Reasoning about uncertainty has been an active area of research for over 30 years. With the advent of networked systems, especially the Web, it became important to be able to combine uncertain information that comes from different sources. One of the hard problems in this area is combining evidence obtained from correlated, possibly conflicting, information sources.

This dissertation develops Belief Logic Programming (BLP), a novel form of quantitative logic programming that deals with uncertain and inconsistent information and is able to combine and correlate evidence obtained from non-independent information sources. BLP was inspired by Dempster-Shafer theory of evidence and belief combination functions. Our approach does not depend on a particular method of combining evidence and, in fact, different combination methods can be used simultaneously for different types of uncertain information. Most importantly, unlike previous efforts to integrate uncertainty and logic programming, BLP can correlate structural information contained in rules and provides more accurate estimates for certainty factors.

Together with declarative and fixpoint semantics for BLP, the dissertation develops optimized query evaluation algorithms. In addition, the monotonicity and non-monotonicity properties of BLP as well as the relationship to defeasible reasoning, paraconsistent reasoning, and Dempster-Shafer theory of evidence are discussed.

After developing the basic framework, the dissertation develops several extensions. One extension allows cyclic dependencies in BLP rules. Another extension captures quantitative correlation among the base facts. Since full correlation information might not always be available, we develop an approach that allows approximating correlation information using only partial information. Under certain conditions, this approximate method yields the same results as the method that is based on full information. The query evaluation algorithms are then extended to cover the enhancements.