

# Intelligent modeling of e-business maturity

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## Abstract

E-business has a significant impact on managers and academics. Despite the rhetoric surrounding e-business strategy formulation mechanisms, which support reasoning of the effect of strategic change activities to the maturity of the e-business models, are still emerging. This paper describes an attempt to build and operate such a reasoning mechanism as a novel supplement to e-business strategy formulation exercises. This new approach proposes the utilization of the fuzzy causal characteristics of Fuzzy Cognitive Maps (FCMs) as the underlying methodology in order to generate a hierarchical and dynamic network of interconnected maturity indicators. By using FCMs, this research aims at simulating complex strategic models with imprecise relationships while quantifying the impact of strategic changes to the overall e-business efficiency. This research establishes generic adaptive domains – maps in order to implement the integration of hierarchical FCMs into e-business strategy formulation activities. Finally, this paper discusses experiments with the proposed mechanism and comments on its usability.

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## 1. Introduction

Today, there is an increasing demand for a strategic-level assessment of e-business capabilities that can be assembled and analyzed rapidly at low cost and without significant intrusion into the subject enterprises. The benefits from completing such an exercise are quite straightforward, for instance, identification of significant strengths and weaknesses, establishment of a rationale for action, a reference point for measuring future progress, etc.

This paper proposes a novel supplement to strategic-level maturity assessment methodologies based on fuzzy cognitive maps (FCMs). This decision aid mechanism proposes a new approach to supplement the current status analysis and objectives composition phases of typical e-business strategy formulation projects, by supporting “intelligent” modeling of e-business maturity and “intelligent” reasoning of the anticipated impact of e-business

strategic change initiatives. The proposed mechanism utilizes the fuzzy causal characteristics of FCMs as a new modeling technique to develop a causal representation of dynamic e-business maturity domains. This research proposes a holistic set of adaptive domains in order to generate a hierarchical network of interconnected e-business maturity indicators. The proposed mechanism aims at simulating the operational efficiency of complex hierarchical strategy models with imprecise relationships while quantifying the impact of strategic alignment to the overall e-business efficiency. Also, this paper proposes an updated FCM algorithm to model effectively the hierarchical and distributed nature of e-business maturity.

This application of FCMs in modeling the maturity of e-business is considered to be novel. Moreover, it is the belief of this paper that the fuzzy reasoning capabilities enhance considerably the usefulness of the proposed mechanism while reducing the effort to identify precise maturity measurements. The proposed model has both theoretical and practical benefits. Given the demand for effective strategic positioning of e-business initiatives, such a succinct mechanism of conveying the essential dynamics of

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e-business fundamental principles is believed to be useful for anyone contemplating or undertaking an e-business strategy formulation exercise. Primarily, the proposed model targets the principle beneficiaries and stakeholders of strategy formulation projects (enterprise top administration, strategic decision makers, internal auditors, etc) assisting them to reason effectively about the status of e-business maturity metrics, given the (actual or hypothetical) implementation of a set of strategic changes. Nevertheless, the explanatory nature of the mechanism can prove to be useful in a wider educational setting.

This paper consists of five sections. Section 2 presents a short literature overview, Section 3 presents an overview of the FCM based system, while Section 4 discusses the new approach to e-business maturity modeling based on FCMs. Finally, Section 5 concludes this paper and briefly discusses future research activities.

## 2. Literature overview

### 2.1. E-business drivers

E-business offers promise to apply web and other electronic channel technologies to enable fully the integration of end-to-end processes. It involves both core and support business aspects, it focuses on information sharing efficiency, not just financial transactions. E-business primary objective is business improvement through:

- Deployment of new technologies in the value chain.
- Connection of the value chains between enterprises (B2B) and between enterprises and consumers (B2C) in order to improve service, exploit alternative distribution/communication channels and support cost reduction due to the associated value chain optimization.
- Increase of the speed of information processing (mainly at real-time) and responsiveness by utilizing common information sources (both external and internal).

E-business has a significant impact on every business function. Integrated information technology causes a shift in the value chain of the enterprise. It causes a considerable deflation of prices due to radical cost reductions, annihilation of profit margins, disintermediation of companies and industries due to the transparent product/service delivery to the end customer, increase in cross selling volumes and so forth. On the other hand, no industry is immune to intense competition due to chain reactions that affect all electronic network partners (Palmer, 2002). This may cause a higher level of uncertainty of future business prospects, but it is only fair to say that adaptive risk management may reduce such pitfalls. Also, the current enterprise valuation can be radical altered by this new business environment therefore enterprises must reconsider their core competencies and strategies to maintain their competitive advantages.

The new economy associated with e-business has broken down many of the traditional barriers. The fundamental shift in focus from optimizing the efficiency of individual enterprises to optimizing the efficiency of a network of enterprises for competitive advantage is a considerable challenge (Chung, Yam, Chan, & Potter, 2005). E-business activities now operate across an extended network of digitally connected partners to enable demand/capacity/price optimizations while offering self-service client relationships at multiple channels with a significant communication speed.

It is the view of this paper that while e-business solution providers promise financial prosperity and sales volumes, case studies clearly indicate that awareness, targeted strategic planning and holistic organizational alignment are the key success factors for managing business in the digital age. Understanding the speed and scope of e-business impacts while generating the essential momentum forms the basis for setting realistic strategic priorities, mapping out a go-forward plan while evaluating the critical factors for e-business success. Effective service/product delivery through electronic channels requires efficient process control and management of measurable targets, in order to maintain the necessary range of organizational buy-in, to manage risk and assure accountability.

### 2.2. Relevant research in business modeling

#### 2.2.1. Modeling traditional business activities

Enterprises usually employ modeling techniques to drive re-design activities and communicate the impact of internal change. Such modeling techniques may loosely fit within the area of decision support systems (Carlsson & Turban, 2002; Shim et al., 2002; Sprague & Watson, 1986). Several modeling approaches can be brought to bear on the task of supplementing business modeling activities. In particular the field of knowledge-based systems (Harmon & King, 1985; Metaxiotis, Psarras, & Samouilidis, 2003) could fulfill the desire for more accurate predictive business modeling tools. The research presented by Lin, Yang, and Pai (2002) proposed generic structures with no formal reasoning capabilities to model traditional business processes, which could represent a business process in various concerns and multiple layers of abstraction.

The research presented by Burgess (1998) modeled business process models with system dynamics to support the feasibility stage of business process re-engineering (BPR). Similarly, research (Burgess, 1998) modeled the interaction between competitive capabilities of quality and cost during total quality management (TQM) initiatives (Burgess, 1996). This model did not decompose hierarchical relationships, nor did it allow the connection of the sub-models. Finally, the model required formal definition of causal relationships (e.g. functions), which posed a significant overhead in supplementing the business modeling exercise. The research presented by Crowe, Fong, Bauman, and Zayas-Castro (2002) reported the development of a tool

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