Guest Editor’s Introduction

Intelligent E-Business: From Technology to Value

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E-business is the point where economic value creation and information technology come together. The Internet and the World Wide Web in particular have emerged as major driving forces in changing our economy. Business executives are now aware that information technology is a key strategic factor in industry, not just a tool to increase business-as-usual efficiency. This has happened over just a few years, but most of Internet business’s socioeconomic impact likely lies ahead.

These developments have led to the quick growth of scientific interest and activities related to e-business. Given these developments’ pace and depth, big challenges and opportunities exist for applying intelligent systems technology and methodology. In fact, e-business has several distinct characteristics that make investigating the deployment of intelligent systems technology highly attractive:

- **Connectivity.** Global connectivity of businesses and customers reduces old barriers in space and time and enables many new value constellations—networks of enterprises that work together for the same economic goal—that are much richer in form than the traditional (linear) value chain (see, for example, the recent debate in the *Harvard Business Review*).3
- **Interactivity.** A natural next step is that the customer and supplier can carry out e-business through real-time interaction. This enables a variety of new interactive business models.
- **Context.** Both connectivity and interactivity give rise to significant complexities. In e-business, widespread distribution and heterogeneity are the norm rather than the exception. So, we truly need information systems that can sense, understand, and act in the specific context in which e-business actors work.

Intelligent systems promise better interoperability of humans, systems, and agents in e-business, by helping to handle large-scale connectivity and interactivity on the Internet and Web in a context-sensitive way. One example is ontology and Semantic Web technology that undertakes to understand user context and share associated consensus knowledge through semantic methods. Several *IEEE Intelligent Systems* special issues have recently reported on advances in this field.

The logics of value

For intelligent systems research in e-business to have real impact, we need to cross the existing borders between computer science and economic and management sciences. Truly interdisciplinary progress in science appears difficult to achieve because of the traditional decomposition into disciplines, which can turn different academic fields into almost separate cultures. Nevertheless, the contributors to this special issue on intelligent e-business hope to show how interdisciplinary thinking has helped to advance e-business.

E-business implies that information technology must prove itself in an interactive and distributed context of economic value creation. Technology push and market pull both play their role in driving e-business forward. So, you could say that three different logics of value determine an e-business’s success (see Figure 1):

- **Techno-logic** refers to whether the technology an e-business needs suffices in terms of functionality and commercial availability and to whether the enterprise has the required corporate technology competencies.
• Market logic asks whether you can expect customers to be interested and willing to pay for an e-business offering. Additionally, an e-business is often innovative and therefore requires changes in customer behavior—and it is well known that adoption of innovations presents barriers to customer acceptance. ③
• Business logic considers the different roles of the various enterprises (suppliers and intermediaries) that together define the production and delivery chain’s setup. You can break down the traditional industry value chain and reconfigure it in many networked ways—one of the new degrees of freedom in designing e-business—reducing economic transaction costs.

Although these three logics concern clearly separate issues, they must work together and be aligned for e-business to succeed. Many dotcoms and Internet businesses have learned these lessons the hard way. We must holistically assess information systems (intelligent or not) with respect to Figure 1’s different techno–market–business logic dimensions.

Interactive digital strategies

The Internet and Web enable new business forms that exploit greater levels of interactivity for both customers and suppliers, increasing the opportunities for intelligent systems in e-business. Interactivity can (techno-logically) help unite the business and market logics. So, customers can become more directly and actively involved in value production. Different value development processes ensue, however, depending on the customer or supplier’s level of interactive input. ⑤ Figure 2 depicts these interactive value processes:

• Value adding offers linear combinations of product or service components to sell larger product bundles.
• Value extracting increases a given product’s cost efficiency at a given price (known in industry as value engineering) through computerization or shifting labor to the customer.
• Value capturing exploits existing customer and sales data for improving marketing precision, personalization of offers, and so on.
• Value creating aims for network or community effects (beyond linear addition) by combining knowledge, labor, creativity, and connectivity between the customer and supplier.

The distributive dimension (value adding and extracting) denotes how the production effort is split between supplier and customer, while the generative dimension (value capturing and creating) indicates the output increase due to combined interactivity—in other words, sharing versus baking the value pie.

This framework helps put new technological capabilities into a sharper economic-value perspective. However, the old economic-value principles are still valid, and you can easily find examples of all four value development processes in the old economy. But the Internet and Web do provide novel means for higher two-way or community interaction and involvement; for reducing the barriers of time, space, connectivity, and individual context; and thus for moving toward value generation. Consequently, we must consider business and customer involvement on a more equal footing. This is a new economic phenomenon that the technology of online interactivity directly causes.

This framework that ties together the business and market logics also yields a characterization of digital strategies based on different degrees of interactive input by both the enterprise and customer (see Table 1). (See Don Tapscott and his colleagues’ work for an alternative business writer’s perspective on interactive digital strategies. ⑥) This helps us understand and position the very different strategic roles and functions of varying intelligent systems technologies—including semantic information search, ontology-based product content management, shopbots, data mining, intelligent partnering agents, trading agents and online market design, and knowledge-based groupware supporting virtual communities. The articles in this special issue address some of these subjects.

In this issue

In this issue, we explore various types of intelligent e-business systems and their associated interactive digital strategies and offer several cross-sections through the techno-market-business space, as depicted in Figure 1.
In “Designing and Evaluating E-Business Models,” Jaap Gordijn and Hans Akkermans present ontology-based graphical and scenario methods to analyze e-business models. For e-business, a business model shows why and how value is created, exchanged, and consumed in a network of actors. The study outlines how you can qualitatively and quantitatively tackle strategic partnering issues in innovative value constellations. (An interesting resource on a wide variety of e-business models is North Carolina State University’s Web site, Business Models on the Web, http://ecommerce.ncsu.edu/business_models.html.)

In “Extending Equilibrium Markets,” Per Carlsson, Fredrik Ygge, and Arne Andersson discuss e-market design based on the general equilibrium theory of economics. They extend this theory by showing how you can handle irregularities and discontinuities in supply and demand curves in very large marketplaces. An intriguing feature of their market algorithm is that it handles irregularities by using the market’s large size and complexity to its advantage instead of seeing it as a drawback. On an interdisciplinary note, this approach resembles how fluctuations in quantum mechanics average out in large-scale systems to yield conceptually and computationally much simpler classical models. As an industrial application, the authors study deregulated power markets that naturally show large price fluctuations as well as irregular demand curves on short time scales.

In “Matching Buyers and Suppliers: An Intelligent Dynamic-Exchange Mode,” Sung Ho Ha and Sang Chan Park discuss automated supplier selection in B2B marketplaces. If e-market businesses break up the conventional supply chain, finding the right partner becomes an issue. The authors offer a solution featuring intelligent partnering agents capable of multi-criteria decision-making.

In “A Multiagent Framework for Automated Online Bargaining,” Fu-ren Lin and Kuang-ying Chang consider adaptive bidding by learning from business-to-consumer marketplaces. They show how intelligent agents can improve the bargaining process by learning online from experiences in previous negotiation rounds and generalizing associated patterns.

In “Do What I Mean: Online Shopping with a Natural Language Search Agent,” Barry Silverman, Mintu Bachmann, and Khaled Al-Akkar demonstrate how natural language query agents improve meaning understanding and precision in e-catalog search engines for online shopping. The proposed solution has operated continuously since late 2000, and the article presents experimental results on the natural language agents’ timing and effectiveness in their search for the right product.

In “Product Data Integration in B2B E-Commerce,” Dieter Fensel, Ying Ding, Ellen Schulten, Borys Omelayenko, Guy Botquin, Mike Brown, and Alan Flett survey research issues that result from the heterogeneous information descriptions of products, e-catalogs, and e-business documents. Achieving interoperability is a key issue in e-business content management that calls for the kind of intelligent solutions the Semantic Web hopes to provide.

Finally, in “The E-Commerce Product Classification Challenge” (see p. 86), Ellen Schulten, Hans Akkermans, Nicola Guarino, Guy Botquin, Nelson Lopes, Martin Dörr, and Norman Sadeh launch a contest that invites research groups to show how to semiautomatically map a given product description between different e-commerce product classification standards. Other articles in this special issue and in previous Intelligent Systems issues (for example, see Trends and Controversies) discuss related research work. I hope that a contest-like research challenge provides an attractive forum to discuss different intelligent solutions for the same real-life e-commerce problem. After all, intelligent e-business quite simply means confronting the research, business, and technology challenges of today for the benefit of value creation tomorrow.

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References