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Ubiquitous Retailing Innovative Scenario: From the Fixed Point of Sale to the Flexible Ubiquitous Store

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Abstract

The current advances in information and communications technologies developed new tools for retailers to innovate. In fact, the increasing computing capacity and the advancements in networking systems provided a new ubiquitous scenario that can be adapted for retailing in order to develop innovative shopping environments. The aim of this paper is to deeply understand the emergence of the ubiquitous retailing phenomenon and the possible shift from the physical point of sale to a ubiquitous one, by analysing this radical innovation and the main consequences for firms and market.

Keywords: innovation management; technology management; retailing; ubiquitous computing; ubiquitous retailing.

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Introduction

To date, for many retail-oriented firms the competitive advantage depends mainly by the capability of introducing innovations, with emphasis on the novelties related to the information technologies (Bennet and Savani, 2011; Zawslak, et al., 2012; Cropley, Kaufman, Cropley, 2011). Hence, retailing needs to develop innovative strategies able to attract, maintain, loyal consumers and promote the brand and the firm's reputation, with emphasis on the innovative technical systems in the points of sale (POS), (Bhattacharya, et al., 2011). In fact, consumers expect innovations in the stores able to make them saving time and make the physical store more convenient (Pantano and Viassone, 2012). As a consequence, the retail process is subjected to constant changes due to the frequent advancements in technology (Chiu, Fang, Tseng, 2010). For instance, the spread of Internet and web-based tools provided platforms for e-commerce, e-tailing and e-business that modified the traditional way of shopping (Bourlakis, Papagiannidis, Fox, 2008; Lee and Seo, 2006; Yang and Kim, 2012; Pantano and Corvello, 2013), by substituting or supporting the traditional retailing. In the one hand these technologies provide systems for strengthen the brand image, in the other they offer an alternative channel for shopping, by offering more products than a traditional POS such as through the possibility to access directly from home 24/7 (Pantano and Viassone, 2012).

The innovations based on the new advanced technologies able to enhance retailing are discontinuous innovations able to radically modify the process, by changing the (i) product searching, (ii) product displaying, (iii) information accessing, (iv) payment modalities, and (v) vendor-client relationship (Pantano and Di Pietro, 2012). Since these technologies provide a large amount of information on the available products that consumers can access according to their personal needs through an ease interaction between the user and the system, they dramatically leap in terms of consumers' familiarity and usage behaviour (Veryzer, 1998). In particular, they allow to search, locate, and compare available products and can be easily adapted for a wide range of items (Pantano and Di Pietro, 2012; Pantano and Laria, 2012). In this way, they enhance and support the shopping experience, by giving clients both the possibility to choose the effective usage of the available technologies and the possibility to ask for a real salesperson's help.

Among the currently adopted technologies, Radio Frequency Identification (RFID) systems, smart shopping trolleys, virtual and augmented reality for displays (e.g. digital signage), and applications for consumers' mobile are the most diffused in the stores (Pantano and Laria, 2012; Bhattacharya, et al., 2011). New displays and projectors exploit the recent advances in 3D graphics technologies for showing more products in an entertaining way, whereas the integration with touch screen devices allow users' to virtually interact with the product and achieving more customized information; thus these enhanced functionalities also reduce the consumers' perceived risk and uncertainty (Shim and Lee, 2011). Furthermore, while the new self-service technologies and mobile payment modalities allow consumers to pay automatically for their purchases, with benefits for time saving (Chiu, Fang, Tseng, 2010), consumers encounter their own service via the interaction with the new technology interface, thus, the client-vendor interaction is mainly mediated by a machine (Chen, Chen, Chen, 2009). As a consequence, consumers might tend to interact more with the technological system than with the firm's employees, with consequences for the traditional face-to-face communication channel.

While the interest in innovating the points of sale increases, the recent advances in technology provide also a novel radical ubiquitous tool that could be introduced also in retailing consequences, by dramatically changing the concept of retailing linked to a fixed physical space, by introducing a sort of new distributed (or ubiquitous) retail environments.

The aim of this paper is to deeply understand the shift from the physical point of sale to a ubiquitous one as consequence of the spread of ubiquitous computing, by analysing this radical innovation in retailing and the main consequences for the firms and market.

The first part of the paper introduces the concept of ubiquitous computing and its application to retail sector, whereas the second one is devoted to the analysis of the shifting from the traditional physical and fixed point of sale, to a distributed and virtual one.

Theoretical Background

Ubiquitous computing

The increasing computing capabilities, the mobile and wireless technologies improvements, as well as the development of flexible software architectures and automatic identification technologies support the ubiquitous access to data for both users and suppliers, by pushing its usage in many application domains (Kim, et al., 2009).

Ubiquitous computing is the integration of computing in human activities through a pervasive penetration (Evans and Hu, 2006). This technology is an extension of mobile computing based on the portable accessing technologies (i.e. cameras, Location Based Service, Ubiquitous Sensor Network, etc.), always connected to a network, and linked to web-based multimedia content repositories that adapt the

provided contents according to users' characteristics (i.e. location) (Santana Martins and da Graca Campos Pimentel, 2011; Lin, et al., 2011). Hence, these system are characterized by the content-awareness, which allows them to adapt itself based on both the knowledge about user' state (i.e. location, preferences, personal data, etc.) and the physical environment information on real-time, in opposition to the traditional desktop computing, where system response is based only on the environmental stimuli (i.e. users requests) (Kurkovsky and Harihar, 2006; Kourouthanassis, Giaglis, Vrechopoulos, 2007).

The features of ubiquitous computing can be summarized as follows (Lin, et al., 2011; Kurkovski, 2005): (i) network accessibility (user's mobile device is constantly able to access to the network); (ii) device connectivity (user's mobile device connectivity is always allowed through different technologies such as wireless, Bluetooth, etc.); (iii) applications and input devices (user's mobile can access to requested information through input devices such as camera or GPS-Geographical Position System), for instance the users' mobile is equipped with an application able to recognize the current location and displays subsequent data) and usually the application is based on a user-friendly interface that shows a wide amount of multimedia contents (easy to share and update); and (iv) context-awareness (the system is able to adapt its behaviour according to people's usage, for instance the system recognizes consumer's location and propose a certain offer based on this information).

In this way, everybody is always connected to a network for achieving (sharing) content-awareness, services, and products no matter if he/she really needs (Asahi, 2011). Hence, information and digital materials can be collected by everybody, everywhere and anytime. Due to the low costs of information sharing, ubiquitous computing is able to increase the number of transactions by supporting the delivery of customized services and complementary products, with benefits for value creation (Kim, et al., 2009). In fact, previous studies evaluated the acceptance of ubiquitous computing technologies, by finding the users intention to adopt these systems especially due to the emerging convenience (Yoon and Kim, 2007).

Since the adaptive capability of these systems, the ubiquitous computing concept can be successfully introduced in several fields such learning (it could be very efficient for personalized learning in higher education) (Lee, Lee, Kweon, 2011), cultural heritage and tourism, by becoming a new tool for promotion (Wang, et al., 2011). Date in 2008, Wu and Hisa anticipated the application of ubiquitous computing also at retailing, by predicting the u-commerce as a disruptive innovation able to make traditional e-commerce obsolete and to force firms to develop new capabilities for fast responding to the market trend.

Ubiquitous retailing

Ubiquitous computing is introducing deep innovations in retail practices, by changing both the way users' access and consumption of information, and the way by which firms and organization reach their clients (Kim, et al., 2009). In fact, the availability of these systems modifies the interface between clients and vendor, as well as the whole retail process by providing new consumer-oriented services (Roussos, et al., 2003), and extending (removing) the boundaries of the physical space (Kourouthanassis, Giaglis, Vrechopoulos, 2007).

This new kind of distributed retail environment exploits the current advances on mobiles and wireless technologies, RFID (Radio Identification) systems, QR code (a sort of bidimensional barcode that memorizes information to be read by a mobile or smartphone), and on the new techniques for the fast moving of consumer goods (FMCG), for achieving the fast product recognition and delivery (Bennet and Savani, 2011). This technology is based on consumer's past knowledge of mobile applications that can be enriched with several functionalities. Hence, it is devoted to people who already got a smart mobile device (e.g. smartphone, iPad and iPhone, etc.) and with knowledge of the possible applications for these devices (both in terms of availability, installing modalities and main functionalities). In this way, the mobiles became a sort of interactive guide in the shopping environment. In particular, consumers use their own mobile for interacting with products, achieving more information, accessing to personalized recommendations, etc., by focusing the camera on product's tag (or code) and exploiting the user-friendly interface of the ad hoc application. Therefore, the main benefit for retailing based on ubiquitous computing is the ability of enriching the shopping experience, by providing consumers with new stimuli and factors that allow them to save time and live more enjoying experiences (Kourouthanassis, Giaglis, Vrechopoulos, 2007).

From a managerial point of view, the ubiquitous computing provides a wide range of data on the single consumer, which can be exploited for the development of future (direct) marketing strategies. In fact, the user's geographical location system and QR code associated with each product are able to match his/her exact position with products preferences (i.e. purchased products, purchases frequency, total amount of purchases, etc.), personal profile (i.e. gender, education, personal address, monthly income, etc.), behaviour (i.e. visited place for how long, path to reach a destination, etc.), etc. (Bennet and Savani, 2011). Data on consumers can be easily collected in two situations: whenever a consumer purchases a certain good or visit a particular space embedded in the ubiquitous system and he/she focuses on a particular item (i.e. by focusing the mobile's camera on the item's tag). Furthermore, they solve consumers' dilemma concerning the

comparison among different products, which is allowed in the online scenario, by providing this possibility also to consumers in the ubiquitous retail environment thanks to the network connectivity (Lee and Seo, 2006). Although these technologies for retailing allow communicating personalized advertising and product recommendations, they might achieve negative consequences for consumers' privacy concerns (Asahi, 2011, Bennet and Savani, 2011).

Since ubiquitous computing is based on mobile shopping, it overcomes the physical limitation of the users' own mobile by transferring the computing capacity on the ubiquitous system, thus it overcomes the limitations concerning m-commerce (mobile-commerce) related to the mobile technical characteristics such as memory size and computing capacity (Hejazinia and Razzazi, 2010; Yang and Kim, 2012). In fact, in this environment the technical capacities are not limited to the characteristic of the single device, but they are distributed for increasing the efficiency of the whole system, with benefits for the computing and memorization capacity of each mobile and for the quality of the final service for consumers.

While in 2008 Wu and Hisa predicted the launched of ubiquitous scenarios for retailing, innovative platforms for u-tailing became available recently for testing their effectiveness with consumers. In fact, ubiquitous computing in retailing is a new concept, thus it needs to be further investigated for deeply understanding its impact on traditional offline shopping and on the emerging of new business models. For this reason, the research concerning the radical innovation involved in the adoption of ubiquitous retailing is still on an early stage (Yang and Kim, 2012).

Ubiquitous retailing scenario: the case of Sorli Virtual (Spain)
Preliminary prototypes of ubiquitous systems for retailing have been recently introduced in some zones with high pedestrian traffic such as metro and buses stops for preliminary tests with consumers. A meaningful example is the new ubiquitous store launched in the metro stop Sarrià in Barcellona (Spain) in July, 2012: the Sorli Virtual (Figure 1).

Figure 1. An example of ubiquitous retailing: the Sorli Virtual in Barcelona (Spain).

This store was the first one developed through ubiquitous computing in Europe, whereas in Korea and US the diffusion of similar points of sale is higher. The functioning of this system is based on the QR code associated to each available product and on the users' camera for scanning the code. When the camera focuses on a certain code, the system transmits the information to the centre that calls consumers to proceed with the order and the payment. Consumer will get the purchases directly at home.

Figure 2 summarizes the retail process based on this interactive system, by describing the different phases: (1) each product is tagged with a code that memorizes the related information (i.e. price, quantity, etc.); (2) consumer focuses his/her mobile camera on the code to achieve information, the application interface guides the user into the process from the choice of quantity to the payment through credit card; (3) the system recognizes consumer's request and starts the payment procedure, by transferring the order to the distribution centre (that contains more products than a traditional physical store); (4) the centre confirms the availability of the chosen product and contacts consumer for confirming the order, if the order is confirmed, the system completes payment and proceeds with the item delivery at home; and (5) the system updates consumer's information with the data related to the last purchased item(s) and consumer's behaviour (i.e. zone of access, visualized items before ordering, etc.).

The system is mainly based on the item code, application interface and network connectivity through users' own mobile. For this reason, it can be easily adapted for a wide range of products, by modifying the code, improving the interface and updating the data repositories (with the information

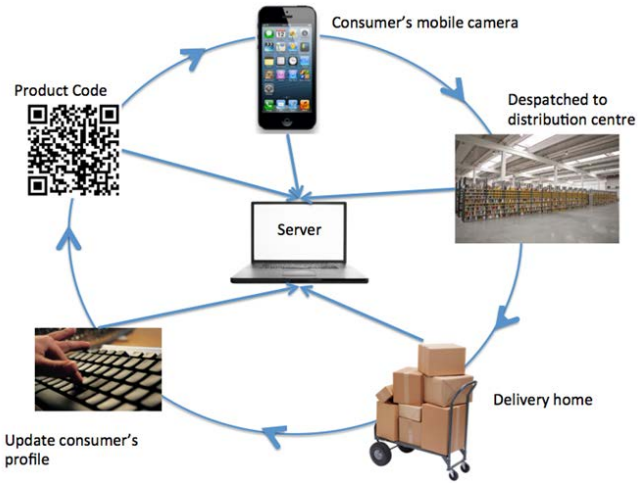

Figure 2. Ubiquitous retailing scenario (functioning).

related to each product to be added). Furthermore, the current progresses in 3D virtual reality will provide more realistic and efficient user-friendly interfaces, while the advancements in Fast Moving Consumer Goods will make the delivery process faster.

Hence, the ubiquitous scenario combines the advantages of e-commerce tools (i.e. a wider number of products, fast response to consumers' requests, open 24/7, possibility to compare fast a huge number of items, etc.) and the ones of the physical store (i.e. the products are displayed on shelves with realistic dimension), by offering an alternative to the both shopping environments.

So far, it is possible to make a comparison between the retailing based on physical points of sale enriched with advanced technologies and the new scenario based on ubiquitous computing.

Table 1 summarizes the main characteristics for the different retail environments enriched with advanced technologies: the traditional points of sales with innovative systems, the e-tailing scenario and the ubiquitous retailing.

From table 1 the similarities and differences related to the application of the different technologies for retailing clearly emerge. The first similarities concern the fast response that the technologies provide to consumers' requests, the entertaining service and the possibility to easily adapt the system to a large variety of products; whereas the first difference concerns the effective usage of the technology. In fact, consumers in the physical points of sale can choose to adopt the available system for supporting their shopping activity, whereas clients in e-context or in an ubiquitous retail context are forced to use the technology for proceed with the shopping activity, (even if the employment of consumers' own mobile or computer increases the acceptance of the technology, due to his/her past knowledge of the tools and functionalities). This might represent a disadvantage by targeting the system only for that part of population with knowledge on mobile technologies or on web tools.

Although the advanced technologies in the stores allow consumers to compare the available products, e-tailing and ubiquitous computing-based ones allow consumers to compare the items with all the items available in the network. Thus, providing more information for supporting the purchasing decision. Furthermore, e-tailing and ubiquitous retailing context provide only a web-based assistance, whereas in the point of sale real salesperson might support consumers and enhance the direct contact between seller and buyer. This would represent a deterring factor for people who prefer the face-to-face communication with vendor than the human-computer-interaction, with possible consequences for the trust in the retailer.

Another important difference concerns the payment modalities. In the physical points of sale the advanced technologies provide several modalities (cash, credit card, payment through mobile, etc.), whereas in the web-based scenario consumers are allowed to pay only by credit card and in the ubiquitous scenario only by mobiles (credit cards or other mobile modalities must be previously integrated/memorized in the system), with (negative) consequences for privacy concerns.

The three retail contexts support consumers' navigation, even if in the physical store consumers might find a location system, whereas in the ubiquitous scenario the client is forced to use it for the shopping experience. In fact, in the ubiquitous computing-based retailing the systems recognizes the consumer (in terms of personal profile or location) and adapts its behaviour on the basis of this data, whereas in the technology-based points of sale the system needs consumers' interaction to adapt the behaviour.

Concerning retailers' investment, in the case of advanced technologies-based points of sale, vendors need to invest both in the technology maintenance (e.g. substitution, repairs, improvements, etc.) and in the software upgrading, whereas in the case of e-tailing and ubiquitous systems the main investments are devoted to the software developments, because these systems are based on users' own mobile or computer interfaces, which represent the hardware part more subject to damages and improvements.

Discussions

Innovating capabilities represent a critical factor for firm's profitability (Veryzer, 1998; Zawslak, et al., 2012), thus introducing innovations also in retailing has been recognized to be a new critical challenge (Pantano and Laria, 2012; Pantano and Viassone, 2012). Our study shows some recent advances in technologies that may well provide an effective alternative for shopping, by offering innovative and exciting scenarios.
This study identifies the recent researches in retailing for empirically comparing the new shopping environments and understanding the links across the different advancements. Due to the numerous developments among different areas such as management, marketing, psychology and computer science, we underline some lines for future inquiries that could be the focus of further studies, which concern (i) privacy, (ii) consequences for physical points of sale, and (iii) firm's preparedness.

Since the context awareness of the system is based on the use of consumers' personal data (Kourouthanassis, Giaglis, Vrechopoulos, 2007), users could reject this kind of system in a long-term period by preferring preserving their privacy. In fact, ubiquitous retailing is based on consumers'

	Technology-based point of sale	Web-based retailing	Ubiquitous computing-based retailing
Facilities	Fast response	Fast response	Fast response
	System flexibility	System flexibility	System flexibility
	Entertainment	Entertainment	Entertainment
	System available in the point of sale	System available online	System based on consumer' own mobile
	Reactive to consumers' interaction	Context-awareness	Context-awareness
	Consumer's usage choice	Compulsory the use of a computer	Compulsory the use of consumer's own mobile
Product info	Product variety	Product variety	Product variety
	Detailed and customized product information	Detailed and customized product information	Detailed and customized product information
	Product comparison among available items	Product comparison among products available through the network	Product comparison among products available through the network
Product selection assistance	Virtual assistance	Online assistance (through network connection)	Online assistance (through network connection)
	Real salesperson assistance (physical support)	No real salesperson assistance	No real salesperson assistance
	Several payment modalities	Only credit card payment allowed	Mobile payment
Space	Fixed	Virtual	Open
	Navigational efficiency	Navigational efficiency	Navigational efficiency
	Possible location indicator	No locator indicator	Location indicator
Time	Opening hours	Always open	Always open
Further Improvements	Retailers investment in both hardware & software	Retailers investments mainly in software	Retailers investments mainly in software

Table 1: Comparison between advanced technology-based, web-based and a ubiquitous computing-based shopping environment.

profile and geographical position for providing information on products and services, as well as personalized recommendations. In accordance with Asahi (2011), the effective functioning of the system requires consumer's sensitive data, to what extent he/she will be interested in providing these ones is still under investigation. The consumers' frequency updating of personal location on public profiles in social networks like Facebook shows how they could be interested in sharing information like the geographical position, but it is difficult to evaluate their intention to share other data like interests, past purchases, preferences while using the ubiquitous systems for retailing. Allowing the system to access to personal data supports the delivering of customized information with benefits for time saving, but to what extent are consumers willing to reduce their privacy for saving time while shopping? Hence, the new advancements in technologies for retailing should take into account to what extent designing personalized services for consumers by preserving their privacy.

Concerning the consequences for the points of sale, the new ubiquitous scenario offers a shopping environment not linked to opening hours, enriched with more services customized on consumers' needs and with more products that

the ones available in a traditional stores, as well as a more flexible layout (linked just to the virtual reconstruction of products and furniture, and not also to real furniture). In fact, the availability of the products in the new store is related to the capacity of the distribution centre, which is usually much bigger than a single point of sale. Furthermore, the software connecting the mobile application with the data repository exploits the consumer's profile for proposing more efficient direct marketing strategies, as well as tracks consumers' behaviour and predicts the subsequent market trends. Since this scenario does not require the physical presence of a salesperson, cash desks and fitting rooms, it could be more effective for certain products categories that consumers are willing to buy without the physical touch (such as food and beverage).

Wu and Hisa (2008) hypothesized also the emergence of possible conflicts between the physical and virtual channels due to the introduction of ubiquitous technologies for retailing. Even if a substitution of the traditional stores is not predictable in the short period, the ubiquitous retailing forces retailers to introduce more innovations, by increasing the uncertainty in the scenario and prompting the development of new strategies. Although firms have little knowledge of the effects of the ubiquitous computing in the long term from a commercially viable point of view (Bennet and Savani, 2011), the applications power is increasing rapidly.

Another critical issue concerns the preparedness of firms. Since these technologies are changing the retail process in terms of environment, quality and modality of delivering services, and client-vendor interaction (Chen, Chen, Chen, 2009), firms need new business models for adapting to the changeable scenario. In particular, the ubiquitous one identifies three main lines of inquiry: (i) to what extent are the firms proactive to reply efficiently to these changes? (ii) What will be the new role of retailers and salespersons? And (iii) which will be the firms' dynamic capabilities and how will they been managed to reply efficiently to this innovative scenario?

In fact, the speed of changes in retailing and the encountered risks and threats for firms and organizations force them to adapt fast their behaviour for maintain competitive advantages (Bennet and Savani, 2011; Veryzer, 1998), whereas the increasing exploitation of technical systems substitutes, limits, and modifies the traditional role of salespersons who are not anymore shopping assistants, but who needs more skills related to technology and possible technology failure. Is their presence in the new stores compulsory for maintaining and repairing the technological damages more than for supporting consumers? Thus, their function in retail process dramatically changes. Moreover, can they be replaced totally by technologies in supporting consumers' decision-making?

Conclusions and future works

The introduction of ubiquitous computing also in retail context offers numerous befits for both vendor and clients (Kim, et al., 2009; Roussos, et al., 2003; Kourouthanassis, Giaglis, Vrechopoulos, 2007). So far, research has focused on the identification and development of new applications for ubiquitous computing in retail context in order to achieve superior innovations and advantages for firms and organizations (Lee and Seo, 2006; Yang and Kim, 2012; Hejazinia and Razzazi, 2010).

Our study extends these findings and reveals the progresses in the ubiquitous computing, as well as the possible underestimation of the consequences of the future improvements. In fact, it represents a sort of discontinuous or radical innovation that dramatically change the retail process, in terms of client-vendor relationships, searching for goods, payment modalities, shopping atmosphere and so on. Furthermore, it involves a high level of uncertainty emerging from the consumers' (not) acceptance risk (concerning consumers' perceived ease of use and usefulness of the system, privacy, security, etc.), as well as from the introduction of new technologies that also modify the store layout and atmosphere. Despite the emerging high level of technological and market feasibility encountered in this radical innovation by underlying some critical issues (Veryzer, 1998), ubiquitous technology-based retailing shows several benefits for both retailers and consumers, but it also underlines some critical issues. We accomplish this work by identifying three main critical issues for ubiquitous retailing success that involves both the retailers' and consumers' point of view: consumers' privacy management, consequences for physical points of sale, and firm's preparedness.
As a consequence, firm's activities should be aimed at developing new capacities to accommodated u-tailing whose introduction stimulates the completion in the sector. Main stimuli would focus on the perception of the extensive benefits arising its adoption. Moreover, the follower or pioneer strategies in u-tailing could trigger different consequences for business profitability.

In our expectation, this study may serve as a benchmark for future researches to investigate efficient and successful developments in retailing and to record the continuous emergence of innovations for the field.

Although researches in innovations in retailing have widely acknowledged the importance of employing the Technology Acceptance Model for predicting their adoption and diffusion (Pantano and Di Pietro, 2012), there is still a lack of knowledge on how these introductions modify the traditional retailing business models and to what extent firms can employ these ones for achieving long-standing profits, as

well as on the best practices for managing this discontinuous innovation process.

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