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Improving the Retail Grocery Supply Chain through Mobile Shopping of Electronically Referenced Products

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Abstract

The grocery industry is one of the largest and most important industries, with supermarkets and grocery stores being amongst the most popular and diverse businesses. This evolution would not have been possible without effective supply chain management. However, contemporary supply chains, especially those of Fast Moving Consumer Goods (FMCG), still conceal numerous inefficiencies, mainly in

the collaboration between trading partners, which heavily affect the overall replenishment process. These inefficiencies imply that opportunities for further improvements can be identified. The MyGROCER concept aims at exploring these opportunities to provide an effective solution to the inefficiencies of the retail grocery supply chain through mobile shopping of electronically referenced grocery products. The MyGROCER business and technology framework exploits the opportunities that emerging telecommunication and mobile commerce technologies, coupled with automatic product identification technologies, provide to enable an efficient home replenishment schema, to enhance the quality of service provided by retailers, and ultimately to 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.

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 (Food Market Institute, 2001). 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 (ECR Europe, 2000). Recent technological and logistical advancements have made supply chain management within the grocery industry even more successful. Advances such as electronic data interchange, third party logistics provision, 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 most effectively (ECR Europe, 2001). Nevertheless, many supply chains, especially those of Fast Moving Consumer Goods (FMCG), still present significant inefficiencies, mainly regarding the collaboration between trading partners (Accenture, 2001).

As far as the upstream-side inefficiencies are concerned, 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, more generally, the fact that the replenishment is not consumer-based. On top of that, mainly because of information problems, 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. Currently, forecasting of consumers demand is based on processing of historical POS data (Chandra et al, 2000), while decision support systems that utilize data warehousing and data mining techniques are being used to process the vast amount of available data (Helms et al, 2000). Nevertheless, these forecasts lack accuracy since demand patterns are constantly changing (Stank et al, 1999), while predicting the future based only on past data assumes that historical patterns will reoccur (Helms et al, 2000). Furthermore, forecasts do not take into consideration the influence of promotions on new and existing products, while competitive pressures in the supply chain might not offer enough time for in-depth analysis (Stank et al, 1999). To this end, store replenishment is typically based on estimation centre level, not driven by true consumer demand data. To overcome this inefficiency, grocery stores usually hold high levels of anticipatory inventory in order to avoid out-of-stock conditions (Chandra et al, 2001). These result to high supply variability that is a consequence of unstable process cycle times and it is compensated through time, inventory and capacity buffers (all requiring additional capital investments). Therefore, specific inventory policies such as JIT, vendor-managed inventory, and so on have been established (Chandra et al, 2001). Still, real-time information about the store's inventory level (including the central warehouse's one) is often simply missing.
- Secondly, there is limited visibility of the supply chain due to disconnected systems, limited collaboration among trading partners, and reduced information sharing.

Furthermore, the downstream-side presents significant factors that influence the so called "shopping experience". Baker (1986) (Baker, 1986) referred to environmental conditions (temperature, scent music and so on), while Fram (1994) emphasized on time-pressure as a factor that influences the shopping experience (Fram et al, 1994). Aylott et al (1998), contributed to the list of problematic issues during a "grocery shopping transaction" through the conduction of a research in the UK comprising 29 focus groups with a total of 239 respondents (Aylott et al, 1998). The results indicated that the majority of the respondents considered queuing (especially during check-out) as the most important stressful factor. Additional factors included information overload (mainly through in-store promotions or advertisements (Bell et al, 1998; Ho et al, 1998; McGoldrick et al, 2000), fragmentation of information and inability to continuously monitor the total price of the products in their shopping cart.

It is evident from the previous analysis that there is ample space for improvements and that the inefficiencies should turn out to be opportunities for the innovators that will leverage the information technology advances. MyGROCER, having identified the opportunities that the above inefficiencies imply, aims at providing innovative and practical solutions. MyGROCER's objective [in full alignment to ECR's

(Efficient Consumer Response) objective¹] 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 aim to 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 mobile consumer.

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, both in-store and at the household, 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 providing value-added services to the consumers as well as to the entire business network. The project is carried out in close co-operation between 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. The next section focuses on the functionality of MyGROCER, while sections 3 and 4 present the supportive business & technology framework. Finally, section 5 concludes with a summary of the proposed innovation and advantages and a critical review on the practical market potential of the system.

2. The MyGROCER Concept & Functionality

MyGROCER is an innovative information system aiming to exploit the opportunities that emerging wireless technologies (such as Bluetooth and WLAN) and automatic product identification technologies provide to the grocery sector. The main objective of the system 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

¹ ECR 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.

sector with clear future extent to the retailing sector in general. The main functionality of MyGROCER can be summarized in three collaborative scenarios: the in-store scenario, the on-the-move scenario and the smart-home scenario. Complementary to these scenarios are the services offered to the retailers and suppliers who take advantage of the information collected and processed by MyGROCER in order to provide fully personalized and enhanced services to the consumers (promotions management, tracking of consumer behaviour and so on). The direct benefits for the retailers and suppliers can be depicted in section 4.

2.1 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, effectively positioned on 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 readers 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. A graphical explanation of the in-store Scenario is included in Figure 1.

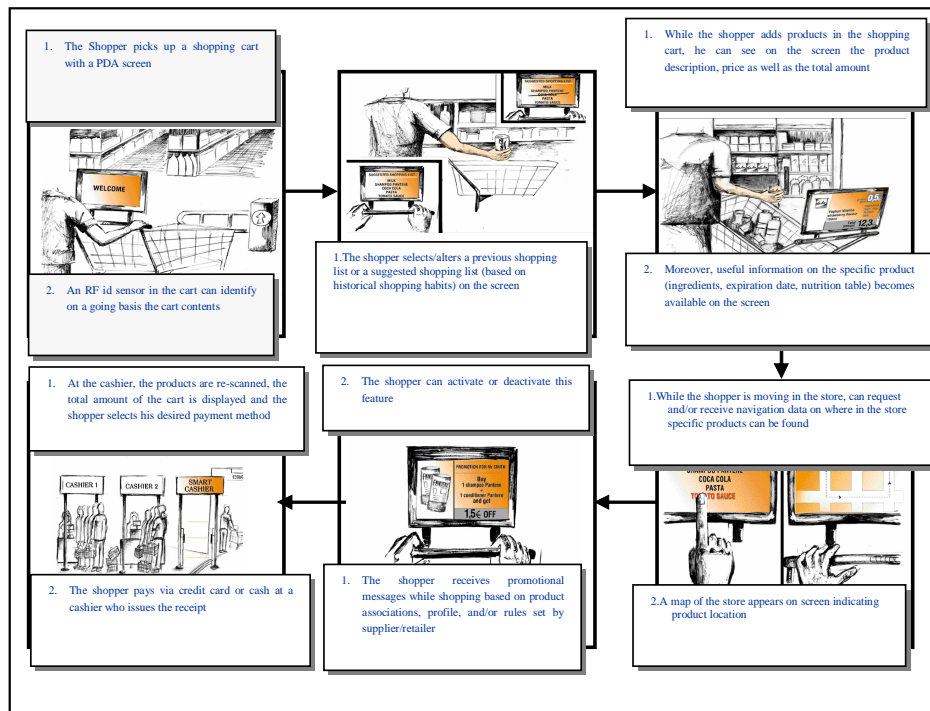


Figure 1: MyGROCER In-Store Scenario

2.2 Smart-Home Scenario

Similar to the supermarket scenario, key-storing locations in the household are inter-networked with RF-Id readers. 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 readers register the “presence” of each individual product and update the inventory in regular intervals. To save energy, readers will be powered-off for the most part of the day and periodically (e.g. every 1-2 hours) will wake-up and scan all items within range. 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 either through his mobile phone in order to conduct mobile shopping transactions or through the shopping cart in-store as a reminder of which products must be purchased.

2.3 On-The-Move Scenario

Consumers can have access to the automatically 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.

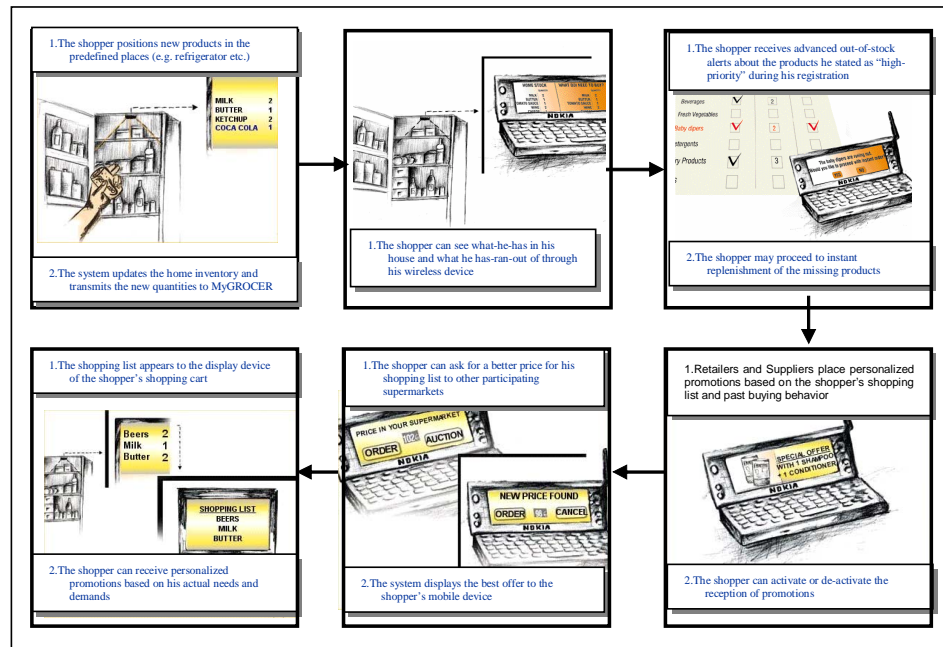


Figure 2: MyGROCER Home & on-the-move Scenario

3. MyGROCER Technical Solution

3.1 MyGROCER Architecture

In order to provide its innovative services, MyGROCER converges different technologies that range from networking architectures to open, interoperable individual components, mobile-based applications, innovative XML communication, 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 (Held, 2000). 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 are based on XML specifications (comprising a new language called PML – Physical Markup Language) already developed as a result of previous research work from MIT (Sarma et al, 2001). In particular, the system consists of an application server responsible for the MyGROCER business logic services e.g. catalogue, order, customer management, an OLAP enabled database server (MS SQL 2000) responsible for maintaining MyGROCER data, manipulating consumers demographics and purchasing behaviour for promotions purposes and providing comprehensive reports to all participating actors, a content transformation server responsible for transforming the XML data from the application server to the native format of the target platform, such as XML to HTML if the target is a browser, XML to WML if it is a WAP phone etc. and Web servers and WAP servers for providing the content to the final recipients. The components of the system are presented in figure 3. The proposed architecture ensures the scalability, openness and seamless deployment of the system in supermarkets with different IT infrastructure since it utilizes XML communication among the devices.

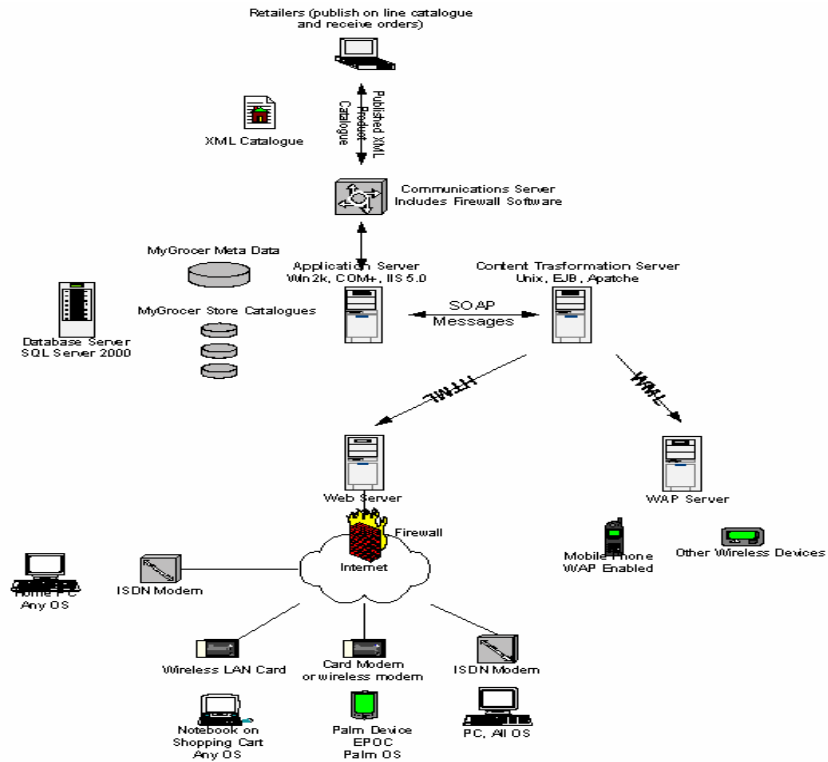


Figure 3: MyGROCER Architecture

The Consortium, envisages that MyGROCER will be able to communicate with a variety of devices ranging from PDAs or ruggedized PCs (in-store), to PDAs / WAP phones (on-the-move) and traditional personal computers mainly for administration purposes.

3.2 The Use of RF-ID in MyGROCER

The Radio Frequency Identification (RF-ID) system is a critical part of the MyGrocer project. Data collected by this system will be used to drive all the higher-level applications (shopping list management, promotions etc.). In the supermarket environment, items equipped with RFID tags instead of bar codes will be recognized by RF-ID readers as they are thrown by the customer into the shopping cart and this information will be passing instantly from the shopping cart to the main server via a wireless technology (WLAN or Bluetooth depending on the supermarket and the existing infrastructure). The server can use this information immediately for promotions, inventory control, and further improvement of customer in-store experience (such as reduction of check-out queues). Furthermore, the properly installed house readers (in the consumer's household) will keep a list

of items in-stock and transmit replenishment information to the MyGROCER server, when necessary, via the Internet. The customer can then have his / her shopping list transmitted to his / her mobile device from the server, accompanied with other value-added possibilities (e.g. personalized promotions, reverse auctioning etc). The use of RF-ID tags in MyGROCER can be summarized in a two-fold perspective: the RF-system of the shopping cart and the role of the RF-tags themselves.

Regarding the RF-system of the shopping cart, MyGROCER proposes the installation of 4 readers on the top of the shopping cart with the purpose to identify products when they are placed into the shopping cart. Each reader covers only a part of the top, open space of the cart, and by that means the combination of all four creates a *thin two-dimensional layer*. To this end, when a consumer places a product inside the cart, the system reads its tag once and the shopping cart application modifies a flag that stores the current “*state of presence*” for this product. Furthermore, the system parses the ID of the tag, extracts the barcode and transmits it to the retailer’s database in order to identify the description and price of the product. If the consumer wishes to remove the product from the cart, the thin layer on the top reads again the tag and performs the same operations but identifies that the product has been already scanned (through the “*state of presence*” flag), therefore must be removed from the consumer’s shopping list. It should be noted that in order to minimize the transmission of barcodes to the central database, a *cache memory* implemented locally on the shopping cart application stores gradually the association of barcodes and prices. The cache memory is automatically cleared at the beginning of each day. The range of the readers will be adjusted to 10-15 cm. A longer range would introduce the problem of false identification of products by nearby shopping-carts or even the shelves of the supermarket.

Regarding the RF-tags that will be produced during the lifespan of the project, an international accepted standard must be adopted in order to eliminate as much as possible the use of incompatible systems by manufacturers and retailers. To this end, passive, self adhesive tags with significant memory capabilities (19 bytes) will be used for our prototype solution. The contents of the tag will follow the guidelines stated by international standards organizations and global working groups (such as the Global Commerce Initiative – GTAG project (Global Commerce Initiative, 2001)). Nevertheless, since these results are not yet finalized, the Consortium has decided to initially store inside the tag the barcode and lot number of each product. Furthermore, each tag will contain a unique serial number in order to ensure that each product will be uniquely identified. Furthermore, for security reasons, at the time an item passes *initially* through the top of the cart, the reader transmits a command that disables a *security bit (EAS)*. To this end, the system ensures the legitimate possession of the item by the consumer even outside the store. If the consumer changes his mind and wants to return the item back on the shelf, the item is removed from the shopping list as described above, and the reader re-enables the security bit as the item passes in front of it.

4. Business Model Innovation

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 *information sharing and collaboration* in terms of POS data, consumers' preferences and so on among the grocery value chain. This sharing of data among the value chain facilitates the replenishment process for both the retailers and the consumers. Currently, ECR has introduced the CPFR initiative (collaborative planning, forecasting and replenishment) whose main objective is to make inventory management more efficient and cost-effective by proposing a set of discrete steps to enable efficient inventory management which requires total cooperation between the actors of the supply chain in order to exchange sales and orders forecasts (Stank et al, 1999). Nevertheless, CPFR streamlines the replenishment between supermarkets, warehouses and suppliers, while MyGROCER automates the complete replenishment lifecycle by the consumers. After all, Kinsey and Senauer (1996) indicate that the ultimate time-saving convenience may be home shopping (Kinsey et al, 1996). Indeed, 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. Most of the CPFR steps (namely joint promotions and sharing of POS information) are considered as prerequisite for MyGROCER in order to provide its full scale of services.

MyGROCER will transform the current business model, with the introduction of the MyGROCER Mediation Service Provider (Figure 4). 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. It should be noted that MyGROCER will operate complementary with the existing business models in the grocery retail sector namely the existing marketplaces such as TRANSORA and so on. The exact nature of cooperation among them will be investigated during the commercialisation phase of the project.

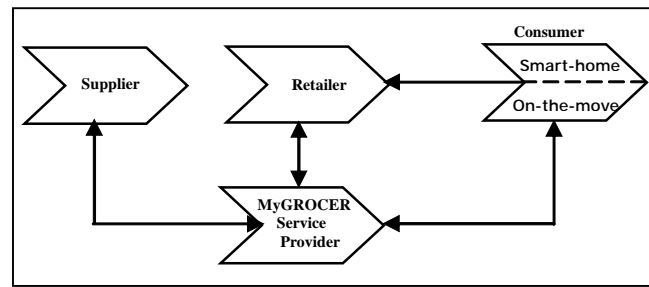


Figure 4: MyGROCER proposed business model

MyGROCER will 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 habits² 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. 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 (1998) 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" (Liebmann, 1998).

5. Considerations and Future Research

This paper has discussed the emergence of a new business model for the retail sector, which aims at transforming the way traditional replenishment and shopping is conducted, through the introduction of a new mediation platform. MyGROCER attempts to combine information technologies, focusing on mobile services and applications, in order to automate replenishment procedures in the retailing sector. More specifically, the main advantages of the proposed concept lie 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.

² It should be noted that MyGROCER will incorporate consumer privacy rights protection principles in accordance with EU legislation and regulatory framework.

- *Interaction with the household:* Actual household information can be acquired and utilized to enhance both the shopping experience within the store and, perhaps more importantly, to seamlessly integrate the end consumer in the supply chain. This, long anticipated, ability to extend the traditional supply chain of the retail industry beyond the POS to include the consumer is perhaps the greatest innovation and contribution of MyGROCER.
- *Efficient sales & orders forecasts:* Sales and order forecasts will take into account the actual preferences of the consumers. At the same time, information exchanged includes real-time consumption patterns deriving both from in-store and in-house consumer behaviour.

Nevertheless, many issues still need to be resolved during the lifespan of the project in order to ensure a viable 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 on the fact that no standards exist yet in terms of operating frequencies, signal modulation between the RF-reader and the RF-tag, and the header information that the RF-tag must contain. Furthermore, the packaging material plays a significant role on whether the reader will be able to read the tag or the signal will be 'absorbed' by the material. Another major problem that imposes difficulties to the immediate commercialisation of a similar solution is the cost of each RF-tag, which is currently estimated to be between €0,15 and €1 depending on production volumes (Gould, 2000) making RF-tags cost-ineffective for low-priced products. At the same time, the RF-readers in 2000 were priced around €1.000 (Smaros et al, 2000). Nevertheless, forecasts suggest that the price of RF-tags will fall to €0,01 (Ashton, 2001) by 2005, while the price of the RF-Readers has already dropped to around €500. 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.

These issues, as well as many others that could not be addressed in this paper due to space requirements, are addressed by the ongoing MyGROCER project. 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 discussed in section 2 and will be realized through a methodology that 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 test whether the pilot system is actually matching the consumer requirements and at the same time is beneficial to the retailers and suppliers.

To this end, analytical consumers surveys (before and after the trials) will be pursued in order to support the user requirements of the system and set the design principles. A consumer survey based on focus groups has already been conducted in Greece during the analysis phase of the project. The survey aimed to provide an understanding of how consumers perceive the MyGROCER concept in comparison to their customary way of shopping. At the same time, it provided valuable information on assessing the consumer appeal and interest in the proposed

scenarios, as well as identification of potential barriers of acceptance at all levels (social, legal, family, etc.) in order to anticipate problematic issues and take timely corrective action. The survey involved a total of four focus group discussions in Athens with consumers responsible for their household shopping. The respondents included both couples (25-37 and 38-50 years old) and women (25-34 and 35-50 years old). The participants were exposed to specific material of selected usage scenarios and services offered by MyGROCER system in-store and on-the-move (paper mock-up of MyGROCER system and services), and then the moderator encouraged them to talk about their thoughts, feelings and reactions to this material, as well as to express their beliefs concerning how these scenarios could influence their attitudes and purchase behaviour. For evaluation and analysis purposes, all groups were audio and video taped upon respondents' permission.

The results of the survey were very optimistic and re-confirmed the potential of strong commercial success of the project. The in-store scenario presented identifiable benefits for the consumers who perceived it as an additional service ("shopping of the future"), under the scope of making shopping easier, well informed, more amusing and much less time consuming. Yet, it was clear that the effect of personal data implications should be carefully examined not only in legal terms but also in communicating the service to consumers. Consumers should be gradually familiarized with the technology and concept idea in order to avoid provoking defensive attitudes. Thus, it was suggested that the service should be presented as a means for customization to adapt to different shopper profiles, become optional, user-friendly, and relate to direct economic benefits for the whole family. In this context, the preference list should take the form of most recent shopping list, presented perhaps as a checklist for necessity items. On the other hand, consumers were reluctant to use the in-home scenario due to privacy reasons. The issue of trust and privacy is extremely important especially if we consider that we constantly need information regarding the consumers' current location in-store, past consumption patterns, household information, demographic data and so on in order to provide fully personalized services. This issue becomes more important in the smart-home scenario where the consumers should allow the installation of RF-Readers in their household. Traditionally, data protection legislation in most EU countries prohibits the capture and storage of any person-related data and only allows exceptions for clearly defined purposes after which the data must be destroyed (Davies et al, 2002). In our case, we allowed consumers to deactivate the provision of personalized services and at the same time participate to the system without providing their full set of personal information. However, this is not the solution to the general problem of trust and privacy. We expect that consumers will eventually be willing to adopt such applications only if they perceive that they are getting better value in return for letting go some of their privacy.

As a conclusion, the market research suggested that a good starting point would be the gradual adopting of the in-store scenario, its benefits communicated clearly to consumers without any particular obligations and effort on their behalf to earn their trust and interest. To this end, the in-home scenario is related to market niches (busy professionals, travelling, disabled people or special situations). In order to

avoid that, consumer education and easy-to-handle technology should be the basis of the proposition, in order to appeal to the mainstream shopper. Regarding the on-the-move scenario, it was considered as useful especially for people with limited time or physical disabilities. Nevertheless, a separation between these two scenarios (in-home & on-the-move) should be taken into consideration for a possible commercialization of the MyGROCER solution. As a conclusion, upon establishment of the in-store scenario the in-home proposition could be reexamined at a time when there is evidence that consumers are well familiarized and appreciative of the new high-tech shopping/ replenishment procedures.

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References

- Accenture, (2001). "mCommerce" [<http://www.accenture.com> , visited 14/03/01]
- Ashton, K., "New technologies – Supply Chain Evolution or Revolution?", Presentation at 6th Official ECR Europe Conference, Glasgow, 2001
- Aylott, R., Mitchell, V.: "An exploratory study of grocery shopping stressors", *British Food Journal*, Vol. 101, No. 9, 1999, pp. 683-700
- Baker, J.: "The role of the environment in marketing services: The consumer perspective", in Czepeil, J. A., Congram C. A. and Shanahan J. (Eds), *The Services Challenge: Integrating for Competitive Advantage*, American Marketing Association, (Chicago 1986), pp. 79-84
- Bell, D. R., Lattin, J. M.: "Shopping behavior and consumer preference for store price format: Why "Large Basket" shoppers prefer EDLP", *Marketing Science*, Vol. 17, No. 1, 1998. pp. 66-88
- Brewer, A., Sloan N. and Landers, T.L., "Intelligent tracking in manufacturing", *Journal of Intelligent Manufacturing*, Vol. 10, 1999, pp. 245-250.
- Chandra, C. and Kumar, S., "Taxonomy of inventory policies for supply-chain effectiveness", *International Journal of Retail & Distribution Management*, Vol. 29 No. 4, 2001, pp. 164-175.

- Chandra, C. and Kumar, S., "Supply chain management in theory and practice: A passing fad or a fundamental change?", *Journal of Industrial Management & Data Systems*, Vol. 100 No. 3, 2000, pp. 100-113.
- Davies, N., Gellersen, H. W.: "Beyond Prototypes: Challenges In Deploying Ubiquitous Systems", *Pervasive Computing*, Vol. 1, No. 1, 2002, pp. 26-35
- ECR Europe / Accenture (2001). "A Guide to CPFR Implementation"
- ECR Europe (2000). [<http://ecrnet.org>]
- Food Market Institute, (2001). [<http://www.fmi.org> , visited 14/06/01]
- Fram, E. H., Ajami, R., "Globalization of markets and shopping stress: cross-country comparisons", *Business Horizons*, Vol. 37, No. 1, 1994, pp. 17-23
- Global Commerce Initiative: "The GCI Intelligent Tagging Model, An examination of product and supply chain opportunities", available online at <http://www.globalcommerceinitiative.org> (May 2001)
- Gould, L.S., "What you need to know about RFID", *Automotive Manufacturing & Production*, Vol. 112, No. 2, 2000, pp. 46-49.
- Held G. (2000), "Data Over Wireless Networks: Bluetooth, WAP, and Wireless Lans", McGraw-Hill Higher Education
- Helms, M.M., Ettkin, L.P. and Chapman, S., "Supply chain forecasting: Collaborative forecasting supports supply chain management", *Journal of Business Process Management*, Vol. 6 No. 5, 2000, pp. 392-407.
- Ho, T., Tang, C. S., Bell, R. B.: "Rational shopping behavior and the option value of variable pricing", *Management Science*, Vol. 44, No. 12, 1998, pp. 145-160
- Kinsey, J., Senauer, B., "Consumer trends and changing food retailing formats", *American Journal of Agricultural Economics*, Vol. 78 No. 5, 1996, pp. 1187-91.
- Liebmann, W., "The Consumer Paradox", WSL, Strategic Retail, New York, NY, 1998
- McGoldrick, P. J., Betts, E. J., Keeling, K. A.: "High-low pricing: Audit evidence and consumer preferences", *Journal of product & brand management*, Vol. 9, No. 5, 2000, pp. 316-324
- Sarma S., Brock D, Engels D., "Radio Frequency Identification and the Electronic Product Code", *IEEE Micro*, November-December 2001, pp. 50-54
- Smaros, J., Holmström, J., "Reaching the consumer through e-grocery VMI", *International Journal of Retail & Distribution Management*, Vol. 28, No 2, 2000, pp. 55-61.
- Stank, T.P., Daugherty, P.J. and Autry, C.A., "Collaborative planning: Supporting automatic replenishment programs", *Journal of Supply Chain Management*, Vol. 4 No. 2, 1999, pp. 75-85.