

Grocery Supply-Chain Management: MyGROCER innovative business and technology framework¹

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Abstract

The grocery industry is one of the largest and most important industries in the modern marketplace. Over the past seventy years, supermarkets and grocery stores have evolved into some of the most convenient and diverse businesses in the world. This evolution would not have been possible without effective supply chain management. In reality, nowadays supply chains -especially these of Fast Moving Consumer Goods (FMCG)- conceal numerous inefficiencies existing in the collaboration with trading partners that heavily affect the whole replenishment process. These inefficiencies imply at the same time that there is significant room for further improvements. Therefore, there are opportunities that should be leveraged stemming from real business needs. MyGROCER (Mobile shopping of electronically referenced grocery products) conception derived from the aforementioned needs and provides an effective solution to the inefficiencies of the retail grocery supply chain. The MyGROCER business and technology framework exploits the opportunities that emerging telecommunication and mobile commerce technologies (e.g. WAP, WML, GPRS, UMTS) and automatic product identification technologies (RF-Id) offer, to enable an efficient home replenishment schema, enhance the quality of service offered by retailers and add value to the consumer. This paper discusses the rationale behind this concept, identifies a number of pertinent research themes, and concludes with a critical appraisal of its market potential.

Keywords: Automatic Product Identification; Automatic Home Replenishment; Mobile Commerce; Grocery Retail Sector

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1. INTRODUCTION

The grocery industry is one of the largest and most important industries in the modern marketplace. Over the past seventy years, supermarkets and grocery stores have evolved into some of the most convenient and diverse businesses in the world [1]. This evolution would not have been possible without effective supply chain management. This management must be present at all levels of the supply chain and in all aspects of business in order for it to be truly effective and foster growth and success within the industry [2]. Recent technological and logistical advancements have made supply chain management within the grocery industry even more successful. Things such as electronic data interchange, third party logistics providers, supply chain modelling, and customer relationship management have all helped to further the growth and success of the grocery industry. With the increasing availability of information systems and enterprise resource planning software, supply chain management in the grocery industry is becoming an even more effective tool to help businesses grow. In the future, the most successful businesses in the grocery industry will be those who manage their supply chains the most effectively [3].

Nevertheless, in reality nowadays supply chains -especially these of Fast Moving Consumer Goods (FMCG)- conceal numerous inefficiencies existing in the collaboration with trading partners. These inefficiencies are shown in the following figure (Figure 1).

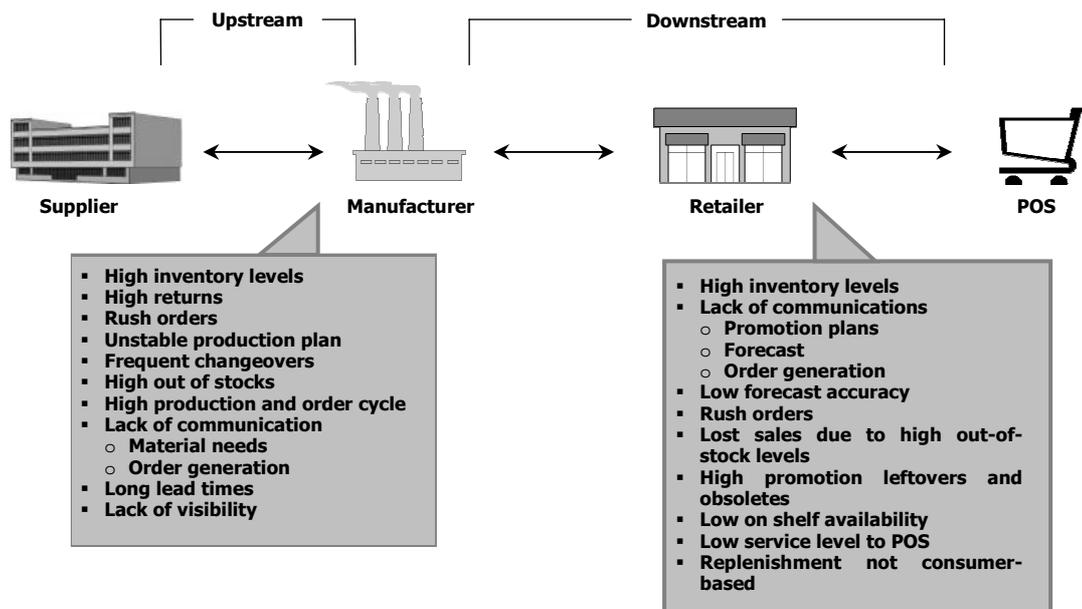


Figure 1: Inefficiencies in Supply Chains (Source: Accenture[4])

From the presented inefficiencies in the upstream side, it is worth mentioning the problem of high out-of-stock situations, the high returns rate, and of course the general long lead times. Accordingly, in the downstream side we should stress the low forecast accuracy, the low on-shelf availability and generally the fact that the replenishment it is not consumer based. On the top of that, because of information problems encountered, there are inefficiencies in the forecast and replenishment process. These inefficiencies can be summarized as follows:

- Firstly, because of the low demand forecast accuracy the trading partners often use increased inventory levels to address unpredictable demand, thus resulting in increased supply chain costs.
- Secondly, there is a high supply variability that is a consequence of unstable process cycle times and it is compensated through time, inventory and capacity buffers in other words more capital investments.
- Thirdly, there is limited visibility of the supply chain due to disconnected systems, limited collaboration among trading partners and reduced information sharing. This limited visibility is particular true for the management of promotional events.
- Lastly, inefficient use of consumer data exists; the replenishment is typically based on estimation centre level, not driven by true consumer demand data. Opportunities to change from a “Make to Stock” to “Make to Order” environment are not realised yet.

It is evident from the previous analysis that there is lot of space for improvements and that the inefficiencies should turn out to be opportunities for the innovators that will leverage the information technology advances. MyGROCER concept -having identified the opportunities that the above inefficiencies imply- aims to provide valuable solutions. MyGROCER’s objective [in full alignment to ECR’s (Efficient Consumer Response) objective²] is to deliver better value to the grocery consumer by using novel RF identification and mobile networking technologies in order to create an environment for automatic product identification, for efficient grocery shopping and product promotion to the extent of automatic home replenishment.

As a result, MyGROCER suggested services will enhance the supply chain with rich information about consumer needs and behaviour as well as with product identification within the store. Moreover, MyGROCER will extend the supply chain beyond in-store Point Of Sales (POS) data by incorporating new entities, such as the consumer’s household and the consumer on-the-move. It should be evident by now that MyGROCER concept consists of value-adding elements that emerged from real business needs and true requirements.

Following in this paper, the emergence of a new business model for the traditional retail sector is presented. This model transforms the way replenishment and shopping is conducted through the introduction of a new mediation platform (MyGROCER). The new mediator will provide the necessary technological infrastructure in-store and at home in order to support a completely new and innovative shopping process. In addition, it will act as a hub that manages and integrates the information generated from the various sources, processes it, and uses it for offering value-added services to the consumers as well as to the entire business network. The project is carried out in close co-operation of a wide number of partners from three European countries (Greece, Belgium and Finland). The international span of the research co-operation is believed to contribute to a wider understanding of the inherently global issues surrounding the retail business and therefore to lead to more informed results of real value (commercial and scholarly alike). MyGROCER is funded by the European Commission as part of the Information Society Technologies (IST) programme [5]. The next section overviews the traditional retail sector, section 3 focuses on the functionality of MyGROCER, while section 4 presents the supportive business & technology framework. Finally, section 5 concludes with a summary of the real advantages and with a critical review on the market potential of the system.

²ECR focuses on the efficiency of the total supply system rather than the efficiency of individual components and aims at reducing total system costs, inventories and physical assets. Emphasis is placed on the application of modern management methods and available technologies in order to achieve a responsive, consumer-driven system, in which customer satisfaction is maximised, costs are minimised, while accurate information and high-quality products flow through a paper-less system between manufacturing line and check-out counter.

2. THE TRADITIONAL RETAIL SECTOR [6]

Anyone considering the grocery retail sector could propose a great number of actors that are involved, directly and indirectly. The traditional supply chain in the grocery retail sector consists of manufacturers, wholesalers, retailers and consumers (figure 2). In the current grocery chain, there is no single co-ordinated replenishment system. Instead, there are separate systems joined by inventory buffers at the retail store and distributor warehouse. In the typical grocery store, the consumer act of replenishing the household does not directly trigger any replenishment activity. The store replenishment activity is only triggered when the shelf stock (or back-room stock, if any) falls to a predetermined re-order point. In the same way, the act of filling an order at the retail store does not trigger any replenishment activity at the distributor's warehouse.

Demand information available to the supplier through the current replenishment system is highly distorted by many factors having nothing to do with actual consumer demand. The information is of little value for production planning decisions and suppliers have to purchase

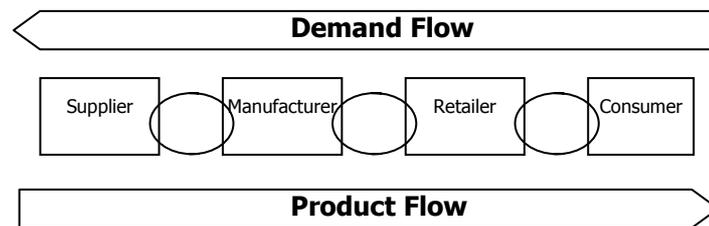


Figure 2: The traditional retail sector value chain

information about consumer buying from other sources, such as POS data deriving either from within the store or purchased from third-parties, surveys results [7], exit polls [8] etc. To compensate for the lack of quality information on which to base sales forecasts, production plans and replenishment schemes, the retail sector emerged into new models of interaction between the key-involved actors. The latest innovation in the grocery industry is the move to e-commerce [9] [10]. These online ventures look to the electronic channel to provide improved personalized service and convenience to specific market segments [11] through the gain of valuable transaction-level consumer information for improved marketing [12]. Kallio, Kempainen, Tarkkala, and Tinnilä [13] identify two types of emerging online grocery models: *the intermediary model*, where the e-grocer offer consumers home delivery from local supermarkets through a web-based interface where the customer can browse the store inventories and order goods and *the channel model*, where the e-grocer creates a new channel that replaces the local supermarket with home-delivery from a distribution centre. Specialized in online business e-grocers, perform the operations of both the wholesaler and the retailer. Although these two models offer centralized services to the end-consumers, they lack the capability of automated replenishment schemas since the consumers should still trigger the replenishment process. Furthermore, these models could not offer an integrated view of the consumer's behaviour both in-store and in-house since they were limited to the shopping transactions within the e-grocer environment. Finally, ubiquity (a core concept for the whole retail and supply management industry [14]) could not be achieved through traditional Internet applications.

3. MyGROCER AS A SOLUTION

MyGROCER mediation platform aims to exploit the opportunities that emerging mobile telecommunication and electronic commerce technologies (e.g. WAP, WML, GPRS) and automatic product identification technologies offer to the retail sector. The main objective of the project is to introduce advanced B2C oriented E-services upon intelligent mobile access devices, enabling full interactivity, personalization and automation of home replenishment activities for products in the grocery retail sector with clear future extent to the retailing sector

in general. The value of the proposed solution becomes apparent when we consider the following three usage scenarios, in-store, in-house and on-the move.

3.1 In-Store Scenario

Innovative wireless networking schemes are implemented inside the supermarket in order to enable the provision of MyGROCER's value-added services. RF-Tags, which comprise of small labels, are replacing traditional barcodes. RF tags uniquely identify each product and are constantly transmitting the "presence" of the product to RF-receivers [15], effectively positioned inside the shopping cart. When the consumer enters the supermarket he logs in MyGROCER through his cart. The system identifies the user and displays his shopping list (missing products) to the shopping cart's display screen. While shopping at the supermarket, the consumer selects products from the shelves as usual. The receivers on the shopping cart can understand when the products are placed in and with the necessary application logic, can also retrieve their price and other information and update the consumer's shopping list from the retailers' servers. The shopping cart may also display in-store promotions that are based on previous consumer buying behaviour or cross-selling product associations. At the check-out counter, there is no need to scan the products again. Instead, the "smart" shopping cart notifies the cashier, sends the shopping-list data to the check-out system and the payment receipt is issued, while the store inventories can be updated. The customer's shopping list information is maintained in the system as point of sales data to be used for future promotional activities.

3.2 Home Scenario

Similar to the supermarket scenario, key-storing locations in the household are inter-networked with RF-Id receivers. If the consumer wants to keep track of his house inventory, he must place the products he bought from the supermarket to these locations. The RF-Id receivers register the "presence" of each individual product and update the inventory in regular intervals. The home scenario prerequisites a "Home Server", either a normal PC or a modified set-top-box with capable storage capability and application logic in order to store the home inventory. As soon as the products are removed from their original location, and not reinstated within specific period of time (possibly defined by the user), a 'replenishment' signal is transmitted to MyGROCER over Internet connection. The consumer can then retrieve his shopping list through his mobile phone and conduct mobile shopping transactions.

3.3 On-The-Move Scenario

Consumers can have access to the generated shopping list (which comprise of products that the system has identified as "missing from the house") through their wireless access devices (PDA, mobile phone etc.). Consumers will be able to administer the shopping list (modify quantities, add new products etc.) and receive at any time information about the total amount they should pay for the selected products. Then, consumers might wish to have home delivery or submit their shopping list to a set of registered supermarkets in MyGROCER database initiating reverse auctioning sequences. Additional value-added services that fall to the on-the-move scenario include notification about products that have ran out-of-stock either at the moment MyGROCER realizes the product's absence or at certain predefined times, advanced product recommendations based on consumers' profile and past buying behaviour, fully automated payment services and on-the-fly management of their profile where the consumers can inform the system about their preferences (e.g. I am vegetarian etc.), definition of high-priority products (for notification reasons), minimum safety-stock product quantities etc.

4. BUSINESS & TECHNOLOGY FRAMEWORK

MyGROCER will transform the way replenishment and shopping is conducted through the introduction of a new mediation platform, which will facilitate the entire process. The core innovative aspect of the project is the introduction of the “Home Continuous Replenishment Process” through the innovative use of “state-of-the-art” technological solutions. The Continuous Replenishment Program of the ECR (Efficient Consumer Response) global initiative in the retail sector [16] can pave the ground for applying this concept on the business-to-consumer relationship. MyGROCER approach is to support this process through more flexible structures (wireless access devices) targeting a significantly extended customer base and not a specific customer segment. After all, Kinsey and Senauer (1996) indicate that the ultimate time-saving convenience may be home shopping [17]. MyGROCER will transform the current business model, with the introduction of the MyGROCER Mediation Service Provider (Figure 3).

The new mediator will provide the necessary technological infrastructure in-store and at home in order to support the new shopping process. In addition, it will act as a hub that manages and integrates the information generated from the various sources, processes it, and uses it for offering value-added services to the consumers as well as to the entire business network. MyGROCER will

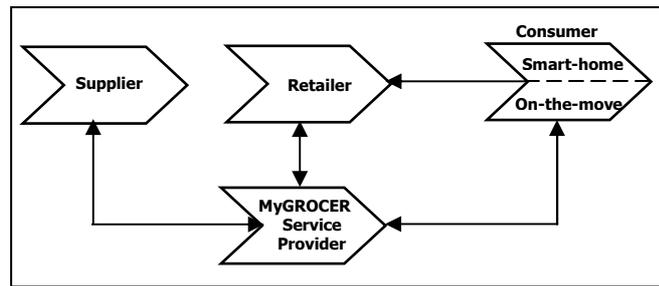


Figure 3: MyGROCER proposed business model

benefit all involved parties in various ways. Consumers will be able to have a new communication channel with retailers using the mediation platform and the proposed infrastructure, which will provide a practical home replenishment schema and new value-added services through their wireless access devices. Retailers will have the opportunity to provide quality services to their customers in-store (elimination of check-out queues, in-store promotions etc) while at the same time they will be able to participate in the new marketplace offering their products and promotions in a contextual and personalized way to the end-consumers. Finally, product suppliers will have the opportunity to monitor product purchasing and usage habits³ in order to better understand consumer needs (anonymously) and enhance their products (or even introduce new ones based on consumer demand) while at the same time place own-label promotions. Apart from the three parties discussed above, it is anticipated that mobile telephone service providers, online banking services and data monitor and advertisement companies will also participate in the emerging marketplace. Their exact role and interactions will be identified during the lifespan of the project. Furthermore, MyGROCER introduces new categories of data such as real-time navigation patterns in-store, current shopping preferences and post buying behaviour, which evolve new concepts to the modern STP (segmentation-targeting-positioning) marketing procedure. MyGROCER provides the opportunity to retailers and suppliers to target their customers on a personalized basis and position their products in a contextual and personalized way according to specific customer needs, wishes, preferences and behaviours in the store and on-the-move. After all, Liebmann [18] observes that while consumers are shopping more, at more outlets, and more often, “...these same consumers repeatedly tell us they are time-pressed and want more convenience- oriented and added value services that will save them time”.

³ It should be noted that MyGROCER will incorporate consumer privacy rights protection principles in accordance with EU legislation and regulatory framework.

In order to provide its innovative services, MyGROCER will converge different technologies (see Figure 4) that range from networking architectures to open, interoperable individual components, WAP-based applications, innovative XML definitions, multidimensional information models, and underlying technology infrastructure (mobile phones, database servers, OLAP technologies, and mobile networks). The core technological innovation that MyGROCER introduces is the use of Radio-Frequency (RF) technology for the products identification. In particular, the project requires the implementation of customized RF-readers capable of scanning the contents of a shopping cart (80cm X 40cm) and specially designed RF-tags with the respective size and material in order to be placed to grocery products.

In addition, Bluetooth & Wireless LAN technologies will be used in order to enable communication between the shopping cart and the retailers system (which includes product information etc.) and track the navigation patterns of the consumers in-store due to their accuracy and high bandwidth capabilities [19]. Furthermore, the operation of MyGROCER is based on the efficient gathering of information regarding missing products (from the household), product offers (from the retailers) and consumer requests for home replenishment. This information is maintained in standardised repositories for brokering purposes. The *Offer Repository* contains standard representations of grocery products explicitly placed by the retailers, while the *Demand Repository* contains the automatically generated shopping lists for each household. Both repositories will be based on XML specifications (comprising a new language called PML – Physical Markup Language) already developed as a result of previous research work from MIT [20].

The overall MyGROCER system consists of a number of inter-related components that can fall into three distinct categories: Information Models, Functional Modules, and Presentation Modules. The overall conceptual architecture of the MyGROCER mediation platform is shown in figure 3.

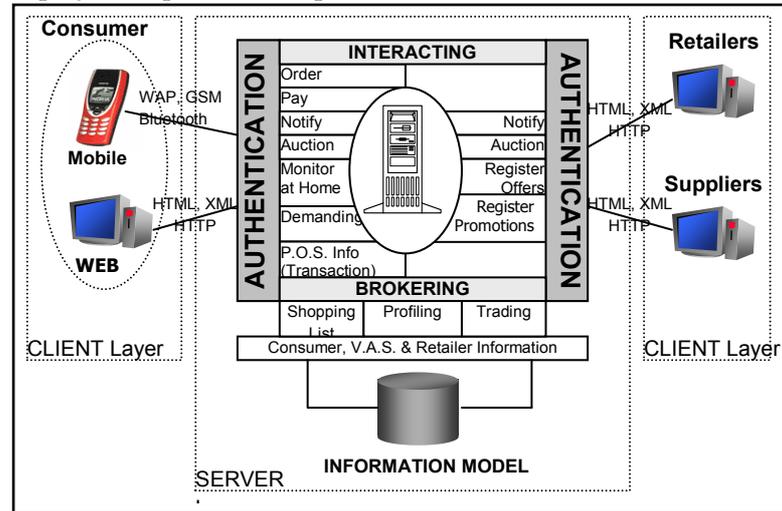


Figure 4: MyGROCER conceptual functional architecture

5. CONSIDERATIONS AND FUTURE ACTIONS

This paper presented the emergence of a new business model for the traditional retail sector, which transforms the way replenishment and shopping is conducted through the introduction of a new mediation platform (MyGROCER). MyGROCER attempts to combine different information technologies with focus to the mobiles services in order to automate the procedures in the retailing sector. More specifically, MyGROCER main advantage lies on the following:

- *Real-time POS data in-store:* Retailers can have an actual snapshot of their in-store inventory whenever they want while suppliers can proceed to ad-hoc orders based on the actual in-store inventory levels.
- *Interaction with the household:* Actual household information can be acquired

- *Efficient sales & orders forecasts*: Sales & Orders forecasts will take into account the actual preferences of the consumers and at the same time information exchanged includes real-time consumption patterns deriving both from in-store & in-house consumer behaviour

The aforementioned features' effect is that we do not know the needs and the behaviour of the consumer within the store (as well as within his/her house), therefore there is an inability to provide true personalised services based on information rich shopping patterns (promotions, useful shopping lists etc.). Moreover, we do not know the 'life pattern' of the actual products within the store and within the house, thus there is an inability to know the instant inventory levels and provide full replenishment services (at store and at home). As far as MyGROCER potential is concerned, we could comment that even though the Internet has been used as a communication channel for the provision of retailing services, its penetration especially in Europe is relatively small. On the other hand, retailers and suppliers in the grocery industry estimate that the market share of these emerging intermediaries will be between 5 and 10 percent in 2005 [21].

Nevertheless, many issues still need to be resolved during the lifespan of the project in order to ensure a viable commercial solution. First of all, the technologies used in MyGROCER are still immature. Especially RF-Id technology is still in its infancy regarding its use in the grocery sector. The problems reside to the fact that no standards exist yet in terms of operating frequencies, signal modulation between the RF-reader and the RF-tag and header information that the RF-tag must contain. However, already some major standardization bodies along with global user groups such as the Global Commerce Initiative [22] are working on the aforementioned issues and a publication of their work is expected in fall of 2001. Another major problem that imposes difficulties to the commercialisation of a similar solution is the cost of each RF-tag which is currently estimated around €0,25 and €1 depending on production volumes [23] making them cost-ineffective for low-priced products, while the RF-readers in 2000 were priced around €1.000 [24]. Nevertheless, forecasts suggest that the price of RF-tags will fall to €0,01 [25] by 2005, while the price of the RF-Readers has already dropped around €500 each. Finally, some technical problems regarding the orientation of the products in the shopping cart in order to be scanned by the RF-Readers still need to be resolved.

The project lasts 20 months and currently is in the design phase. The verification of the results of the project will be achieved through two large-scale national pilot installations in Greece and Finland. The trials are based on the usage scenarios and will be realized through a thorough methodology, which refers to selecting and inviting a group of consumers, preparing and installing the necessary infrastructure and executing the trial scenarios. The trials will play a significant role to the evaluation of the project's results since they will contribute to the user-driven methodology the consortium will follow, thus ensuring that the system that will be finally be implemented will match the actual consumers requirements. To this end, analytical consumers surveys (before and after the trials) based on focus groups will be used in order to support the user requirements of the system and set the design principles. A consumer survey based on the aforementioned methodology (focus groups) has already been conducted in Greece during the analysis phase of the project. The survey aimed to give an understanding on how consumers perceive the MyGROCER concept on their customary way of shopping, assessing the consumers appeal and interest in the proposed scenarios and identification of possible barriers of acceptance in all levels (social, legal, family, etc) in order to anticipate problematic issues and take timely corrective action. The results of the survey were very optimistic and assured the Consortium about the commercial success of the project. Regarding commercialisation, at this stage it is difficult to envisage how MyGROCER will be introduced to the grocery market. Based on preliminary market analysis and feasibility studies, we have concluded that MyGROCER can be marketed as a single integrated product (including the solution for the supermarkets, the mobile commerce transactions and the household integration)

or as different product solutions depending on the market needs and demands. Such products may refer to the three different scenarios (in-store, in-house, on-the-move) or to specific back-end solutions such as the networking infrastructure, the product management application, the shopping list management application, the reverse auctioning solution etc. Feedback from the trials (including consumer feelings and perceptions) will heavily affect the commercialisation of the proposed solution.

REFERENCES

- [1] Food Market Institute, (2001). [<http://www.fmi.org> , visited 14/06/01]
- [2] ECR Europe (2000). [<http://ecrnet.org>]
- [3] ECR Europe / Accenture (2001). "A Guide to CPFR Implementation"
- [4] Accenture, (2001). "mCommerce" [<http://www.accenture.com> , visited 14/03/01]
- [5] Information Society Technologies (IST) Programme, Available online at: www.cordis.lu/ist
- [6] Pramataris K., Doukidis G. (1996), "Exploring Information Systems Potentials in the ECR Context: Developing CMFACTS for P&G Europe"
- [7] Pol, L. and Pak, S., "The use of a two-stage survey design in collecting data from those who have attended periodic special events", Journal of the Market Research Society, Vol. 34 No. 3, 1994, pp. 313-25.
- [8] Moon, N. and McGregor, R., "Exit polls – developing a technique", Journal of the Market Research Society, Vol. 34 No. 3, 1992, pp. 257-68.
- [9] Schwartz E. I. (1997), "The progressive grocer", Wired, September 5, available online at "<http://www.wired.com/wired/archive/5.09/grocer.html>"
- [10] Shook C. (1998), "Lettuce by modem", Forbes, January 12, available online at "<http://www.forbes.com/forbes/98/0112/6101160s1.htm>"
- [11] Palmer J. (2000), "Building a new infrastructure", Food Logistics, July – August supplement, pp. 22-24
- [12] LaPlante A. (1999), "Battle for the fridge", available online at "<http://www.cnn.com/tech/...9904/09/fridgechip.idg/index.html>"
- [13] Kallio J., Kempainen K., Tarkkala M., Tinnilä M. (2000), "New distribution models for electronic grocery stores", Working Paper, LDT – Research Series, Helsinki
- [14] Durlacher Co., "UMTS Report: An Investment Perspective", available online at "<http://www.durlacher.co.uk>"
- [15] Anon. (2), (2000), "RFID makers submit standards plan to ISO", *Logistics Management and Distribution Report*, Vol. 39, No. 5, p. 81.
- [16] ECR Europe (2000a), "ECR in the Third Millennium - Academic Perspectives on the Future of Consumer Goods Industry", Brussels.
- [17] Kinsey, J. and Senauer, B. (1996), "Consumer trends and changing food retailing formats", *American Journal of Agricultural Economics*, Vol. 78 No. 5 pp. 1187-91.
- [18] Liebmann, W. (1998), "The Consumer Paradox", WSL, Strategic Retail, New York, NY.
- [19] Held G. (2000), "Data Over Wireless Networks: Bluetooth, WAP, and Wireless Lans", McGraw-Hill Higher Education
- [20] Brock D. L., "The Physical Markup Language - A Universal Language for Physical Objects", White Paper, MIT Auto-ID Center, available online at: "<http://www.auto-id.mit.edu/pdf/MIT-AUTOID-WH-003.pdf>"
- [21] M. Powell (2000) "A perspective on the key issues in the development of food home shopping in the UK", CIES-Supply Chain for e-commerce and home delivery in the food industry conference handout, May 2000, Berlin, Germany.
- [22] Jordan P., (2001), "Are you ready for Global Standards?", Presentation at 6th Official ECR Europe Conference, Glasgow
- [23] Gould, L.S. (2000), "What you need to know about RFID", *Automotive Manufacturing & Production*, Vol. 112, No. 2, pp. 46-49.
- [24] Smaros, J. & Holmström, J., (2000), "Reaching the consumer through e-grocery VMI", *International Journal of Retail & Distribution Management*, Vol. 28, No 2, pp. 55-61.
- [25] Ashton, K. (2001), "New technologies – Supply Chain Evolution or Revolution?", Presentation at 6th Official ECR Europe Conference, Glasgow.