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3 - 6 August 2009,
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Welcome from the Rector of University of Indonesia

I am honoured to have the opportunity to officially welcome you to the 11th International Conference on QiR (Quality in Research) 2009. The conference provides an excellent forum for engineering professionals, business executives, industry practitioners, and academicians to exchange ideas and to share their experience, knowledge and expertise with each other. I believe the participants will also learn about the latest trends in the development of new tools, knowledge and skills in various engineering design and technology.

As we agree that engineering products or projects bring together resources, skills, technology and ideas to achieve business objectives and deliver business benefits and it comes in all shapes and sizes from the simple and straight-forward to the large and unmentionably complex, thus we need an application of knowledge, skills, tools, and techniques necessary to develop and successfully execute the products or projects plan so it will meet or exceed our customer and stakeholder needs and expectations.

The ultimate concern of engineering product or project is three-fold: the product/project meeting its targets and purposes, the product/project on schedule, and the product/project cost within budget. As the Indonesian economy is growing, local enterprises are obliged to upgrade their skills in innovation and product design. There are also increasingly aware of the importance of professionalism in various engineering areas for industries needs and many professionals are keen to upgrade their capability.

Having said that, I hope this conference can be a kick-off for strengthened our action and partnerships on creating a platform for us; national and international thinkers, academics, government officials, business executives and practitioners, to present and discuss the pivotal role of engineers in the achievement of excellence organizations.

I am sure you will find the 11th International Conference on QiR (Quality in Research) 2009 both informative and stimulating. I would like to thank the Faculty of Engineering, University of Indonesia for organizing this meaningful and timely event, and the supporting organizations for their participation and contributions. With this, I wish you all a fruitful conference. Thank you.

Prof. Dr. der. Soz. Gumilar Rusliwa Somantri
Rector of University of Indonesia
University of Indonesia

Welcome from Dean of Engineering
University of Indonesia

On behalf of the Faculty of Engineering, University of Indonesia, it is my greatest pleasure to extend our warmest welcome to all of you to the 11th International Conference on QiR (Quality in Research) 2009. As we know that this conference is conducted to cover a wide range of engineering design and technology issues. I hope these four days of the conference will be spent in interesting discussion and exchange of ideas. I also hope this conference would be able to provide a state-of-the-art information and knowledge in the challenging world of engineering design and technology. The growing success of our institutions and expertise should urge us to develop our competitive capabilities, especially as we face certain challenges which would be overcome with more hard work and working together hand by hand. We will work together to develop a common path and collaboration opportunities for future action and research on multi disciplinary engineering areas.

I am delighted that you have accepted our invitation to this conference in such large numbers as indicated that we will have many international keynote speakers' lectures and papers from various countries to be presented and discussed during these two days conference. We will explore various engineering techniques and tools in various industries that can be used to build better stakeholder performance and relationships, to enable us to create wealth through innovation, to promote productivity through technology, and to foster our collaboration.

I would like to thank you to our sponsors, supported bodies and various contributors for their generous support of this conference. I would also like to thank our distinguished speakers for agreeing to share their insights with us. To our friends from overseas and other provinces of Indonesia, I would also like to extend a warm welcome to you and wish you an enjoyable stay in Jakarta. Last but not least, I would invite you to join me in thanking the committed staff that made this conference happen and to make it a success.

I wish you a very pleasant stay here in Jakarta and a successful and productive discussion at the conference. Thank you.

Prof. Dr. Bambang Sugiarto
Dean of Engineering University of Indonesia

Welcome from the QiR 2009 Organizing Committee

On behalf of the Organizing Committee, it is my greatest pleasure to extend our warmest welcome to all of you to the 11th International Conference on QiR (Quality in Research) 2009.

I am sure that you will all find this conference stimulating and rewarding. As we are aware of, the impact of globalization has resulted in a very competitive business environment that makes the fulfillment of customer/clients' ever-sophisticated project or product or service needs most challenging. Without any doubt, a good engineering design and technology is powerful in helping our industries to enhance their productivity and competitiveness. Thus, it is our aim and hope that the conference would be able to provide an international forum for exchange knowledge and research expertise as well as to create prospective collaboration and networking on various fields of engineering and architecture.

With its continuous presence in the last 11 years, QiR has become an icon of Faculty of Engineering University of Indonesia in serving the objectives to provide engineering excellence for both national and international needs. The QiR 2009 consists of 2 special issues and 4 symposia covering almost all aspect in engineering, design and architecture. I am delighted to inform you that we have such large numbers of participants today as indicated that we will have 7 keynote speakers' presentation and more than 240 papers from various countries to be presented and discussed during these two days conference. We are fortunate to have a lot of good quality of papers that belongs to:

70 papers on Radio Frequency Identification (RFID) as a Bridge between Computing and Telecommunication
36 papers on Green Infrastructure for Sustainable Development and Tropical Eco-Urbanism.
56 papers on Industrial Engineering Approach for Productivity Improvement
56 papers on Advanced Materials and Processing
30 papers on Energy Conservation through Efficiency in Design and Manufacturing

I would like to thank you to various contributors, speakers and participants for your generous support of this conference. It is my pleasant duty to thank all the members of Organizing Committee and the International Board of Reviewers for their advices and help. We are grateful to all the Sponsors, Supporters and Exhibitors for their spontaneous response and encouragement by way of committing funds and extending help in kind.

I would like to sincerely thank the Dean of Engineering, for fully supporting the Committee and providing all supports to make this conference happen and to make it a success.

I wish you a very pleasant stay here in Jakarta and finally, let me wish all of you a meaningful and fruitful conference. Thank you and hope to see you again in QiR 2011.

Dr. Bondan T. Sofyan
Organizing Chairperson of QiR 2009

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IMPACT OF RFID TO RETAIL SUPPLY CHAIN COLLABORATION

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ABSTRACT

The retail industry is experiencing problems in the supply chain because there is no formal collaboration between the retailer and supplier. Retailers need innovative ways to differentiate themselves in highly saturated and cluttered markets. Demand uncertainty in the supply chain, known as the "bullwhip effect," results in excess inventory and inefficiencies in the supply chain. Demand forecasts and orders are often distorted unless they are developed jointly by the partners. These factors create a need for supply-chain integration and a way to provide supporting collaborative forecasting and replenishing processes, with the goal of increasing sales and reducing inventory investments and cycle time. Collaboration can reduce waste in the supply chain, but it can also increase market responsiveness, customer satisfaction, and competitiveness among all of the members of the partnership. Radio Frequency Identification (RFID) provides a major advantage to supply chain management. Implementing supply chain collaboration along with RFID can enable retailers to achieve the best level of business performance. Retailers can expect extensive inventory and labor-cost savings. RFID has the most potential to offer in streamlining the value-chain management, but handling the amount of data by RFID in the retail industry limits the potential of RFID benefits. In this paper, we explore RFID and propose a research agenda to address a series of broad research questions related to how RFID technology: 1) is developed, adopted, and implemented by retail; 2) is used, supported, and evolved within organizations and alliances; and 3) impacts individuals, business processes, organizations, and markets.

Keywords : business value, supply chain collaboration, diffusion of innovations, radio frequency identification, technology adoption.

1. INTRODUCTION

The traditional retail supply chain consists of all the parties involved directly or indirectly in fulfilling a customer request, including manufacturers, suppliers, transporters, warehouses, retailers, and the customers themselves [9]. Each retail supply-chain entity includes functions like product development, marketing, operations, distribution, finance, and customer service. The only information that is available to the supplier is the purchase order issued by the retailer. Because there is no overall picture of the external demand that is placed by customers, inventory can increase at every level of the supply chain. The main goal of each member of the supply chain is to reduce unwanted inventory levels and increase ROI [13].

Since the early 1990s, there has been a growing understanding that supply chain management should be built around the integration of trading partners [6], the sharing of information and benefits [15] and the collaboration of organizations [16]. Supply chain collaboration as understood today has begun to take form since the mid-1990s, when the forms of collaboration multiplied [17] and new forms of information sharing extended their focus to include not only a passive exchange of information between partners, but also a more proactive approach through common planning and synchronisation of activities and business processes [21], taking advantage of innovative technologies. Anthony [3] suggests that supply chain collaboration occurs when two or more companies share the responsibility of exchanging common planning, management, execution, and performance measurement information. Bowersox et al. [8] state that firms collaborate in the sense of leveraging benefits to achieve common goals.

Supply chain collaboration in retailing and Fast Moving Consumer Goods industry (FMCG) has mainly been expressed in the form of practices such as Vendor Managed Inventory (VMI), Continuous Replenishment Program (CRP), and Collaborative Planning, Forecasting and Replenishment (CPFR). VMI is probably the first trust-based business link between suppliers and customers [6], whereby the manufacturer (supplier) has the sole responsibility for managing the customer's inventory policy, including the replenishment process, based on the variation of stock level in the customer's main warehouse or distribution center [11]. CRP moves one step ahead of VMI and handles the inventory policy not only with the variations of inventory levels at the customers' main stock-holding facility but also with sales forecasting, based on point-of-sales (POS) data from the retailer's stores [1]. Collaborative Planning, Forecasting and Replenishment (CPFR) can be seen as an evolution from VMI and CRP, addressing not only replenishment but also joint demand forecasting and promotions planning, focusing on promotions and special-line items [12]. CPFR is based on extended information sharing between retailer and supplier, including POS data, forecasts and promotion plans. Pramatari et al. [18] further suggest a new form of CPFR, named Process of Collaborative Store Ordering (PCSO), addressing the daily store replenishment process. This process is supported by special IT infrastructure (a web collaborative platform) allowing: the daily online sharing of store-level information (e.g. POS data, store assortments, stock level in the store, promotion activities, out-of-shelf alerts, etc), the sales forecasting and order generation, the online collaboration of the trading partners,

and finally the order exchange and order status tracking. Based on these short descriptions, VMI and CRP are more about efficient replenishment and supply, whereas CPFR puts more emphasis on the demand side.

There is a clear evolution path in the capabilities and sophistication of the Information Technology (IT) infrastructure supporting all these collaboration practices, in the amount of information exchanged between the trading partners and in the process(es) enabled by this information sharing supporting former versus later forms of collaboration. Compared to the traditional ordering process, VMI/CRP and CPFR highly increase the total volume of information transmitted between retailers and suppliers on a daily basis. The volume of information exchanged and the intensity of interaction are expected to further increase dramatically when the advanced data capture capabilities of Radio Frequency Identification (RFID) technology coupled with unique product identification and real-time information gathering are employed. The emergence of RFID is expected to revolutionize many of the supply chain processes, especially those involving collaborating partners (Prater et al., 2005). Figure 1 [17] below summarizes the evolving path of supply chain collaboration practices in retail and the underlying information technologies that have enabled this collaboration over time.

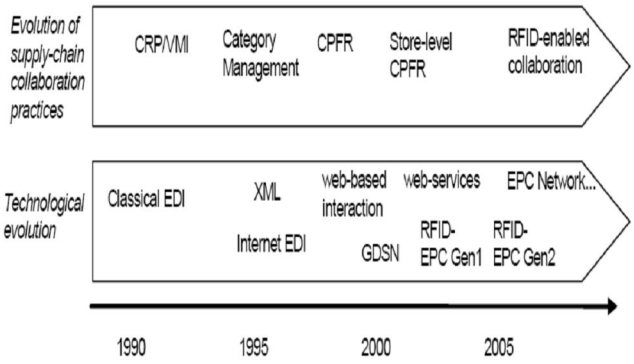

Figure 1: Evolution of supply chain collaboration practices and enabling technologies in retail industry

In this context, this paper proposes eight RFID-enabled supply chain collaboration services (e.g. dynamic pricing, smart recall, in-store promotion management, outof-shelf response) in a networked retail business environment. The services are characterized, on a high-level, by the information shared between retailers and suppliers, the level of tagging (pallet/case/item level) and the location of the tag readers. However, this paper presents the first findings of a research-in-progress with the ultimate purpose to assess and categorize the RFID-enabled supply chain collaboration scenarios according to four dimensions: the extent of collaboration required between retailers and suppliers, the RFID technology requirements, the transformation of existing (or the introduction of new) processes and the business performance impact of the RFID-enabled collaborative service.

2. SUPPLY CHAIN COLLABORATION

Collaboration is defined as two or more companies sharing the responsibility of exchanging common planning, management, execution, and performance-measurement information [3]. The critical step that many companies have not been able to take so far is to incorporate customer-demand information into their production and inventory-control processes. Companies that collaborate typically exchange information on a high level, but the production planning process remains unchanged, which eliminates the opportunity for a radical improvement of the dynamics in the supply chain. In our view, the critical feature is not only to exchange information, but to alter the replenishment and planning decision structure. The demand at the retailer drives the combined inventory and production control process, together with feedback on complete supply-chain inventory, rather than at individual tiers in the supply chain [13].

Manufacturers must secure and emulate the cooperation and dedication of relevant supply-chain partners to adapt in the most cost-effective way. Effective adaptation requires nearly real-time access to reliable, dispersed information to make quick, accurate, proactive decisions that can dramatically improve supplychain performance. True collaboration goes far beyond sharing forecasts and automating the purchase order (PO) process. It requires sharing data regarding sales orders, manufacturing runs, inventory levels, and purchasing activities, see figure 2 [13]. One solution for this particular task is called the Collaborative Planning, Forecasting, and Replenishment (CPFR) process. CPFR is defined as “an initiative among all participants in the supply chain intended to improve the relationship among them through jointly managed planning processes and shared information” [12].

Figure 2 : Sharing forecasts and automating the purchase order (PO) process

The Strategy & Planning cycle establishes the ground rules for the collaborative relationship, determines product mix and placement, and develops event plans for the period (Figure 3). The Demand & Supply Management cycle projects consumer (point-of-sale) demand, as well as

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order and shipment requirements over the planning horizon. The Execution cycle places orders, prepares and delivers shipments, receives and stocks products on retail shelves, records sales transactions, and makes payments. The Analysis phase monitors planning and execution activities for exception conditions, aggregates results, calculates key performance metrics, shares insights, and adjusts plans for continuously improved results. While these collaboration activities are presented in logical order, most companies are involved in all of them at any moment in time.

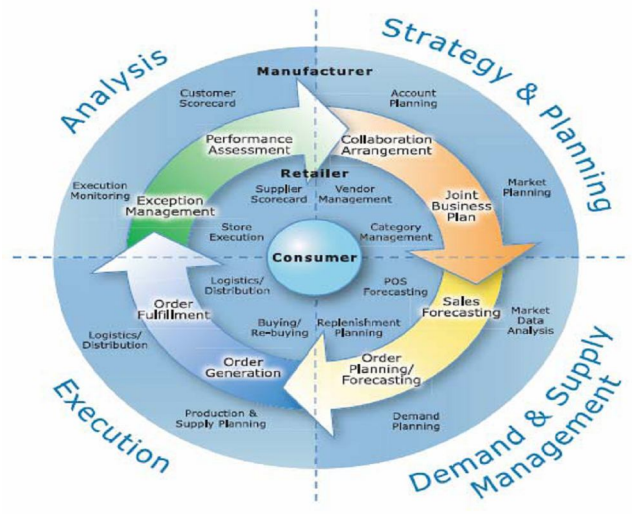

Figure 3 : The Strategy & Planning cycle establishes the ground rules for the collaborative relationship

There is no predefined sequence of steps. Execution issues can impact strategy, and analysis can lead to adjustments in forecasts. This clearly illustrates that CPFR complies with the supply-chain collaboration principles, yet there are issues that hinder the development of true supply-chain collaboration. There is a gap between the true customer demand and the inventory at any time. There is still no visibility of the product through the supply chain; the retailer still experiences out-of-stock conditions; and customers are unsatisfied [22].

3. ADOPTING RFID IN SUPPLY CHAIN

Radio Frequency Identification (RFID) is a generic technology concept that refers to the use of radio waves to identify objects (Auto-ID Center, 2002). The core of RFID technology is the RFID transponder (tag) – a tiny computer chip with an antenna. Consumer good suppliers attach these tags to logistic units (palettes, cases, cartons and hanger-good shipments) and, in some cases, to individual items. Logistic units and individual items are identified by the Electronic Product Code (EPC). An RFID reader is used to identify the EPC stored on the RFID tag (Loebbecke, 2007). The antenna enables the microchip to transmit the object information to the reader, which transforms it to a format understandable by computers (Angelles, 2005). Finkenzeller (1999) provides a general overview of RFID technology while Sarma (2002) describes the specific technology for supply chain management.

Nowadays, many in the retail sector are already looking to the business case of RFID as the "next generation of barcode" through its capabilities to uniquely identify, track and trace consumer products along the entire supply chain requiring neither direct human contact nor line of sight, to store much more information and to enable a broad spectrum of supply chain applications ranging from upstream warehouse and distribution management down to retail-outlet operations, including efficient inventory management, shelf management, promotions management and innovative consumer services, as well as applications spanning the whole supply chain, such as product traceability (Sarma et al., 2002, Loebbecke, 2007). Although RFID technology is still emerging, RFID adoption is pushed by major retailers (RFID journal, 2003) which are already executing a number of pilot applications.

The benefits of RFID adoption in various application areas can be sought across the following axes (Pramatari, 2006): 1) the automation of existing processes, leading to time/cost savings and more efficient operations; 2) the enablement of new or transformed business processes and innovative consumer services, such as monitoring of product shelf availability or consumer self check-out; 3) the improvement of different dimensions of information quality, such as integrity, accuracy, timeliness etc. (Ballou et al., 1998) and 4) the formation of new types of information, leading to a more precise representation of the physical environment, e.g. a product's exact position in the store, a specific product's sales history etc. For the full benefits to be ripped, the information needs to be shared among the supply chain partners in a complex network of relationships and decision making. The internal exploitation of RFID technology by a network leader-retailer looking solely at its own benefits is expected to have a negative impact on RFID market acceptance and adoption rates since suppliers will confront RFID as another unfortunate strategic necessity (Barua et al., 1997).

4. RFID-ENABLED SUPPLY CHAIN COLLABORATION SERVICES

The proposed system, categorized as a distributed Web-based decision support system, with participating user companies being European grocery retailers and suppliers from the fast-moving consumer goods sector [23]. Companies in the sector already have a more-than-ten-years collaboration history and some collaboration processes havebecome standard business practice across Europe, such as CRP/VMI employed in retail warehouse replenishment or Category Management dealing with the marketing aspects of managing product categories in the store [17].

The proposed architecture is a generic distributed architecture that can potentially support various supply chain collaboration and decision support scenarios, whether these are enabled by RFID technology or not [23] :

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1) Backroom Visibility
In this scenario, both retailer and suppliers have a clear picture of the products' stock level in the store, as well as of the products' sales and collaborate on order placement for store replenishment. The store personnel receive from the system real time information about the backroom inventory level of each product. If a product is out-of-shelf, but there is available stock in the backroom, the store personnel is informed to refill the shelf; otherwise, if there is no stock (out-ofstock), a new store order is placed and sent to the distribution center. The salesmen of direct-store-delivery suppliers have also direct access to this information through their PDAs. The system updates the backroom inventory records automatically and sends the information to the PDA of the suppliers' salesmen. The salesmen inform the store staff to refill the shelf, but if there is no backroom stock, they prepare an order based on the inventory information provided by the system. At the retailer's headquarters, they can monitor the orders that the suppliers' salesmen have placed. The salesmen leave the store satisfied, since they succeeded in moving their products to the shelves and they also took efficient ordering decisions to avoid out-of-stock & out-of-shelf. The tags are applied on case and item level. The tag readers are fixed on the backroom entrance and the backroom to sales floor entrance.
2) Out-of-shelf Response
The last 50 yard problem of product shortages on the shelf is a crucial issue in retail operations, both for the supplier and the retailer. On one hand the retailer should be aware of the time to move items from the backroom to the shelf, and on the other hand the supplier should be able to monitor the level of out-of-shelf in the stores, in order to identify problems and take corrective actions about the service level of new products to the end customer. The system monitors the stock in the backroom and on the shelves and when there are out-of-shelf cases it generates an out-of-shelf alert and sends specific instructions on the PDA of backroom personnel about which goods to move from the backroom to the shelf. This collaborative scenario enables the store personnel to better manage the shelf replenishment process, which is currently one of the major causes behind the outof-shelf problem.
3) Remote Shelf management
Retailers and suppliers are provided with real time information about the actual shelf layout and have the opportunity to collaboratively manage the shelves allocation and appearance. RFID readers "scan" and "read" the shelves and provide their "digital image", including information about the size, specific products' position and layout, as well as information about the shelves' performance. By using the system, the suppliers are now able to check if the products get the room they deserve on the shelf and are neatly positioned according to the store's planogram. If the suppliers notice that some of the products have fewer facings on the shelf, than what has been agreed with the retailer, or that some shelf space has been left empty, they informs the retailer, as well as the merchandiser to visit the store and take care of the shelf.
4) Dynamic Pricing
Retailers and suppliers have the opportunity to identify products that are close to their expiration date, or are standing still on the shelves for a long time. For these reasons they can dynamically reduce the products' price, in order to boost consumer demand and reduce waste. This collaborative service is very useful for fresh products, such as dairy products, bread, meat, etc. When consumers visit the store with their shopping list, they usually purchase products with the longest expiration date, since they cost the same. Thus, in order to avoid big on-hand stock of expired products, the system does periodic checks of on-hand stock to identify products approaching expiration date and then informs the suppliers. The suppliers, based on the system's recommendations, suggest to the retailer to decrease the price of these products. The retailer approves the suppliers' proposal for price change. In this case, the customers face a dilemma, if they should sacrifice the longest expiration date for a better price. But there are economic difficulties, so they usually choose the cheaper one. As a result, the customers leave the store happy that they managed to save money and both the retailer and the supplier are also satisfied because they managed to sell products that would otherwise be trashed. The tags are applied on case and item level. The tag readers are fixed on the shelves, on the backroom entrance, and on the backroom to the sales floor entrance.
5) In-store Promotion management and Promotion evaluation
Customers get direct information about special offers and promotions relevant to the product they just picked up from the shelf. When the consumer picks up the product, the fixed tag reader scans it and the customer gets a promotion message on a special information screen or even its mobile phone. The system distinguishes between shelf sales and promotion stands sales. The suppliers use the system to monitor the sales of products in every store and get assistance in the design of new in-store promotion events. The system even provides them with statistics, evaluation reports, recommendations and specific locations in the store to use, based on their performance and cost. The tags are applied on item level. The tag readers are fixed on the shelves, on the promotion stands and near the special information screens.
6) Demand management
According to this scenario, retailers and suppliers are capable of monitoring the inventory and the sales of products in every store and relocate them, if needed, (e.g. in case of a special promotion event) in order to eliminate lost sales opportunities. Using the system, they receive, on real time, from every retail outlet the on-hand inventory level in the backroom, on the shelves, and even on the promotion stands. They also get sales data from the Point-Of-Sales system. For example, if the supplier runs a promotion campaign for product A and notices that product A is almost out-of-stock in store Y, where it has high sale rates, but in store X there is a lot of product inventory that is not sold then he issues an order "Move product A from store X to store Y". The tags are applied

on case and item level. The tag readers are fixed on the backroom entrance, on the backroom entrance to the sales entrance, on the shelves and on the promotion stands.

7) Traceability information

According to this scenario, the consumer at the end-point-of-sales (retail store) has a clear view of the products' history and origin. When the consumer reaches the shelf, he cannot be sure for the product's quality and safety. So, he picks up the product, the fixed tag reader scans it and, by special information screens, the customer gets details about production date and origin, expiration dates and other unique product's information that can ensure product authenticity and safety. The tags are applied on item level. The tag readers are fixed near the special information screens. The traceability information that belongs to the suppliers is shared with the retailers, in order to enable this collaboration service.

8) Smart Recall

Retailers and suppliers have the capability to identify the location of products with specific characteristics and recall them fast and at minimum cost from the market, e.g. in case there is a risk with consumer safety. When a crisis happens and the products of a specific production lot are found defective, the suppliers' quality managers issue an order "Recall the defective production lot from the market". The system identifies the products and provides with all the locations in the retailer's stores where the products of the specific production lot have been sent. The store personnel is informed to withdraw the products from the specific shelves, promotion stands and the backroom and prepare them to be sent back to the suppliers. As a result, the retailer has avoided the customers' dissatisfaction and for the suppliers it was not necessary to recall all the products of the kind. The tags are applied on case and item level. The tag readers are fixed on the backroom entrance and shelves, on the backroom to the sales floor entrance, on the shelves and on the promotion stands.

Table 1 summarizes the above RFID-enabled supply chain collaboration services. Each scenario is presented according to the information shared between the collaborating retailers and suppliers, the tag readers location, and the tagging level.

Table 1: Characteristics of the eight RFID-enabled Supply Chain Collaboration Services

RFID-enabled Collaboration service	Information shared	Tag Readers Location	Tagging Level
Backroom visibility	Backroom on-hand stock Orders POS data	Backroom entrance Backroom to sales floor entrance	Case, Item
Out-of-shelf response	Backroom on-hand stock Shelves on-hand stock Out-of-shelf alerts	Backroom entrance Backroom to sales floor entrance Sales floor shelves	Case, Item
Remote shelf management	Number of products' facings Products' position Shelf layout Shelf sales	Sales floor shelves	Item
Dynamic Pricing	Products expiration date Backroom on-hand stock Shelves on-hand stock	Backroom entrance Backroom to sales floor entrance Sales floor shelves	Case, Item
In-store Promotion management and Promotion evaluation	Shelf sales Promotion stands sales POS data	Sales floor shelves Promotion stands near the special information screens	Item
Demand management	POS data Backroom on-hand stock Shelves on-hand stock Promotion stands on-hand stock	Backroom entrance Backroom to sales floor entrance Sales floor shelves Promotion stands	Case, Item
Traceability information	Product traceability information (production date and origin, expiration date, product history, etc.)	near the special information screens	Item
Smart Recall	Product information Product location information	Backroom entrance Backroom to sales floor entrance Backroom shelves Sales floor shelves Promotion stands	Case, Item

5. CONCLUSIONS

Supply chain collaboration in retailing and Fast Moving Consumer Goods industry (FMCG) has mainly been

expressed in the form of practices such as Vendor Managed Inventory (VMI), Continuous Replenishment Program (CRP), and Collaborative Planning, Forecasting and Replenishment (CPFR). The emergence of RFID is expected to revolutionize many of the collaborative supply chain processes and to empower new collaboration scenarios, such as anticounterfeiting, product recall and reverse logistics, collaborative in-store promotion management and total inventory management. This paper proposes eight RFID-enabled supply chain collaboration services (e.g. dynamic pricing, smart recall, in-store promotion management, out-of-shelf response) in a networked retail business environment. The services are characterized, on a high-level, by the information shared between retailers and suppliers, the level of tagging (pallet/case/item level) and the location of the tag readers. However, these RFID-enabled supply chain collaboration scenarios will be further assessed according to four dimensions : the extent of collaboration required between retailers and suppliers; the RFID technology requirements the transformation of existing (or the introduction of new) processes and the business case contribution of the service.

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CERTIFICATE

This is to certify that

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