Definitions.

The concept of empirical axiomatic theory is a formal representation of the "empirical content of data". This concept originates from the logic of empirical theories [Pzelecki, 1969; Samokhvalov, 1973; Zagoruiko, Samokhvalov, et al, 1978] and from the critical analysis of representative measurement theory [Krantz et al, 1971, 1989, 1990].

Definition. Empirical axiomatic theory is a set M of four components:

$$M = < Obs^V , V, W, S>, \text{ where}$$

Obs^V is a measurement procedure,

$V = \{P_1,\ldots,P_{n1}\}$ is a set of empirical predicates (we assume that the equality "=" belongs to V),

$W = \{Q_1,\ldots,Q_{n2}\}$ is a set of theoretical predicates, where the predicates from W are idealizations of the empirical predicates from V, and

S - is a set of axioms in the $V \cup W$.

The set of axioms S consists of axioms S^V, S^W for V and W and for mapping rules $S^{V \cup W}$. These rules may be derived from the domain knowledge of measurement procedure Obs^V and predicates from V. If there is no mapping rule between V and W, then actually there is theoretical knowledge and sets W, $S^W \cup S^{V \cup W}$ are empty. In this case, empirical axiomatic theory M consists of only three components:

$$M = < Obs^V, V, S^V>.$$

Measurement procedure, Obs^V, interprets the empirical predicates from V. If this procedure is applied to a set of objects $A = \{a_1,\ldots,a_m\}$ then a formal protocol pr^V of observations is produced. This protocol includes symbols for objects $a_1,\ldots,a_m$, symbols of predicates (from V), and possibly some other symbols. It is assumed that measurement procedure Obs^V can be applied to any set of objects A. It can be done by introducing a third truth value (not defined) for the predicates from V. Next, for simplicity of consideration, it is assumed that Obs^V produces only one protocol of observations for a given A. Hence, the procedure Obs^V defines a mapping from the set of objects A to protocols: $Obs^V(A) = pr^V$.

The set of all formulas in the set V, which is true for all protocols of observation $pr^V = Obs^V(A)$ is called empirical dependency.

We say that an empirical axiomatic theory has an empirical interpretation, if all parts of that theory are interpretable in the domain theory (background knowledge): measurement procedure Obs^V, protocol of observations pr^V, predicates from V and W, and axioms S.

The concept of empirical system can be defined in terms of empirical axiomatic system as a non-reducible model [Pfanzagl, 1971] of the set of axioms S^W. This means that the model does not merge objects, which are different for predicates from W.