

**COGNITIVE BUSINESS INTELLIGENCE
SYSTEM:
FRAMEWORK AND APPLICATIONS**

A THESIS
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ABSTRACT

This research proposes a Cognitive Business Intelligence framework which is a novel conceptualization of Business Intelligence. This framework can be used to develop systems which can make decisions that closely resemble human decision-making capability. The framework has been implemented (through Matlab programming) in real world decision scenarios in two different domains to demonstrate its capability.

Business intelligence (BI) refers to technologies, applications and practices for the collection, integration, storage, access, analysis, and presentation of business information to help users make better decisions. BI has become very popular and an important area of study among practitioners and researchers over the past two decades (Chen, Chiang, & Storey, 2012), and BI applications are dominating the technology priority lists of many Chief Information Officers (Wixom, Watson, & Werner, 2011). However, the traditional business intelligence systems are essentially decision support systems with enhanced reporting and visualization facilities (Chaudhuri, Dayal, & Narasayya, 2011). The future of the business intelligence industry lies in systems that can make decisions (Michalewicz, Schmidt, Michalewicz, & Chiriac, 2007). The adaptive BI system proposed by Michalewicz et al. (2007) is an attempt in this direction, but is wholly focused on rational decision-making style, which is just one of the decision-making styles followed by human beings. Rational decision-making is one which is “consciously analytic” (Simon, 1987). Most of the decisions taken by human beings in practice are rather intuition-based decisions. However, the traditional BI systems ignore this aspect.

Some of the unexplored questions in BI domain are: how to build a BI system that is based on the way human beings take decisions; is intelligence the only basis of human decision-making; which other factors are responsible for human decision-making; and how can they be included in a BI framework to build a system that can represent the capabilities of human decision-makers more closely? In this work, the literature on decision-making was studied to identify important factors that contribute to human decision-making. This led to the studies of how each of these factors (knowledge, intuition, intelligence, creativity and wisdom) has been conceptualized in literature and how they are inter-related. Based on these studies, a Cognitive Business Intelligence Framework (CBIF) has been proposed. A system based on CBIF can take business decisions in a way that closely resembles human decision-making. The potential application of this framework is then verified on two different business scenarios, one in the health care domain and the other in the finance domain.

The first application in the health care domain has been developed, and tested on part of the real data collected from a leading hospital in Kerala. It is related to cardiac surgery scheduling in a high-volume facility. The results show tangible benefits with the use of the proposed framework. It has been found that, on an average, the proposed system utilizes the operation theatres ten percent more than the present system. Due to this, the utilization of the

surgeon's available time also increased proportionally. Further, in this implementation, disruptions to the existing patient schedule were minimal. Also, this system accommodates requests of some patients for early dates of surgery.

The second application is a dynamic portfolio designer. The aim is to generate a portfolio with a subset of companies that are part of the NIFTY index, so that the portfolio outperforms the index. Results show that the portfolio generated by the system outperforms the NIFTY index consistently. While accomplishing this, the proportion invested in stocks with beta values greater than 1 was in the range 30% to 40% only. Further, Sharpe ratio computations show that even after adjusting for total risk, the portfolio performs better than the index.

The limitations of the study and the future work planned are also discussed.

In addition to contributing a novel framework to the literature, we have verified the applicability of this framework in two completely different domains. The approach used and the findings have practical relevance and will be helpful to decision-makers in different domains.