Consumer Driven Electronic Transformation
Georgios J. Doukidis
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Editors

Consumer Driven
Electronic Transformation

Applying New Technologies
to Enthuse Consumers
and Transform the Supply Chain

With 49 Figures
and 16 Tables
Foreword

In September 2003, Athens University of Economics & Business hosted the third in a series of international research symposia held under the auspices of the ECR Europe Academic Partnership and ECR Journal: International Commerce Review. Held first in Cambridge in 2001 and then at WHU Koblenz in 2002, the Symposia have become important, unique occasions in the international calendar of business research. No other event brings together in a university environment distinguished academics, business practitioners and consultants to explore the development of the consumer goods industry through collaborative management. The papers collected here, first presented in Athens, represent an important contribution to the research literature of modern business.

The wide-scale institutional development of collaborative practices in the European consumer goods business began in 1994 with the creation of ECR (“Efficient Consumer Response”) Europe, a joint initiative of manufacturers and retailers working together to improve the quality and performance of the value chain. At the heart of ECR was a business environment characterised by dramatic advances in information technology, shifts in consumer demand, and the increasing movements of goods across international borders. This new reality required a fundamental reconsideration of the most effective way of delivering the right products to consumers at the right price. Non-standardized operational practices and the rigid separation of the traditional roles of manufacturer and retailer threatened to block the supply chain unnecessarily and failed to exploit the synergies that came from powerful new information technologies and planning tools. To better serve the consumer, ECR set out to invert the traditional model and break down non-productive barriers. The impacts were extensive and continue to resonate across industry.

As ECR rapidly penetrated the practice of European business, the Executive Board of ECR Europe moved to form an “Academic Partnership”, a development programme designed to bring together academic research and teaching with the business needs of collaborative management. Founded in 1999, the Academic Partnership is now facilitating important ventures between universities and business that enhance both business school education and commercial management. Its publication, ECR Journal: International Commerce Review, together with the Research Symposia, have become primary contributors to international business thinking and practice.
The Athens Symposium represented an extraordinary compilation of diverse, challenging approaches to contemporary business. The presentations, collected in this book, are widely varied and represent the personal views of distinguished thinkers. By design, they are independent papers written to encourage understanding of the opportunities for collaborative business development. They are thoughtful, provocative, and at the heart of the principles of transparency and open debate that have characterised the ECR Europe Academic Partnership since its inception. They offer unique, often exhilarating perspectives on our industries’ future.

Robert Wilkinson

Chairman, ECR Europe Academic Partnership
Member of the Executive Board, ECR Europe
Honorary Fellow, Athens University of Economics & Business

London, June 2004
Preface

The dominant role of Efficient Consumer Response (ECR) practices in the retail industry today has created a strong need for collaboration between business and research communities for the development of robust theoretical frameworks and intelligent technological solutions towards providing direct managerial implications to the retail industry players. To this end, this book aims to highlight the emerging trends, challenges and opportunities in the retail industry, under the perspective of the changing consumer and business behavioural patterns, the reconfiguration of intra and inter-organizational relationships and the evolving technological capabilities.

Elaborating on the core ECR concepts, the book emphasizes the role of consumer behaviour research as the driving force for the configuration of the retail value chain processes. Along these lines, the application of the latest technological inventions to enthuse consumers through accurate targeting along with the identification of the potential of the new technologies, processes and strategies for transforming the supply chain constitute the main pillars of the book.

Specifically, the book focuses on the emerging techniques and technologies for supply chain management and collaboration as well as on the emerging relationships and the electronic transformations governing multichannel retailing. It aims at supporting retailers, consumer goods manufacturers and third parties applying the latest technological inventions to transform the value chain. It also attempts to guide practitioners to effectively proceed in employing new technologies to ignite consumer enthusiasm. Similarly, the book objective is to help companies target more accurately consumer and shopper wishes with focused investments, in shorter time, and with more success. Finally, the book underlines the great potentials for new technologies and processes from a supply and demand side perspective.

The book contains invited papers presented at the 3rd International ECR Research Symposium held at Athens, Greece (September 11-12, 2003). The third in a series of international research symposia held under the auspices of the ECR Europe Academic Partnership and ECR Journal: International Commerce Review and hosted by the ELTRUN Research Center of the Athens University of Economics & Business, Department of Management Science and Technology and the ECR Hellas. The symposium brought together the most active researchers and consultants in the Efficient Consumer Response field. In addition many retailers and suppli-
ers of the Fast Moving Consumer Goods industry participated in the Sym-
posium.

We feel and hope that this book will be a valuable scientific source of
information to practitioners, researchers and academics in the areas of
conventional and electronic retailing both from a supply and demand side
perspective as well as for students following MBA or relevant M.Sc.
courses or undergraduate courses in supply chain management, e-business,
retail management, sales management, management of information sys-
tems, etc.

We would like to take the opportunity to thank the authors of the chap-
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Georgios J. Doukidis
Adam P. Vrechopoulos

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The book contains four parts. Part 1 titled “Emerging Techniques and Technologies for Supply Chain Management” includes four chapters.

The authors of chapter 1 titled “Improvement Opportunities in Retail Logistics” Karel van Donselaar, Tom van Woensel, Rob Broekmeulen and Jan Fransoo from the Eindhoven University of Technology, describe how to increase both customer service and the capacity utilisation in retail chains. The improvement suggestions are based on observations at multiple Dutch retailers. These observations show that the logistic decisions taken by the retailer can be improved by increasing the level of differentiation, sophistication or integration in the decision-making process. Several examples are given to illustrate how these general guidelines can be translated into specific solutions for specific retailers and/or specific products. A special focus in this chapter is on the issue of ‘how to differentiate items when controlling goods flows in a retail environment’. For this differentiation, they introduce five product categories, and, for each of these categories, they discuss how to control the inventories and capacities in the retail chains. The fact that labor costs are the dominant logistic costs in retail chains is taken into account in their differentiation.

Chapter 2 is titled “A Dynamic Real-time Vehicle Routing System for Distribution Operations”. The authors of this chapter, Vasileios Zeimpekis and George M. Giaglis from the Athens University of Economics and Business argue that although vehicle routing software packages and telematic applications for real-time fleet monitoring are currently being used by logistic companies, there is still no guarantee that every vehicle will follow the initial pre-defined delivery plan. This is mainly happening due to unforeseen events that occur during urban freight movement, such as negative environmental conditions, traffic congestion, vehicle breakdowns, road works, lack of unloading space in the depots, and so on. The basic aim of this chapter is to present the inefficiencies that take place during standard deliveries and ex-van sales, define the vehicle routing parameters that should be taken into consideration in urban distribution management, and propose a generic architecture of an innovative dynamic real-time event-driven vehicle system that aims to re-route vehicles in order to avoid delivery crisis.

Then, the authors of chapter 3 titled “Bargaining and Alliances in Supply Chains”, Mahesh Nagarajan and Yehuda Bassok from the University of British Columbia and the University of Southern California, respectively, deal with negotiation as a common and an important activity in many organizations. They report that within an organization, pay scales, work
schedules, budgets etc. are often negotiated between various parties. From an inter-organizational view, negotiation is possibly the most common method of drawing up contractual terms, settling disagreements etc. between supply chain partners. The number of seminars and workshops that are designed to improve the negotiation skills of top-level management is ever on the increase. Indeed, considerable energy has been spent by academicians in characterizing the type and importance of negotiations between firms in various sectors. Thus, they support that adopting a negotiation framework to examine profit allocations among supply chain partners seems very natural. They concentrate in the retail industry providing a framework to analyze the negotiation process relevant to procurement contracts and offer some important results.

Finally, the authors of chapter 4 titled “Last-mile Supply Chain Integration: Easy Connection and Information Exchange between Suppliers and Retailers” William Drakos and Yannis Pantzis from Information Systems Impact, support that integrating and automating information exchange (e.g. orders, invoices, catalogues, etc.) across the entire Retail Chain by connecting Suppliers, Retailers, Warehouses, Retail Stores and other players has been a complicated, expensive and time consuming task and – as such – has only been employed by larger enterprises. They argue that a flexible Integration and Business Process Automation service, enabling rapid and intelligent consolidation of business documents exchange among business partners, is needed. They state that by utilizing the latest Internet technologies and standards, multiple disparate internal applications can “speak out” to business partners, resulting in a large business network of loosely connected business partners. Along these lines, they note that compatibility with existing systems and technologies (like EDI-based systems) secures the effectiveness of the solution. To that end, they propose an Enterprise Application Integration (EAI) service that has been specially designed so as to allow Small-Medium Enterprises (SMEs) effectively catch up with the new electronic business culture.

Part 2 is titled “Multichannel Retailing: Relationships, Integration and Electronic Transformations”. It includes 3 chapters.

The author of chapter 1 titled “Multichannel Retailing and Brand Policy” Luca Pellegrini from Università IULM, deals with the implications of multichannel patronage on manufacturer-retailer relationships with a focus on brand policies. He notes that in the modern retail landscape, consumers can obtain the same product categories in several store formats, taking advantage of the differentiated service they offer. The results of a survey on consumer channel patronage are used by the author to explore the impact of buyer characteristics on the choice of channel and on purchasing patterns
across channels. He reports that since channels attract different consumers, for different product categories in different occasions, it is suggested that they can be used as a base for segmentation. He then considers the options for brand policies, in particular, looking at ways to differentiate both products and brands across channels. He concludes that this would create value to consumers through a more focused provision of products, and also improve manufacturer-retailer relationships through the development of channel-specific configurations of the supply chain.

Then, the author of chapter 2 titled “Designing Alternative Store Layouts for Internet Retailing” Adam P. Vrechopoulos from the Athens University of Economics and Business, adopts a methodological approach towards designing the three major conventional retailing store layouts (i.e. grid, free-form, racetrack) within a Web-based shopping interface. He reviews the existing hypermedia design methodologies and employs graph theory as a consumer navigation representation tool. Then, he proceeds by designing the concept that each of the three layouts should follow within the context of a virtual retail store on the Web. Several methodological steps were taken towards developing alternative virtual store layouts that retain distinct differences among each other, while simulating their corresponding concepts and rules from conventional retailing. Managerial implications to Internet retailers in terms of category management and store design issues as well as areas for further research are provided by the author at the end.

Finally, the authors of chapter 3 titled “In Search for Viable e-Solutions” Solveig Wikstrom, Bo Lennstrand, and Christian Persson from Stockholm University, Gotland University and Stockholm Royal Institute of Technology, explore the criteria for successful e-commerce. This is done by taking their previous research results on the benefits and shortcomings consumers experience from the e-channel, and comparing them with ongoing results on the service qualities of successful e-companies. By integrating these findings, they can identify qualities that characterize e-solutions that are useful for the consumers and profitable for firms. They conclude by suggesting two solutions. First, they support that in order to improve the functioning of the website, images of the traditional physical channel should be inserted into the website. Second, they propose a strategy whereby firms integrate the e-channel with the traditional channels, i.e. develop a multi-channel strategy.

Part 3 is titled “Beyond CPFR: Defining the Future of Supply Chain Collaboration and includes 5 chapters.

The authors of chapter 1 titled “On Shelf Availability: An Examination of the Extent, the Causes and the Efforts to Address Retail Out-of-Stocks” Daniel Corsten and Thomas Gruen from the University of St. Gallen and
the University of Colorado, respectively, argue that with all the hype around ECR and the brave new world of technologies, one would believe that retail out-of-stocks have gone down over the last ten years. According to them, that is wrong. They report that retailers have been struggling with considerable out-of-stocks for decades – with little evidence of improvement. Along these lines, they note that a similar wrong belief is that shoppers are still willing to accept low service levels. In fact, increasingly, consumers switch brands when they don’t find the brand they wanted. But retailers must be wary, because the results of their research show that, increasingly, shoppers switch stores quickly and may never come back. So, who is to blame? The supply chain. And where to tackle it? On the shop floor. Over the past two years, they have conducted a major, world-wide study of the extent, causes, and consumer responses to out-of-stocks in the fast-moving consumer goods industry. In this interesting chapter, they report these empirical findings and provide insight to solving this chronic industry problem.

Then, the authors of chapter 2 titled “Increasing Shelf Availability through Internet-Based Information Sharing and Collaborative Store Ordering” Katherine C. Pramatari and Panagiotis Miliotis from the Athens University of Economics and Business, underline that on-shelf availability is a critical issue for both manufacturers and retailers today, who associate out-of-shelf situations with lost consumer loyalty and missing sales. They report that from the sparse texts and empirical studies that are available, it emerges that the main reasons behind the problem are found in the retail store replenishment practices and, particularly, in errors and omissions in the ordering process. In this chapter, they suggest a new replenishment practice, enabled by Internet-based information sharing and collaboration between retail store managers and supplier salesmen, leading to increased order accuracy and, as a result, to fewer out-of-stock situations. The empirical results from applying this new replenishment practice and a quantitative analysis of the impact of shelf availability from a pilot running, showing more than 50% reduction in the out-of-shelf situations, are also provided by the authors at the end.

The author of chapter 3 titled “Towards the Development of an Algorithm to Discover Out-Of-Shelf Situations, Dimitrios A. Papakiriakopoulos from the Athens University of Economics and Business, investigates the possibility of developing an algorithm that identifies the OOS situations, utilizing information systems capabilities. In more detail, the author, having available the POS data, orders details, products assortment etc., develops a method for constructing an algorithm that will automatically discover OOS situations on a daily basis. He notes that currently, the identification of OOS rates is based on physical audits, which consumes
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resources and is only an approximation to the problem. In the next section, he describes the factors affecting the OOS problem. He further discusses the accuracy of an existing method that identifies OOS situations, namely the European Out-Of-Shelf Index (EOI). Finally, he presents his method of work, followed by some preliminary empirical results.

The authors of chapter 4 titled “Food Value Chain Analysis” David Simons, Mark Francis and Daniel T. Jones from the Cardiff University underline that previous research has highlighted the importance of greater vertical co-ordination within red meat supply chains, to reduce risk and uncertainty and foster an environment of innovation and value creation. In this chapter they present the VCA project that calls for eight complete value chains to be studied and mapped in detail, with the primary objective being the mapping of value streams and the identification of opportunities for cost savings through the elimination of waste. They state that each of these chains will involve one or more producer, abattoir, processor, and supermarket or food service outlet. They also note that the value chains have been selected to encompass the maximum diversity, including the three product species (beef, lamb and pork) and different routes to market (retail and food service). Finally, they report that the results will be used to identify and prioritize intra- and inter-firm waste elimination opportunities.

Finally, the author of chapter 5 titled “Extending ECR into Product Innovation” Joerg Hofstetter from the University of St. Gallen states that little activity has been dedicated by practitioners so far to jointly improve the conventional product development and launch activities. He notes that while there is little doubt among top managers about the importance of product innovation, the ways of how to tackle this important field are still at question. To that end, he includes in his article recent research findings based on the investigation of several emerging collaborative business practices and experiences of several leading companies.

The last Part of the book (Part 4) is titled “Beyond RFID: Supporting Supply-Chain Management with Intelligent Tagging”. It includes 3 chapters.

The authors of chapter 1 titled “Turning Signals into Profits in the RFID-Enabled Supply Chain” Nigel Green, Kurt Kammerer and Tim Shideler from VI Agents LLC, deal with Auto-ID/RFID as a technological tool that provides real-time material flow data. They report that distinguishing noise from relevant data signals, using these signals to identify supply chain bottlenecks and taking operational advantage of optimization opportunities, will be major prerequisites to supply chain improvement. They report that supply chains are value networks made up by network nodes (i.e. distribution centers, stores, etc.), which collaborate around material movement events and according to defined service levels and rules. They also support
that in a real-time world, success depends on both central and local decision-making. To that end, they state that whereas supply chains may be centrally governed, distributed control and execution of events are equally important as it is the only practical way to cope with the complexity of a real-time value network.

Then the authors of chapter 2 titled “Shopping in the 21st century: Embedding Technology in the Retail Arena” Panos E. Kourouthanassis and George M. Giaglis from the Athens University of Economics and Business, investigate the effect of the emerging information technology advances in consumer culture. They report that nowadays, the sociodemographic changes in consumer market (such as increased number of dual-income, single-parent and technology-familiar households) have significantly altered shoppers’ expectations, demands and spending patterns. As a result, the traditional levers of price, selection and location – although still important - are no longer sufficient in order to achieve competitive differentiation for retailers. Moreover, they state that recent advances in Information Technology (such as wireless networking and RFID-based products’ identification) can create technologically augmented environments, which consequently may lead to a new consumer culture in the form of enhanced shopping experiences within the retail outlet. This chapter presents an overview of these developments and their impact on the retail sector, and concludes with the results of a Greek case study illustrating the perceived adoption of the emerging shopping schemes by supermarket shoppers.

Finally, the authors of the last chapter (chapter 3) titled “Towards ‘Smarter’ Supply and Demand-Chain Collaboration Practices enabled by RFID Technology” Katerina C. Pramatari, Georgios J. Doukidis and Panos E. Kourouthanassis from the Athens University of Economics and Business, argue that the Internet has made it easier to share information among trading partners, enabling new forms of collaboration in the supply and demand chain management. They report that with the introduction of Radio Frequency Identification (RFID), this possibility takes on different dimensions, greatly expanding the information that can be shared and the collaborative processes that can be supported between retailers and suppliers. In this chapter, they discuss the evolution path of supply chain collaboration practices in retailing, and how these further evolve with the introduction of RFID technology. This interesting chapter gives an overview of internal and collaborative processes enabled by this new technology, and discusses the underlying infrastructure required to support it.
PART 1
EMERGING TECHNIQUES AND TECHNOLOGIES FOR SUPPLY CHAIN MANAGEMENT
Improvement Opportunities in Retail Logistics

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1 Introduction

This chapter focuses on inventory replenishment strategies and capacity utilization in the retail sector. In recent years, this sector has spent considerable amounts of time and money trying to improve its operations in such a way so as to respond efficiently to customers’ needs. This has led to several developments like the introduction of automated store ordering.

The automation of the store ordering is generally done at one central point within the company, and the resulting ordering rules can be used in all stores. The retailers realize that it is of strategic importance to use this economy of scale to gather all existing knowledge and expertise on inventory control theory and retail operations in order to get the best set of ordering rules in the industry.

To further improve the inventory replenishments in the stores, Eindhoven University of Technology has executed several projects with FMCG manufacturers, wholesalers and retailers in The Netherlands. These projects often take an integral supply chain perspective when choosing the most appropriate inventory replenishment strategy for a particular group of products in the stores. Based on the experience obtained in these projects and other results reported in the literature, we aim to give an overview of improvement opportunities in Retail Logistics, which can be used to enhance Automated Store Ordering (ASO) systems.
In general, the logistic decisions taken by the retailer can be improved by increasing:

- the level of differentiation when controlling the operations;
- the level of sophistication in the Decision Support Systems;
- the level of integration of multiple decisions (made by the retailer company and/or its supply chain partners).

Below, several examples are given to illustrate how each of these general guidelines can be translated into specific solutions, taking into account the fact that different retailers and/or different products need different logistic solutions.

### 2 The Level of Differentiation when Controlling the Operations

Different types of items need different ways of replenishment. For example, general textbooks on inventory management (Silver et al., 1998) propose the so-called ABC-classification, based on the perception that items with large turnover (A-items) need to be treated differently compared to items with low turnover (C-items). While there is some value in this approach, we propose a different classification for retail-items. We distinguish the following five main product categories:

1. Phasing-in/out items (including items with a short Product Life Cycle)
2. Promotion items
3. Purchasing driven items
4. Capacity driven items
5. Regular items

Below, each of these five product categories is discussed in more detail.

The phasing-in/out items (including items with a short product life cycle) are different from other items since there is either very little demand history available, or it becomes very risky to carry inventory due to obsolescence. Thus, for these items, special attention is given to issues like demand forecasting and inventory management in an environment with high risk of obsolescence and/or markdown policies.

Improvement opportunities reported in the literature are:

- Using similarity in forecasts made by different individual people as an indicator of forecast accuracy when no sales data are available yet;
- Using early sales data to improve demand forecasts in the case of style goods;
- Using repeat rate information from customer cards to improve demand forecasts when new products are introduced;
- Using optimal markdown policies to reduce the risk of obsolescence.

Fisher et al. (1994 and 1996) show that demand forecasts for items with a short product life cycle (like style goods) can be improved substantially in two ways. The first improvement applies when an initial production or buy decision has to be made and no sales data are available yet for the new assortment. They show that when each member of a buying committee makes an independent demand forecast for every product, the variance in these individual forecasts is an almost perfect predictor of the overall demand forecast accuracy. This allows the manufacturer and/or retailer to select the items with a high demand forecast accuracy, which can be manufactured at the beginning of the production season. The production of items with low demand forecast accuracy is postponed until a group of large retailers placed their first orders (called the Early Write program). These first orders typically make up approximately 20% of the total orders. Fisher et al. (1994 and 196) show that these first orders can be used to improve the demand forecast for the whole product life cycle. They implemented this method at a supplier in the fashion-ski-apparel market, and showed that markdowns can be reduced substantially. While this procedure was first applied at a manufacturer, a similar procedure may also be used at a retailer, when he/she receives his/her first actual sales data in the new season. Fisher et al. (2001) report how the inventory replenishment of products with a short product lifecycle can be optimized for a retailer, when the retailer has two buying opportunities: an initial buy and a reorder opportunity.

Another tool to quickly evaluate the performance of items that are phasing in is applied by Dunnhumby at Tesco (Hill and Dowle, 2003). The strength of their approach is that they use detailed information on the buying behavior of individual customers. This is possible thanks to the retailer’s customer card, which is providing them with information for more than 10 million customers. When a new product is introduced, they measure not only the sales rate, but also the repeat rate, which is defined as the proportion of customers who come back to the store for the new product. This information enables them to tell within weeks of the launch whether a product is successful or not. To forecast demand, they identify the 10 most similar product launches (in terms of how the repeat rate evolves over time) that have taken place in the same product category in the last 2.5 years. This concept is somewhat similar to the approach taken by Kurawarwala et al. (1996), although the latter approach is based on sales rather than on repeat rates.
Even with a good demand forecast, leftovers are likely at the end of a product life cycle. To prevent this, a markdown policy may be applied. Several models exist in the literature, which deal with issues like the size and the timing of the markdowns. A paper that considers this issue in the context of inventory control at retailers is Smith et al. (1998). An extensive overview on papers related to markdown policies is reported in Tsay (2001).

The promotion items are items that are part of the regular assortment, but are either offered temporarily at a reduced price or offered at the regular price but with additional visibility (e.g. via advertisements or via a special location in the store).

Improvement opportunities reported in the literature are:

- Using marketing intelligence and/or econometric models to forecast demand for the promotion items and their substitutes
- Using a push-strategy with two waves
- Coordinating the promotion with the supplier

For these items, demand should no longer be forecasted based on extrapolation of time series (e.g. via methods like exponential smoothing or moving average, which are typically used when the item is not promoted), but based on marketing intelligence taking into account price-elasticities and/or the impact of promotions and advertising on consumer buying behavior (see Cooper et al. 1999). Since the sales during promotions may well be a (large) multiple of regular sales, promotions should be typically coordinated with external suppliers to make sure enough products are available in time in the retailers’ DC (see Pramatari et al. 2002). For items in the same product category as the promoted item, substitution effects may occur, which have to be taken into account when forecasting their demand (see Huchzermeier et al. 2002).

While regular items are typically pulled by the retail stores, promotion items are typically pushed by a central decision maker. For example, the shipments from the DC may typically be based on a so-called alpha-policy: the items are distributed in two waves, and, in the first wave, alpha % is pushed to the stores. Often, the optimal value for alpha is somewhere between 70 and 80%. A few days after the promotion started, the remaining 20 to 30% is distributed based on the early sales data. This kind of policy has been studied in a non-promotional context by Erkip (1984), Jönsson et al. (1987) and McGavin et al. (1993). An application of the alpha-policy at a Dutch retailer for items on promotion is reported by De Leeuw (1996).

The purchasing driven items are one-time-items that are not part of the regular assortment, but are bought by the Purchasing department. The reason might be that they spotted a special buying or selling opportunity. The