble himself by thinking up new terms. He takes a commonly known word and uses it at his whim. You probably would never guess that a field is what we call a ring, whose set of nonzero elements form a group with respect to the law induced by the multiplication defined on this ring. If after reconciling ourselves to this definition of a field, we want to know what the mathematicians mean by a ring in this connection, we will find that a ring is a set with the algebraic structure defined by two internal laws, the first of which is the law of a commutative group on this set, and the second law is associative and is doubly distributive with respect to the first.

Thus, the term "information" appeared with new meanings almost simultaneously in the work of Wiener (1961) and in the work of Shannon, a mathematician who worked at Bell Laboratory (Shannon & Weaver, 1959). Both works were originally published in 1948. Developing ideas of the general character of control in objects of any nature, Wiener extended the use of the term "information" by transferring it from humans only to animals in general and then machines in particular. The latter seemed especially important because it permitted an explanation, by the same mechanisms, of both the goal-oriented behavior of people and the goal-oriented behavior of machines. In other words, the new concept of information now included any controlling signals in any