The aims of this thesis are threefold: (1) to show to sociologists that formalization is useful, i.e., that a great deal of informal sociological conclusions are unsound; that formalization subsequently leads to improved sociological theories and to new results, provided that the theory's underlying ideas are 'good'; (2) to formalize the sociological theory "organizational ecology" (OE). OE is a collection of theory fragments, of which some are being formalized in first-order logic and others in mathematics; (3) to present heuristics and examples to sociologists who themselves want to formalize. As a side issue, some prejudices against formalization are debunked (in Ch.1).

Logical formalization proceeds iteratively along a number of steps, from a discursive theory to its formal representation. At each step, heuristics are presented (in Ch.1). Six steps are distinguished: (1) study of the discursive theory, (2) dictionary of important concepts, (3) core theory cast in informal premises and theorems, (4) semantics of the core theory, (5) formalization of the core theory, thereby applying an automated theorem-prover, and (6) evaluation of the formalization. This tentative formalization method has much in common with standard software engineering.

The target theory to be formalized is organizational ecology (OE). OE is a theory about 'Darwinian selection' in populations of social organizations (Ch.2). A population consists of organizations of a similar form. An example of such a form is automobile manufacturers. Individual organizations are seen as inert. According to OE, rational adaptation of organizations to their environment plays an insignificant role.

As an exception to many sociological theories that are less clear, OE's inertia fragment has 10 explicit assumptions and 5 explicit theorems, in natural language. These sentences have been formalized in first-order logic (see Ch.3). The theorems could not otherwise be derived. The relative clarity of this theory fragment made it possible to derive them after making small modifications to the assumptions. Adding a distinction between organizations under reorganization, and organizations in normal, reorganization-free conditions, has made the inertia fragment consistent. A couple of new theorems have been derived from the initial set of formalized sentences.

The niche fragment's conclusions should follow from a mathematical model. In this model, however, two dimensions have been confused by the authors. The model does not and can not support the conclusions. Neither can the argument in natural language. In order to repair the niche fragment, two strategies have been applied. (1) Making a 'reverse engineering' from the conclusions to find reasonable assumptions in OE that support them. This has been achieved by a formalization in first-order logic (Ch.4). (2) Repairing the mathematical model, which then makes different predictions than intended by the authors (Ch.5).

The density dependence fragment has been formalized by its author, as a class of mathematical models. The theorems contain typos and give room for counterexamples, as was found by other researchers. Furthermore, the definition of competition among organizations is not convincingly motivated (see Ch.6). With a new definition, the intended theorems follow. Moreover, the new definition, plus a couple of formalized assumptions from another theory fragment - resource partitioning - and an empirical generalization, make it possible to derive a number of new results that are sociologically relevant. These new results incorporate and substantially extend the claims in resource partitioning (Ch.6).

To conclude, in all formalized fragments of OE, all conclusions required modifications of the theory to derive them. These modifications consisted of making implicit information explicit, elucidating and relating basic concepts, fine-tuning assumptions, definitions and theorems, using assumptions from one fragment in another fragment, and developing mathematical models. Along the way, OE has been made more parsimonious, by discarding redundant concepts and assumptions, and by deriving some assumptions as theorems. Some fragments
have been generalized, and other fragments turned out to be more restricted than they appeared to be at first sight. Last but not least, a number of new propositions has been derived.

By sociological standards, OE is an advanced theory. Logical flaws, as discussed in this thesis, are certainly not characteristic for OE in particular, and can be found in many sociological theories, often in more severe forms. Sociologists appreciate logical criteria, but rarely, if at all, do they apply these criteria to their own theories. This thesis demonstrates that logical flaws can be found and repaired, and that thereby new insights can be gained. For this purpose a number of heuristics and examples have been provided. Other sociological theories, possibly in worse logical shape than OE, would possibly benefit even more from formalization.