The Retail Food Industry Center
Advancing Knowledge About Processing, Distribution, Sales, and Food Service

Working Paper 99-06
The Retail Food Industry Center
University of Minnesota
Printed Copy $22.50

Design and Delivery of Electronic Services: Implications for Customer Value in Electronic Food Retailing

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August 1999

Gregory Heim is a doctoral candidate and Kingshuk Sinha, the corresponding author, is an associate professor in the Operations and Management Science Department. The study was supported by a grant from the Alfred P. Sloan Foundation by way of The Retail Food Industry Center, University of Minnesota, 317 Classroom Office Building, 1994 Buford Avenue, St. Paul, Minnesota 55108-6040, USA. The work also was supported by a Grant-in-Aid of Research from the University of Minnesota. An earlier version of the paper was presented at a workshop on the Information Technology/Operations Interface at the University of Florida at Gainesville (February 25-27, 1999) and has benefited from the comments of the workshop participants. The authors acknowledge Chuck Anderson, Joy M. Field, James A. Fitzsimmons, Michael J. Houston, Akshay R. Rao, David L. Reinders, Roger G. Schroeder, and Paul Wolfson for their assistance, comments on earlier versions of the paper, or both.

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Abstract

Electronic food retailers can satisfy their customers more effectively if they understand how this particular market works. As in other service segments, the emergence of electronic business-to-customer services in the retail food industry poses questions for managers about the design of new food retailing services and the redesign of existing services for delivery through electronic channels. Important topics include characteristics of electronic service offerings, the typical operational configurations used to deliver electronic services, and the ways in which they relate to the effectiveness of electronic service delivery. We address this issue by developing a product-process matrix for understanding and analyzing electronic retailing services in general. We tailor the matrix to food retailing in particular. The product-process matrix allows electronic food retailers to determine in advance what features they need in a web site to serve their chosen market effectively.

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Design and Delivery of Electronic Services: Implications for Customer Value in Electronic Food Retailing

FIGURES

Design and Delivery of Electronic Services: Implications for Customer Value in Electronic Food Retailing

1. Introduction

This paper presents a framework for matching electronic services in food retailing to a targeted market. The framework is a product-process matrix, which focuses on a few key characteristics to organize the broad range of electronic services available and the different types of markets in electronic food retailing. The matrix is useful for predicting which service offerings will work well and which will not, and can help determine what type of web site is appropriate for a particular product and type of consumer.

At one end of the market spectrum is the niche market, one in which there is low demand for a small number of services. Niche markets both require and can only support a fairly simple web site. Retailers in niche markets with appropriate web sites include the pickup grocery service Eatwell Farm (http://www.eatwell.com), and SureSave (http://www.suresave.com), which sells customized deli trays. At the other end of the range, are complex mass markets, and customized markets with idiosyncratic consumers. Retailers in these markets require more complicated service offerings. Peapod®, the online grocery service has a very complex web site, (http://www.peapod.com/)™ which includes proprietary software and links to its grocery chain allies. Mrs. Fields® Original Cookies (http://www.mrsfields.com) uses a dynamic system of pages to sell hundreds of varieties of cookies to a national market. While these implications of the product-process matrix seem obvious once stated, the offerings to be found on the World Wide Web suggest that they are not.

Electronic commerce – defined as the electronic exchange of information, goods, services, and payments – used to be the preserve of large companies that could afford to build or lease the necessary

proprietary networks (Harrington and Reed, 1996).[1] Early applications of electronic commerce were largely limited to business-to-business services such as electronic data interchange and electronic funds transfer, and typically required mainframe computer systems, complex and purpose-specific software, and massive systems integration. Declining costs, ongoing advances, and convergence of digital technologies have led to the widespread penetration of such technologies into workplaces and homes (Bane, Bradley, and Collis 1998; *Time* July 20, 1998). Hence, it is becoming increasingly possible for firms to deliver services electronically to an individual customer anywhere and at any time (Collis, Bane, and Bradley 1997). This new and emerging class of service operations, namely electronic *business-to-customer* service operations, is the subject of our paper.

While the emergence of electronic services presents firms with unprecedented opportunities to create value for customers, it also presents new possibilities to fail (Biro, 1998; Hagel and Armstrong 1997; Harrington and Reed 1996; Yoffie 1997). The novelty of this emerging class of technology intensive services has created the need for developing "a paradigm for the field of service operations management that allows us to capture the technological dimensions of 21st century services" (Chase 1996, p. 305). This paper is a step toward addressing that need. Our premise is that understanding the complex and dynamic interrelationships between electronic service products and their underlying process technologies is key to managing electronic service operations effectively. In this paper, we analyze electronic food retailing services using a product-process matrix for electronic service operations. Because electronic food retailers are designing new operational models of food retailing and offering a variety of unique foods and services not typically available through traditional food retailers, the design and delivery of electronic services in food retailing is especially interesting. We demonstrate

[1] For a thorough discussion on electronic commerce, see Kalakota and Whinston (1996, 1997), and Tapscott(1996).

the application of the matrix by deriving propositions pertaining to the delivery of customer value through electronic food retailing services.

Our motivation for developing this product-process matrix is to provide a conceptual framework for examining the different types of electronic service products and process technologies, the interrelationships between these products and processes, and their implications for the delivery of customer value. Conceptual frameworks are fundamental to theory building (Doty and Glick 1994; Swamidass 1991). Product-process matrices have proven to be useful for both research and practice because of their descriptive and prescriptive abilities (Hayes and Wheelwright 1984; Kotha and Orne 1989). Here, we demonstrate the application of the product-process matrix to position electronic food retailing services with reference to characteristics of electronic service products and electronic service process technology. From a prescriptive standpoint, the matrix is the basis for propositions that begin with the position of particular electronic food retailing services in the matrix, and end by showing the effect on customer value.

The remainder of this paper is organized as follows. Section 2 reviews the literature on service design and development, and presents dimensions that differentiate between electronic and traditional service products and processes. Section 3 describes characteristics of food retailing and recent changes in the food industry that make electronic food retailing an appropriate context for this research. Section 4 develops the electronic service product structure and Section 5 develops the electronic service process structure. The product-process matrix and the motivation for examining the delivery of customer value through electronic services are discussed in Section 6, and Section 7 demonstrates the application of the product-process matrix to derive four propositions on customer value. Section 8 contains concluding remarks.

2. Electronic Vs. Traditional Services: Some Background

The development of a product-process matrix requires the conceptualization of its two building blocks: the product structure and the process structure (Hayes and Wheelwright 1984). Thus, to develop a product-process matrix for electronic food retailing service operations, we must conceptualize the electronic service product structure and the electronic service process structure. Beyond a small number of articles and case studies, the literature on service management sheds little light on dimensions that distinguish between electronic services. Advances in service technology have begun to motivate investigations into issues related to electronic service design, but this literature has tended to examine individual services rather than differentiate between groups of service operations. For example, Iansiti and MacCormack (1998) have examined the accelerated product and service design cycles in leading Internet firms, and case studies by Gerace et al. (1996) and Rangan and Bell (1998) have examined the electronic service design and delivery decisions made by Virtual Vineyards and Dell Computers, respectively. In the sub-sections to follow, we will identify dimensions of service products and processes, and then discuss the potential insights that can be gained from using these dimensions to differentiate between electronic services.

2.1 Service Product Dimensions

We first consider the usefulness of generic dimensions that differentiate services from goods. Service products possess characteristics of intangibility, heterogeneity, and inseparability of production and consumption. *Intangibility* exists because services have no physical shape, which makes it difficult to count, measure, inventory, test, or fully describe the services. *Heterogeneity* results from variability in service system performance due to differences in delivery expectations and techniques of delivery.

Inseparability of services describes the interface of sales, delivery and consumption. Goods are produced and inventoried for later sale and consumption, but services are characterized by simultaneous marketing, sale, delivery, and consumption.

Although electronic services can include entirely new service transactions they can also share many of the characteristics of traditional services. Electronic services are intangible because the service transactions and experiences delivered via electronic channels are difficult to measure, inventory, or describe fully. Service heterogeneity in electronic services stems from differences in provider technologies, service staff capabilities, and delivery expectations. Customers also contribute to electronic service heterogeneity because of their differing needs, self-service capabilities, willingness to interact, expectations and perceptions. Heterogeneity in electronic services also results from the performance of technology connecting the customer to the service delivery system. Finally, electronic services are inseparable because they have to be marketed, sold, delivered, and consumed simultaneously. Because intangibility, heterogeneity, and inseparability appear to be generic properties of electronic services, they do not differentiate well between such services.

While many dimensions have been proposed for traditional services, very little if any research has been conducted to identify dimensions that differentiate between electronic services. Cook, Goh, and Chung (1998) present a comprehensive review of the dimensions of traditional services. One dimension that might be adapted to electronic services is service quality. In examining traditional services, researchers created multidimensional constructs such as service quality (Parasuraman et al. 1985) and core and auxiliary elements of service quality (Lapierre 1996; Lovelock 1995) that could be used to describe and differentiate between traditional services. Electronic services also have core and auxiliary dimensions, which may occur as online offerings, such as multi-player gaming services, and

offline offerings, as with electronic travel services that hand deliver paper tickets and itineraries. However, while existing constructs of core and auxiliary service quality differentiate between traditional person-to-person services, they do not necessarily distinguish between electronic services, or span previously unconsidered dimensions of electronic services.

2.2 Service Process Dimensions

A variety of dimensions can be found in the literature along which service processes have been characterized. Service processes include front office processes involving direct interaction with customers and back office processes with which customers have little contact. Chase (1978) characterized service operations according to their level of customer contact. Extending Chase (1978), Maister and Lovelock (1982) characterized service operations by the extent of contact and extent of customization. Schmenner (1986) used the criteria of the degree of labor intensity, and degree of interaction and customization, Shostack (1987) used the degree of complexity of the service delivery structure and the degree of divergence that is allowed during a service step. Haywood-Farmer (1988) extended this work to characterize services according to degree of contact and interaction, degree of labor intensity, and degree of labor customization. Goodwin and Radford (1993) presented a framework derived from customer scripts that focuses on customer participation in the service delivery, and the provider's ability to control the customer's entry into the service delivery process. Kellogg and Nie (1995) differentiated between different stages of the service process using the construct of customer influence on the service process, which encompasses customer contact and interaction.

Electronic services differ in the extent to which customer contact, customization, interaction, and labor intensity can be used to differentiate between operations. The service offerings consist of online

interactive service dimensions and offline non-interactive service dimensions. The online dimensions involve continuous customer contact with the service system and offline elements involve little customer contact. As electronic services incorporate online elements, customer contact loses its power to differentiate because purely electronic services in any industry can only be delivered if the customer maintains contact with the service system. However, since customer contact can include varying levels of interaction, the level of *interaction* can differentiate between electronic services.

Similarly, the dimension of *customization* can be enriched to differentiate between electronic service operations. Electronic service customization takes place during online customer interactions and through offline back-office processes separated from the customer. The service staff can achieve *online customization* through the use of technologies such as videoconferencing systems, and by connecting customizable technologies directly to online service operations. The service staff and technology can also perform many customizable tasks within back office service operations that lead to *offline* customization. Note that in terms of competitive capabilities of operations, the process dimension of flexibility facilitates the delivery of interaction or customization.

3. Food Retailing: An Overview

Several factors which underly the growth in number and type of electronic food retailing services make it an unusually interesting industry for analysis. First, aggregate revenue in the industry is large enough to motivate companies to switch customers from one service channel to another. Emerging electronic services are not expected to increase total consumer expenditures (Peterson, et al. 1997). Instead, they will grow by convincing customers to substitute consumption of electronic services for their

previous mode of consumption of personal services. Second, electronic food retailers span the full breadth of electronic retail services. Electronic food retailers exhibit service product characteristics that represent the theoretical dimensions along which electronic services can be differentiated. They also use all types of process technologies that appear in electronic retail services. Because of the existence of so many electronic food retailers that satisfy these conditions, electronic food retailing also can fulfill statistical requirements for subsequent observational studies. We discuss each of these issues below, as they relate to electronic food retailing.

3.1 Electronic Food Retailing: Substitution Incentives for Suppliers

The difference in food expenditures between traditional grocery store and electronic food retailing segments is a significant incentive for electronic food retailers to attempt to switch customers from the one to the other. Food retailing makes up a significant proportion of consumer household expenditures. American consumers spent 10.9 percent of their disposable income on average on food for consumption both at home and away (Donegan, 1998a). Overall, grocery sales in the United States in 1997 accounted for $436.3 billion in revenues (Donegan, 1998a). In contrast, electronic food retailing in 1998 was estimated to make up only $270 million in revenue (*Time*, 1998).

The many changes in recent years that have affected traditional food stores, the food supply chain and customers provide additional incentives for companies to sell to their customers via electronic food retailing services. For existing retail stores, industry changes in scale and scope have negatively affected smaller grocers and lesser-known food brands. Grocers have tended to replace their traditional stores with bigger stores focused on large volume and low prices, and with specialized stores concentrating on market niches (Heikkilä et al. 1998, Kinsey and Senauer, 1996). Traditional grocery

stores also have lost sales to specialized categories of stores such as merchandise discounters, category killers, and super center stores (Kinsey and Senauer, 1996). Overall, these competitive battles have been fought within a channel that has been decreasing in size over time. Stores that sell raw food items to be prepared at home have watched their share of total consumer food expenditures decline over time (Donegan, 1998a).

The food industry's efforts to streamline food distribution throughout the food supply chain had additional negative effects on certain food segments. The streamlining initiative, called Efficient Consumer Response (ECR), changes the movement of food products in the retail food supply chain from a push system to a pull system in a manner similar to just-in-time (JIT) manufacturing. ECR uses barcodes to scan and collect customer purchase data, which can be used in factory scheduling, and in category management to rationalize the variety of products in a store. The information technology that is required improves information flows between different supply chain parties and creates a smoother flow of products and paperless information within the food supply chain. ECR also refocuses supply chain performance from traditional volume measures to measures of customer satisfaction, cycle times, yield, reliability, and financial measures based on return on assets (Kinsey and Senauer, 1996). The cooperation between manufacturers and distributors adopting ECR has improved some areas of the food supply chain. However, ECR also increased consolidation and competition for shelf space, which in turn has led to a growing mistrust between manufacturers and distributors. Similar concentration changes in Finland led wholesalers to limit the access of upstream producers to the consumer market (Heikkilä et al. 1998). Distrust and changes in food supply chain bargaining power create incentives for food manufacturers to shift their selling efforts to alternative trade channels outside of traditional grocery stores (Mathews, 1998).

Finally, changes in consumer food consumption preferences and practices have led to the substitution of prepared foods for groceries. Consumers today increasingly want food in a ready-to-eat format, and want it to be healthful, nutritious, and in great variety (Kinsey and Senauer, 1996). They show no signs of caring whether they buy these foods in traditional grocery stores or via alternative channels, as alternative food retailing channel expenditures have recently grown much faster than traditional grocery service expenditures (Mathews, 1998). Consumers also have increased spending devoted to food prepared away from home (Donegan, 1998a). This movement of demand toward prepared foods has led traditional food retailers to broaden their operations, which in the past concentrated on food inventory management, in order to become purveyors of fully prepared meals called "home meal replacement" or "home ready meals" (Donegan, 1998b; Kinsey and Senauer, 1996). The consequent decline in revenues further encourage traditional grocers into electronic food retailing.

3.2 Electronic Food Retailing: Complementarity Incentives for Customers

Food plays many roles in individual and social life. These roles create complementary foods and service elements exploitable by food retailers to develop unique service operations. For example, Peter Granoff of Virtual Vineyards stated:

> "Wine and food … are about farming, and they provide a bridge from those wild places to finer things, like art and culture. Then, of course, wine and food are about pleasure, so they appeal to the senses and the intellect. Additionally, the learning curve is steep in these fields. The more you learn, the more you need to know. Perhaps most importantly, though, wine and food are the vehicles for the coming together of family, friends, and loved ones." (Peter Granoff of Virtual Vineyards, in Gerace et al., 1996)

Food retailing services can satisfy customers along each of these dimensions. They can involve goods, services and service experiences, as well as information about the relationship of each of these items to

sensual and intellectual characteristics of food preparation and consumption. The goods can include perishables, semi-perishables, non-perishables and non-food goods, each of which in turn can be packaged along with other goods, services and service experiences inside and outside of the food industry to fulfill customer objectives. Because of such a potentially broad offering of goods and service elements, the overall food retailing process can be more "bundle based" (Heikkilä et al. 1998) than for other types of retailing services typically involved in the sale of single goods having few immediate complementary elements.

Shopping can also be designed to incorporate complementary processes. A simple conceptualization of the food retailing process involves search, purchase and customization processes for food items. Front office food retailing processes help the customer choose and pay for a basket of food items, and back office service processes manufacture ready to eat and customized foods and assemble baskets of packaged foods chosen by the customer. However, grocery services have increasingly included complementary non-food services. Traditional retailers have recognized synergies between food shopping and other tasks and have enhanced their operations by integrating complementary services such as photo development, dry cleaning and banking.

Electronic food retailing services can deliver service elements offered by grocery stores, as well as complementary service elements offered by electronic services in most any information intensive industries. When purchasing food for a meal planned at a certain time and place, the customer is confronted with a complex, dynamically changing environment of product information and availability, which forces customers continuously to reconsider the purchase opportunities. In contrast to a physical search in the traditional grocery store, electronic services can use information technology to help control the complexity of the customer's shopping experience at a time and place. Electronic food retailers can

offer many potential service offerings, from replenishment processes and recipes linked to purchase transactions, to offerings that fulfill needs for the pleasure-seeking, sensuality, heritage, traditions, rituals, art, culture, and learning that often are associated with food (Gerace, et al., 1996), to complementary services such as banking and entertainment.

4. Electronic Service Product Structure

A product-process matrix needs two building blocks: a product structure and a process structure. To apply the product-process matrix for electronic services to food retailing, we will first look at the electronic service *product* structure and then at the electronic service *process* structure.

Figure 1 is a 2x2 matrix that identifies electronic service products by their service content – either static or dynamic, and their target market segment – either unique or broad. The resulting four cells of the 2x2 matrix correspond to *niche market*, *market extender*, *mass market*, and *customized market* service products. The dimensions along which electronic service products within each of the four cells of the matrix differ are scale and scope of the services, mix and content of online and offline customization, and the nature of joint branding.

4.1 Niche Market Electronic Services

Niche market electronic service products are typically targeted at a local or niche market where low demand exists for a small number of services. In niche market services, static online elements tend to be packaged with offline customization. From a service provider's perspective, customized online services are expensive to design and deliver, making them less likely to be offered in niche market services.

While niche market services involve limited online dimensions, the customer may demand offline customization to enrich the service experience.

Figure 1. Electronic Service Product Structure Categories

	Electronic Service Content	
Market Segment	**Static**	**Dynamic**
Unique	***Niche Market*** One or a Few Services Low Demand Low Online Customization High Offline Customization No Joint Branding	***Customized Market*** Many Services High Demand High Online Customization Low Offline Customization High Joint Branding
Broad	***Market Extenders*** Several Services Low/Medium Demand Medium Online Customization Medium Offline Customization Low Joint Branding	***Mass Market*** Many Services Medium/High Demand Medium/High Online Customization Low Offline Customization Medium Joint Branding

Food retailers that sell a few unique goods or services can target the niche market electronic service category. Examples of these firms include Alaska Choice Seafoods, Bella Café Company, Big Bang Cereal and 3 Cousins. Alaska Choice Seafoods (http://www.alaskanet.com/Shopping/Anchorage/index.html) offers a gift pack of its salmon products. Its service system uses six static pages that contain product descriptions and nutritional information, and static order forms. Bella Café Company (http://home.earthlink.net/~bellacafe) uses 17 static pages to sell its instant espresso beverage, but customers must order offline. Their service system mainly serves as a

static repository of recipes that describe how one can use their product. Big Bang Cereal (http://www.odyssee.net/~bigbang) uses 16 static pages, translated into French and English, to sell its food supplement cereal in Canada and the United States. 3 Cousins (http://www.profitpages.com/Bubbas-Pickles) uses two static order form pages to sell Bubba's Old Country Style Garlic Pickles.

Other examples of niche market services in electronic food retailing involve offline customization for niche and local markets. Small organic farmers, for example, can target their produce at local customers. Eatwell Farm (http://www.eatwell.com/) is a pick-up grocery service that fills orders placed by customers using the Internet. The online dimensions of Eatwell's service include ordering subscriptions for delivery of customized baskets of food, culinary tips, and information related to its current crops. Eatwell Farm assembles the order in an offline process, and transports it to a neighborhood location where the customer can pick it up. SureSave (http://www.suresave.com/) provides static pictures and information about how customers can order its customized deli trays. Many other retail services also target market niches and use customized offline actions that can be ordered online to design products that meet individual customer needs, and enhance the online service experience. Fancy Fortune Cookies (http://www.fortunecookiesonline.com/) personalizes fortune cookies offline for online sale. Personalized Peanuts (http://www.gourmetassoc.com/peanuts/) sells cans of roasted Virginia peanuts to business people and individuals, and customizes the cans offline by printing personalized labels.

4.2 Market Extender Electronic Services

Electronic service providers can grow by increasing the scope and online customizability of their services. Market extender electronic services are broader than those in the niche market category. They

are characterized by increased standardization of offline dimensions, and increased customization of online dimensions.

Hannaford's HomeRuns® (http://www.homeruns.com/) and Streamline® (http://homer.natural.com/) are two examples of market extender electronic services aimed at expanded markets, local and specialized national markets which have higher aggregate demand than niche market services. Virtual Vineyards® (http://www.virtualvin.com/) entered the electronic food retailing market with a broad offering of California wines targeted at a national market and described in their service system using static product recommendations (Gerace et al., 1996). Their long term strategy is to transform its static content over time into a personalized, automated shopping system offering wines and complementary foods that would be chosen by the customer or suggested by customized online information resources.

A number of electronic food retailers have moved into market extender services by increasing the variety of foods and by offering to ship to larger regions without employing extensive dynamic content. An important issue in offering more food products is the presentation of products and options to customers. Market extender services vary from single lists of all products to static pages for each product. U-BREW Corporation (http://www.kzed.com/ubrew) uses a simple product list and a 15 page static service system to sell over 1000 homebrewing products to United States customers. The company also devotes more than half of its service system to brewing recipes and information about local homebrewing clubs. Walnut Acres Organic Farm™ (http://www.walnutacres.com/) offers more than 700 organic products variations using a system of 37 pages of static content that includes a simple static order form. In contrast to U-BREW, Walnut Acres® devotes most of its service system to static

descriptions and product pictures. Its descriptions present related categories of products on separate pages.

4.3 Mass Market Electronic Services

Mass market electronic services can be targeted at a market with a broader cross-section of customers than can be targeted by market extender electronic services. As demand increases, customization of offline goods and services involved in electronic service products becomes increasingly difficult to perform. With a greater breadth of service offerings, customers need to have online customization that helps them search through the large variety of services and filters out irrelevant services. Large markets facilitate a breadth of services, but they also provide incentives for competitors to deliver similar services. Mass-market services, therefore, can become commodities. Providers of these services may attempt to differentiate themselves by joint branding of service portfolios that cannot be imitated.

Peapod® (http://www.peapod.com/)™ is one of several firms that offers mass market online grocery services in many major metropolitan markets. Because it serves large regional markets, Peapod® and similar services can form alliances and jointly brand themselves with major grocery chains, and deliver customized electronic service elements via proprietary software. As they expand to additional metropolitan markets, they must increasingly customize their service delivery systems to accommodate regional customer needs and additional grocer operations.

Food retailers in the broad-dynamic service product category have greater dynamic content and can offer product information and resources in a way that simplifies the order process. Mrs. Fields® Original Cookies (http://www.mrsfields.com/) uses a dynamic system of pages to sell approximately 3500

variations of cookies and gift packages to a national market. The McIlhenny Company® uses its Tabasco® Pepperfest service (http://www.tabasco.com/) to supplement the items it sells in grocery stores and ships products internationally. Tabasco® Pepperfest uses about 60 static pages to provide company information and uses more than 300 dynamically-generated pages to sell more than 350 items including hot sauces, condiments and Tabasco® branded clothing. Tabasco® Pepperfest also targets customers by using a repository for customer recipes that incorporate McIlhenny® sauces, information about the McIlhenny® company, musical and cultural entertainment that describes the history of McIlhenny® sauces, and a dynamically updated list of messages that customers can leave for the McIlhenny® racing team. Tabasco® Pepperfest also includes a registration system for a monthly informative e-mail that the company sends to customers.

4.4 Customized Market Electronic Services

Offline customization of niche market services can satisfy the idiosyncratic needs of some, but others may require online customization. Customized market electronic services can serve this market, and their providers can avoid copycats by offering uniquely customized joint services that build distinctiveness within the marketplace.

The customized market service product category can be targeted when several companies involve their brands in an electronic service. ARGE Austrian Country Market (http://www.lisa.at/), for example, offers specialty foods produced by 10 small Austrian companies. Its electronic service has separate pages targeted at German and English markets. The Austrian Country Market also uses nine separate order forms that send customer orders directly to the individual companies. The Cooking Post (http://www.cookingpost.com/) targets specialized niche markets of Native American foods and includes

products of eight different tribal organizations. Cooking Post's content is largely static, but the service offers tribal products and food baskets that include a mix of foods from several of the tribes. Pearl's Pantry (http://www.foodstuff.com/) includes brands of nine specially selected vendors that supply gourmet products. Pearl's Pantry targets consumers in search of gourmet foods, and offers a convenient shopping destination for those who want a wide variety of gourmet foods, high quality cookware, cutlery, and tableware. The service allows customers to view products offered by each brand on separate order pages or according to related product types. The selected items can be compiled into a single order using a dynamic shopping basket system. Pearl's Pantry also offers complementary services such as a searchable gourmet recipe database. Finally, retailing services provided by Excite (http://www.excite.com/shopping/), Yahoo! (http://shopping.yahoo.com/), AOL (http://www.aol.com/shopping/), and Amazon.com's Shop the Web (http://shoptheweb.amazon.com) bring together goods and services of many different companies, including food products, in highly customizable retailing environments that can integrate brands and services of many different electronic service providers.

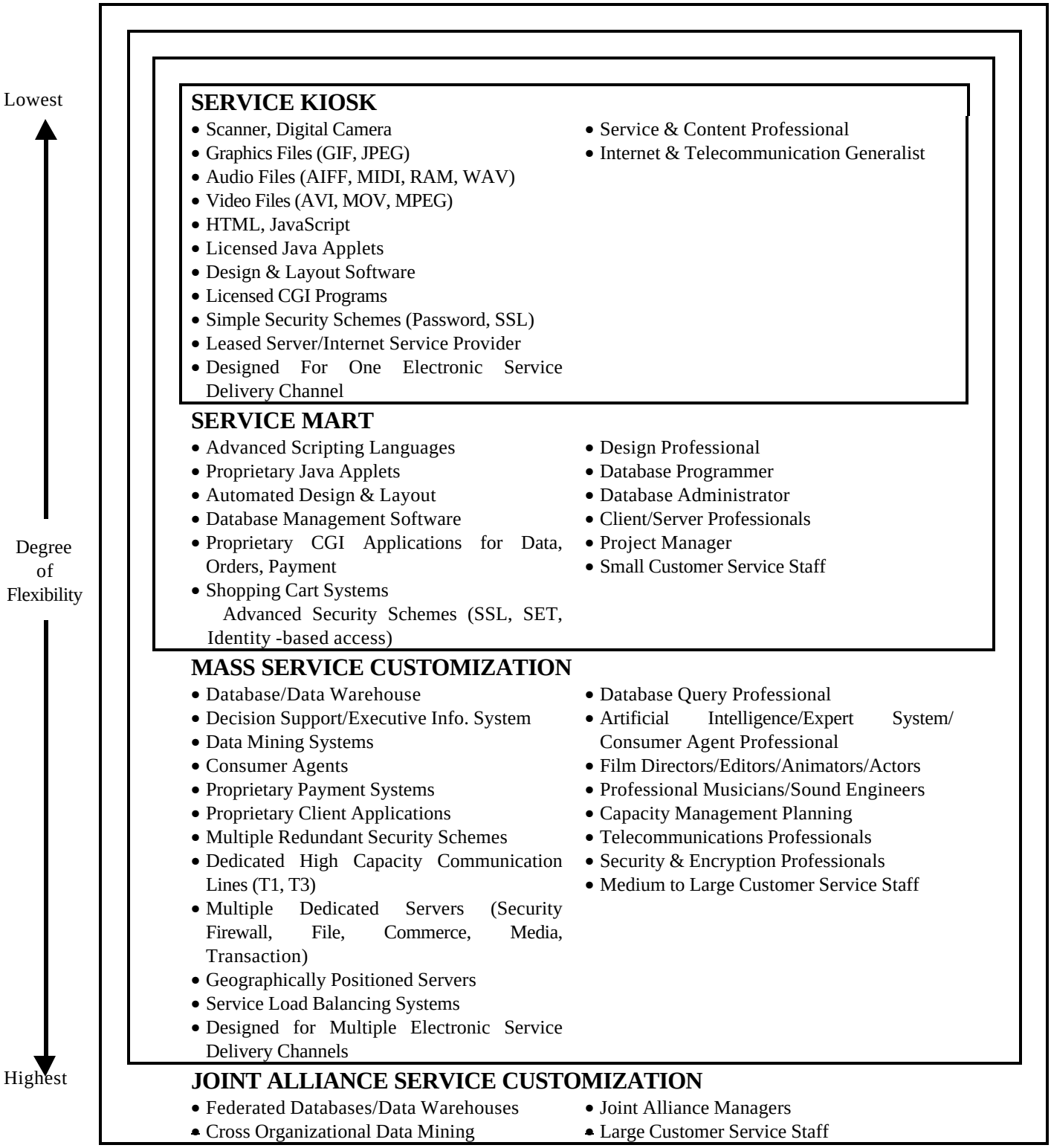
5. Electronic Services Process Structure

We conceptualize the electronic service process structure, the second building block of the product process matrix, as four stages that are delineated according to the flexibility of electronic service process technology that service providers use to adapt to the dynamically complex and changing needs of customers.[2] More specifically, flexibility can be partitioned into dimensions of mix flexibility, volume flexibility (often referred to as scalability), and technology compatibility, each of which tends to increase as one moves down along the four process stages.

Figure 2 relates the four stages to typical technologies used in each stage, beginning with the least flexible technologies and ending with highly flexible technologies and infrastructure. As we indicate in Figure 2, earlier process stages are embedded within each subsequent stage. Technologies used in an earlier stage of the electronic service operations are often required for

[2] Greenspun (1997) is an authoritative reference on decisions that need to be made when choosing technologies for electronic services. Yoffie (1997) provides a comprehensive review of the trends in electronic process technologies.

Figure 2. Stages in the Electronic Service Process Structure: Technologies and Technical Support Staff



delivery in later stages. A glossary of electronic service process technology acronyms and terminology used in this paper is presented in the Appendix.

The names of the four stages of the electronic service process structure are chosen to evoke relationships to traditional operations already found in the marketplace. *Service kiosk* evokes small stands set up in shopping malls or airports for individuals to deliver services. *Service mart* calls to mind a store that can deliver a relatively varied number of options to customers, but is still limited in what it can deliver by the capacity of its technologies. *Mass service customization* describes a bundle of many services that meet dynamically changing customer preferences. Finally, *joint alliance service customization* refers to several services that integrate their flexible process technologies.

5.1 Service Kiosk

The service kiosk uses inflexible but widely available technologies for delivery of electronic services. As shown in Figure 2, they typically deliver electronic services that use the computer markup language HTML, static image files, static sound files, and freely obtainable or licensed Java applets and server computer programs executed by CGI scripts. Service kiosks also choose not to operate their electronic service infrastructure, such as servers, security systems, and access to telecommunication infrastructure. Instead, they outsource the services that design and maintain those systems. Outsourced servers and infrastructure constrain the capabilities of the electronic services, which can limit the number and variety of services delivered online as well as the number of customers that can be served simultaneously.

Some companies use a service kiosk as their only form of service operation, while others use it as an inexpensive extension of existing physical operations. Manufacturers, distributors, and traditional

retailers of media, food products, and other customer goods, as well as small stores, have all used service kiosks to extend their reach to electronic delivery channels. Raisin Rack Specialty Food Emporium (http://www.raisinrack.com/) sells produce, grains, herbs, and vitamins for a chain of three stores in Ohio. The Raisin Rack order form is an HTML form that e-mails the customer's order and shipping address to Raisin Rack, and then requires customers to call or fax their credit card information. The Hawaiian grocery chain Sure Save (http://www.suresave.com/) offers deli services, coupons, and information through its online store. The Sure Save online store order system initially employed HTML forms, CGI scripts, and secure payment transactions outsourced to interLink Hawaii (http://www.ilhawaii.net/), but more recently SureSave has removed the order system and replaced it with telephone numbers for their stores.

5.2 Service Mart

The service mart builds on service kiosk technologies, adds more flexible technologies, and requires additional technical support staff. In this process, static technologies used in the service kiosk can be created dynamically and linked together to deliver more highly customized services. These include the use of CGI scripts and client side Java applets both to increase the breadth and flexibility of service offerings, as well as to differentiate them. The most flexible service mart systems can use CGI scripts, Cold Fusion or Active Server Pages to connect small databases to the service process. These databases can be queried to dynamically build pages based on current information about products, and to collect customer data for customizing the current service delivery and improve future services. A reliable service mart requires robust server and telecommunication capacity. Large unexpected variations in service demand are one of the most difficult technical challenges in electronic service design

and require foresight of service design staff and the use of scalable technologies (Iansiti and MacCormack 1998). However, technological limitations of CGI scripts, in particular, impose upper bounds on the volume flexibility of service mart systems. While service kiosk operations are designed to be self-standing and not to require much interactive monitoring or maintenance by service staff, service mart operations require active involvement by a variety of technical support staff.

Food retailing operations mix a broad variety of electronic service technologies at the service mart stage. Baltimore Coffee and Tea (http://www.baltcoffee.com/) uses a CGI shopping cart identification system to sell more than 1000 variations of coffee and tea products. This system lets customers choose whether to browse through a quickly delivered text version of the catalog or a graphically rich version. When the customer finishes selecting products, the CGI scripts collect the shipping address and payment information, calculate shipping costs, and present customers with a final order, all within an encrypted environment that uses the computer security protocol SSL. Virtual Vineyards® (http://www.virtualvin.com/) uses HTML forms for merchandise orders (*PC Week*, January 6, 1997), and supports encryption and security standards for processing online transactions. A&A Italian Specialty Foods (http://www.aafoodstore.com/) uses CGI Perl scripts to load product description pages for more than 100 products. The process embeds a shopper identification number, keyed to the customer shopping basket of selected items, into the HTML code of each product description page. The Magic Seasonings® Catalog (http://www.chefpaul.com/) sells nearly 150 of Chef Paul Prudhomme's seasonings and branded products using a CGI shopping cart system that can create an online form for immediate payment or an offline form that can be printed and mailed. Pearl's Pantry (http://www.foodstuff.com/) manages information on about 325 products for nine companies using a mixture of HTML pages and

Cold Fusion® scripting. It also manages customer shopping by placing Netscape® cookie text strings[3] on customers' computers. Cellar Homebrew (http://www.cellar-homebrew.com/) uses server side include (SSI) scripting and Netscape® cookies to update static pages with the list of products in a customer's shopping cart. Cellar Homebrew also uses a CGI shopping cart system that lets customers search for products and a CGI recipe calculator program that allows brewers to input a beer recipe and estimates the alcoholic content and bitterness of their finished beer.

5.3 Mass Service Customization

Mass service customization uses the most flexible electronic service technologies. This process requires the greatest breadth of technologies and technical support staff to deliver flexible services. As shown in Figure 2, technologies associated with the service mart are enhanced and adapted to more complicated market requirements. Massive databases are built to collect customer data and are linked to data mining systems[4] to learn about and enhance relationships with customers. In mass service customization, electronic service delivery systems may handle millions of requests per hour, which requires scalable systems of multiple servers that can handle wildly varying aggregate customer demands without a noticeable decrease in the effectiveness of service delivery. Such server systems can be load balanced to distribute the utilized capacity across several servers, and distributed geographically to improve responsiveness. Backup systems of redundant hard disk arrays, servers, power generators, and digital infrastructure connections are also put in place in case primary systems fail. A security

[3] Text strings stored on a customer's computer by an electronic service through the customer's WWW browser. Food retailing services use cookies to store information about the customer, such as the last time the customer used the service, or a number that identifies the customer's electronic shopping basket.
[4] Computer programs that automate statistical analysis involved in marketing research.

scheme involving several redundant security systems can be implemented to protect service technology and sensitive customer information during service transactions.

Several grocery services operate at the level of mass service customization. Peapod® (http://www.peapod.com/) originally used proprietary software that customers had to download from their web site, install, and use to access the services. The client software positioned Peapod® in both the grocery and Internet services industries, because the monthly fee allowed customers to receive Internet e-mail and use the Peapod® client to surf the World Wide Web. Peapod® more recently changed to a shopping process delivered via a WWW browser. Crusoe Island (http://www.crusoeisland.com/) is a flour mill and food store that uses Active Server™ Pages to generate its shopping cart system from a database of information about the 1300 organic and natural foods it sells.

In electronic food retailing, much of the usefulness of mass service customization technologies is due to two characteristics. The first is that they make it possible to deliver value-added services which enhance the purchase and consumption of foods. The second is that they allow existing databases to be configured quickly into electronic forms of existing retail shops. Virtual Vineyards® started out with service mart technology, but the ultimate objective was to move into flexible database technology to be used for greater personalization for customers and integration with suppliers (Gerace, et al., 1996). Chocoholic.com (http://www.chocoholic.com/) uses a database system to sell approximately 140 different types of gourmet chocolates. The Chocoholic.com service system lets customers search for products by company or by product type through CGI Perl scripts that query the Chocoholic.com database system. Chocoholic.com also uses its databases to offer personalized services, including a chocolate gift reminder service. The owner of Cornell's Brewshop (http://www.cornells.com/brewshop.htm) developed his

service system using Cold Fusion® to turn the Cornell's Hardware Store database into several separate online stores.

Some electronic food retailers have used off-the-shelf mass service customization retailing systems. Coffee Review™ (http://www.coffeereview.com/), Brown & Jenkins Fresh-Roasted Coffees (http://www.brownjenkins.com/), and Bruno Brothers Fine Food and Gift Emporium (http://www.brunobros.com) all rely on the iCat® retailing system. Packaged retailing systems offer electronic food retailers a number of dynamic service enhancements, including customer registration, storage of payment information, product search systems and flexible payment systems.

5.4 Joint Alliance Service Customization

Traditional joint branding alliances co-brand goods or services that are produced by one alliance partner. Alliances have become increasingly important within and across electronic service provider segments. The technological integration of several firms' electronic services creates significant challenges, but the potential gains from integration motivate these alliances and joint product development. The distinguishing trait of joint alliance service customization is its ability to deliver electronic services using technology that is dispersed both geographically and across organizational boundaries. Firms pursuing joint alliance service customization employ the greatest breadth of technology and technical support staff. At this stage, most alliance partners have developed capabilities at the level of mass service customization. Joint alliances, therefore, involve integration of operations that allows the allied organizations to deliver service packages and respond to individual customer preferences. Mass service customization technologies use flexible, reliable technologies that facilitate both the integration of databases of different companies and decision-making using data from all

organizations in the alliance. Technical support staff is also needed to manage organizational coordination, and customer service staff must be able to respond to customers of jointly delivered service portfolios.

Joint alliance mass service customization is, so far at least, rare among electronic food retailers, but information services companies have adopted it to position themselves as intermediaries in the retail food supply chain. Food retailers do perceive some value to customers from collecting complementary goods together in one system for the ease of customers; for example, the Aull-n-Aull Web Winery (http://webwinery.com/), a collective retail service operation, sells wine over the World Wide Web for a number of small regional winemakers and specialty winemakers. However, food retailers tend to concentrate on transaction processes involved in selling their goods, rather than on value-added information processes that build service experience, (e.g. entertainment, recipe-orientated purchasing) dimensions or link food retailers together. Although traditional food retailers have not integrated their electronic services together, the AOL.COM (http://www.aol.com/shopping/) store and Amazon.com's Shop the Web

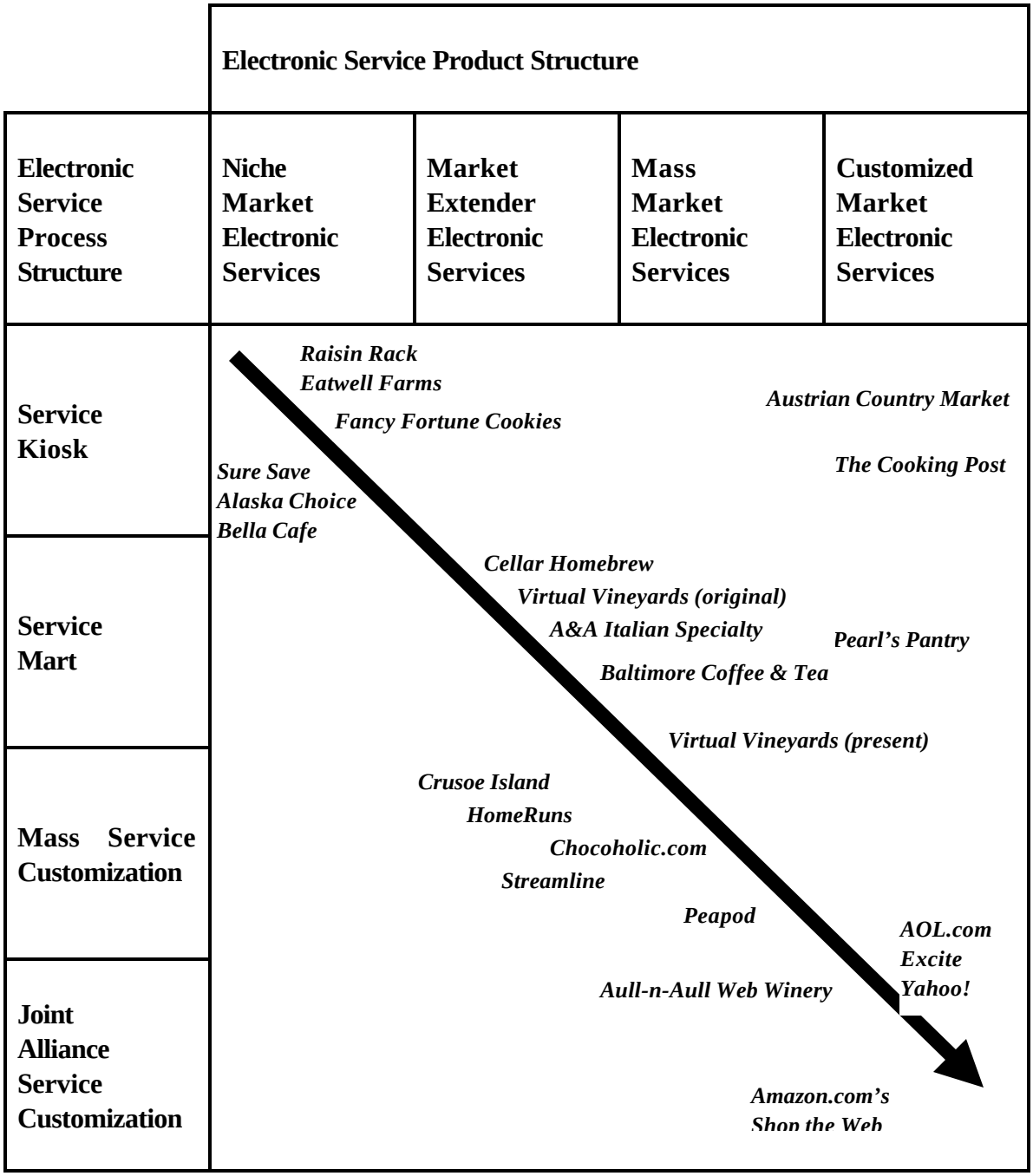
(http://shoptheweb.amazon.com/) have used joint alliance service customization to integrate product information together from hundreds of food and non-food electronic retail services. In the case of AOL.COM, customers can use a personalized gift search system that lets them search across all of the products of participating services, based on self-reported personality profiles.

6. The Product-Process Matrix

Figure 3 shows the product-process matrix for electronic service operations. Positions of the electronic food retailing services we have cited as examples for the categories of the electronic product structure and the stages of the electronic process structure in the previous two sections are shown on the matrix.

The two sides of the matrix are the electronic service product structure and the electronic service process structure. Services in the upper left-hand cells of the matrix are characterized by technologies with limited flexibility that make it difficult to change the online service dynamically. The increased scale of services makes offline customization (e.g. customization of

Figure 3. Product-Process Matrix for Electronic Food Retailing Services



individual food items purchased by each customer) less feasible as we move to the lower right area of the matrix. At the same time, services in this area are capable of using technology to interpret customer information and create a customized service experience. These service operations also expand to

provide complementary services for larger groups of related customer needs. All of the service operations in the lower right corner can deliver the widest variety of service offerings for customers within the group of service markets in which the food retailing services operate individually.

The matrix is useful for electronic food retailers because it helps to build an understanding of the impact of electronic services on customer value, which is fundamental to the success of endeavors such as electronic food retailing. Researchers have suggested that perceived value of a good or a service is the construct that is most closely related to a customer's purchase decision. The delivery of customer value, therefore, will determine the rate and the extent to which customers will switch from conventional food retailing services to electronic food retailing services.

Perceived value is more individual and personal than perceived quality. According to Zeithaml (1988, p. 14), perceived value is the customer's "overall assessment of the utility of a product based on perceptions of what is received and what is given." More recently, Woodruff and Gardial (1996, p. 54) have defined customer value as the "customers' perception of what they want to have happen (i.e., the consequences) in a specific use situation, with the help of a product or service offering, in order to accomplish a desired purpose or goal."

Our review of the literature on electronic services suggests that uncertainty typically associated with this class of services stems from lack of a clear understanding of their implications for customer value. Alba et al. (1997, p. 16) observe that "the relative attractiveness of IHS [interactive home shopping] will be determined, as in the case of catalogs, by the consumer's ability to predict the relative utility or satisfaction to be derived from a good presented electronically." In a similar vein, Jeffrey P.

Bezos, founder and chairman of Amazon.com has noted: "I hear a lot of people talking about business models, but I don't hear much about customer value" (*New York Times* January 18, 1999, p. C3).[5]

7. Propositions on Customer Value

We will now demonstrate the application of the product-process matrix to develop propositions on customer value through electronic service operations. The propositions relate positions and paths on the matrix to customer value. We also discuss the conceptual basis for each of the propositions.

Proposition 1. Electronic services positioned toward the upper right hand corner of Figure 3 couple a market segment that wants a breadth of customized online services, with service operations that use inflexible technologies. Service kiosk technology is limited in its ability to deliver customized online service offerings. Technical support staff for a service kiosk usually create static content that can support repetitive transactions, but cannot support the scale and customization required to deliver a multitude of varying service transactions and experiences. Firms positioning service kiosks to deliver customized, jointly branded services will discover a mismatch between customer service expectations and experience.

Services positioned toward the lower left-hand corner of the matrix are more technologically feasible, but will deliver less value than services positioned along the diagonal. In low demand service markets, service operations employing jointly allied mass service customization have real and perceived costs above the level customers are willing to pay. Services positioned in the lower left-hand corner use technologies capable of delivering high online customization to target customers who desire high offline

[5] On measurement of customer value, see Gale (1994); Woodruff and Gardial (1996); Parasuraman (1997); Sinha and DeSarbo (1998).

customization. The lower left-hand corner also creates perceived costs for customers, because the customer has to make a "sacrifice" in installing, learning, and operating special service technology. This corner, like the upper right corner, leads to a mismatch between service expectations and service delivered and motivates the following proposition:

Proposition 1. *Electronic food retailing services positioned along the matrix diagonal deliver greater customer value than services positioned in the upper right hand or lower left hand corners of the matrix.*

Proposition 2. As electronic service operations move toward mass service customization and joint alliance service customization, online dimensions of service become easier to customize. Movement to these processes involves an increased technological breadth and technically specialized support staff. Customers can often use these technologies to search and sort service information, and to customize service options. Service transaction data can also be collected and used to build business-to-customer relationships by personalizing immediate and subsequent service offerings and by drawing the customer back. Personalization requires huge databases called data warehouses to collect customer data, and tools such as data mining systems to gather and sort through this information. Consumer agents, expert systems, and statistical techniques can use the data to infer which type of services are of interest to a particular customer. These technologies require competent technical support personnel who understand the technology and the service context to ensure that value is added to the service.

Electronic services delivered by alliances allow customers to purchase one or more alliance partners' services through jointly customized service offerings. This model of service operations delivers value by giving customers enough flexibility to customize a package that contains several complementary service offerings. Such integration of service operations is likely to reduce customers' search costs. The

larger variety of services may make historical information about purchases of this or similar customers even more useful for suggesting and designing service packages that meet customers' needs. Jointly operated services also facilitate joint branding, which can contribute to extrinsic attributes that drive perceived value, and can also benefit customers when services are new, experience-based, or used infrequently. These considerations lead to the following proposition:

Proposition 2. *Electronic food retailing services positioned toward the bottom of the matrix, i.e., mass service customization or joint alliance service customization, deliver greater customer value than services delivered by a service kiosk or service mart.*

Proposition 3. Electronic services create customer value when they become reasonable substitutes for conventional offline modes of service delivery. Moving along the service product structure of the matrix, a tradeoff takes place between the value created by offline dimensions of conventional services and online dimensions of electronic services. Firms toward the right of the service product structure in Figure 3 target broad markets and cater to diverse customer preferences. Quick customization and response from online interactive media channels can create rich experiences that translate into lower search costs and enhanced customer value. Electronic service operations positioned toward the right of the matrix decrease or eliminate person-to-person contact, but they also reduce waiting time and allow customers to transact a service order quickly. Online customization also decreases the service heterogeneity that results from different service personnel and customer perceptions by letting customers control the service. We state, therefore, the following proposition:

Proposition 3. *Electronic food retailing services positioned toward the right of the matrix deliver greater customer value than services toward the left*

of the matrix when the value is derived mainly from online customization and brand alliances.

Proposition 4. Conventional services use service personnel and technology for direct interaction with people, physical objects, and information. Electronic service operations toward the left of Figure 3 often involve elements of conventional services adapted to an electronic delivery channel. Small to medium sized retailers, for example, use service kiosk and service mart process technologies to exploit the capabilities of electronic channels to expand their retail operations. These retailers typically combine simple catalogs and order forms with service kiosk and service mart process technologies. They also use service personnel to select, customize, and fill orders generated by the electronic order process. The lower stages of the electronic service process structure, when targeted at the left of the service product structure, enhance the value of offline services and merchandise with pre-purchase sales experiences, post-sales consumption experiences, and the relationship with the customer, which leads to the following proposition:

Proposition 4. *Electronic food retailing services positioned toward the left of the matrix deliver greater customer value than services toward the right of the matrix when the value is derived mainly from offline dimensions of service offerings.*

8. Concluding Remarks

The primary contributions of this paper to the service operations management literature are the electronic product and process structures, the product-process matrix, and the insights on delivery of customer value derived from the matrix. Typologies such as the electronic service product structure and the electronic service process structure, a conceptual framework such as the product-process matrix, and the propositions relating product-process interrelationships to customer value derived from the matrix can be tested empirically via cross-sectional or longitudinal analyses (see Safizadeh et al., 1996; Doty, Glick, and Huber, 1993). To the best of our knowledge, this paper represents one of the first research initiatives to develop a theory on design and delivery of electronic services.

From a practitioner standpoint, the paper is valuable because it illustrates the product-process matrix within a single, richly descriptive context, electronic food retailing services. The product-process matrix also has the potential for application both as a diagnostic and a planning tool after it has been empirically validated. As a diagnostic tool, the matrix can be used by service providers to examine the causes of poor delivery of electronic services that result from a mismatch between the electronic service products and process technology capabilities. As a planning tool, the matrix can help service providers who are considering the introduction of new categories of electronic service products to determine new and appropriate process technology capabilities.

A logical extension of the present paper will be to test empirically the electronic service product and process structures, develop and operationalize the measurement of the customer value construct, and investigate the relationship between customer value and fit between the elements of the product and process structures. A research program in partnership with electronic food retailers is already

underway. This research program is aimed at demonstrating the application of the product-process matrix (i) as a diagnostic tool for improving continuously the design and delivery of existing services by electronic food retailers, and (ii) as a planning tool for determining the process technology capabilities necessary for effective design and delivery of new services by electronic food retailers.

Glossary of Electronic Service Technology

Following is an abbreviated description of electronic service process technology terminology. For more detailed information, see the Techweb® Technology Encyclopedia (http://www.techweb.com/encyclopedia/).

Active Server Pages: An alternative to CGI scripts. Active Server Page web pages include programming code used to interact with databases and programs on a server.

AIFF: Audio Interchange File Format. A digital audio file format from Apple®.

AVI: Audio Video Interleaved. A digital multimedia video file format from Microsoft®.

Client Application: A computer program used to deliver electronic service content to a computer or other service delivery device owned by a customer.

Cold Fusion: An alternative to CGI scripts. Cold Fusion web pages use the Cold Fusion Markup Language to interact with databases.

Common Gateway Interface (CGI): A WWW-to-server interface that receives requests from a WWW server to execute programs stored on a server computer. The Common Gateway Interface executes these programs, and returns the program output to the WWW server, which in turn sends the

output to the customer's service delivery device. Typically, CGI programs are written in scripting languages such as PERL, or are executable programs written in C or C++.

Consumer Agent: A computer program or system that can help customers accomplish some task, such as purchasing a product, based on decision criteria provided by the customer to the agent, such as a desired price range. For a futuristic example, see Alba et al. (1997).

Data Mining System: A system that facilitates either manual or automated examination of databases of customer information to discover patterns and relationships between variables.

Data Warehouse: A massive database that supports organizational decision making. Data warehouses integrate organizational data, such as operational data or a customer's purchasing history, into a single database management system.

Encryption: A security procedure that uses cryptography to encode electronic service content into a collection of computer bits that appear to be random, making them virtually impossible for anyone other than the service provider and customer to decode. Encryption is used in electronic services to protect customer credit card numbers and other sensitive data.

Federated Databases: A system of independently managed, heterogeneous database systems that facilitate controlled sharing of data.

GIF: Graphics Interchange Format. A digital graphics file format developed by CompuServe®. GIF files can display one graphic, or several graphics presented in a repeatable sequence.

HTML: HyperText Markup Language. A presentation language used to define the page layout of digital documents on an electronic service delivery device.

Identity-based Access: A security scheme that uses an identifier to manage customer access to electronic services. Common schemes involve Internet Protocol (IP) address numbers, and cookie text

strings placed on a customer's computer. Future electronic services may use identifiers such as digital fingerprints or smart cards.

Internet Service Provider: A company that resells digital telecommunication line capacity, leases server computer disk space, and leases digital technologies that can be used to develop and deliver electronic services. The companies also perform contract work to develop and manage electronic service operations.

Java® Applet: A computer program module, written in the computer language Java. Java was designed so that Java programs could theoretically run on any device capable of digital processing, including personal computers. Java applets are shipped as object code from a server to a customer's service delivery device, upon which they are run by a Java virtual machine programmed to run applets on that device.

JavaScript™: A scripting language embedded inside HTML that can be used to enhance electronic services and to control electronic service delivery devices, such as windows in a World Wide Web browser.

JPEG, JPG: Joint Photographic Experts Group. A compressed digital graphic file format.

Load Balancing System: A capacity management system that dynamically allocates electronic service processing to individual servers based on their current workloads.

MIDI: Musical Instrument Digital Interface. A digital audio file format.

MOV: The QuickTime® digital multimedia video file format, developed by Apple®.

MPEG: Moving Pictures Experts Group. A compressed digital video file format.

Password: A security scheme in which customers input a username and a password to access electronic services.

RA, RAM: RealAudio™ and RealVideo™ digital audio and video file formats playable by Progressive Networks®, Inc. programs. These file formats facilitate transfers of static audio and video files as well as streams of dynamically generated audio and video.

Scripting Language: Computer languages used to define the layout and timing of audio and visual elements of electronic services.

Security Scheme: A collection of security systems that limit access to electronic services to paying customers, and forbid access to those who want to play with or damage the server computers used in the service operations.

Server: Software installed on a computer that receives service requests sent across a telecommunication network from a customer service delivery device. Servers fulfill these requests by sending documents, querying databases, or executing programs.

SET: Secure Electronic Transaction. A secure credit card payment protocol developed by MasterCard® and Visa®.

Shopping Cart System: A computer program used by electronic retailers. The shopping cart system manages the list of products selected by each customer through the point of a successful payment transaction. Shopping cart systems also often facilitate the management of product information and prices presented to the customer.

SSL: Secure Sockets Layer. A security protocol developed by Netscape® Communications Corporation.

T1, T3: Point-to-point dedicated telecommunications lines. T1 communication lines operate at a capacity of 1.544 megabits per second. T3 lines operate at a capacity of 44.736 megabits per second.

WAV: A digital audio file format developed for Microsoft Windows®.

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