Overview of E-commerce Technologies, Data Analysis Capabilities and Marketing Knowledge

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Abstract. The E-commerce trends are showing a growing rate in the last decade for both B to B and B to C trade. The e-commerce technologies enable firms to collect a huge amount of data regarding the profile of consumers, the habits of consumption, the frequency and amounts of purchases, the payment details, the level of satisfaction and also the intention to repurchase the product or equivalent products in the future. The e-commerce technologies are then helping managers to collect relevant data and orient strategic and tactical marketing decisions. The problem that faces small and medium enterprises nowadays is the lack of customer information analysis capabilities that treat the large, heterogeneous and volatile aspects of the data collected with the e-commerce tools. This paper proposes a survey of the main e-commerce technologies and tools that collect consumer data and the potential contribution of each type of data in generating relevant customer knowledge that orient the marketing decisions. This research highlights all the stages of the process from the e-commerce technologies that collect data, then the analytical phase for the extraction of knowledge and finally the marketing decision orientation.

Keywords: E-commerce technologies · Data analysis capabilities · Marketing · Customer knowledge · Analytics

1 Introduction

The e-commerce (EC) technologies have drawn a lot of attention from the research and business community as there are numerous and increasing development efforts (Kumar 2018; Roberts et al. 2014; AWS 2019).

EC is defined briefly as buying and selling on Internet. EC is based on the use of information and communication technologies. The fast growth of EC users is due to rapid advancement in the field of networking and connectivity and computer engineering. The telecommunication field provides the ease of connectivity, the relative low cost of connecting devices (smartphones, computers, tablets, objects connected, sensors nodes…) and the communication infrastructure. Computer engineering field offers applications, data analysis and approaches of processing data.

These technologies are important for enterprises in helping managers to collect relevant data and orient strategic and tactical marketing decisions.

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EC provides "anytime, anywhere, any device" commerce. For business companies, online shopping provides an additional and important channel of commerce. Nowadays, EC have been extended to social commerce, mobile commerce (m-commerce), ubiquitous and pervasive commerce. Ubiquitous commerce is described as the evolution of the e-commerce and m-commerce (Kumar et al. 2015).

The e-commerce spawns Myriad applications and tools that have the potential to customize marketing strategy in time. With EC, companies can have a competitive advantage by accomplishing just in time production and distribution. Previous research in the field of Marketing focuses on the role of technology in modern Marketing and the transformative marketing (Kumar 2018), Big data in Marketing (Amado et al. 2017) and the real time analytics for unlocking customer and driving the customer experience (Harvard Business Review Analytic Survey 2018).

This paper presents the main technologies that support the whole process of electronic commerce. We consider the development of the website, the transactional process followed by a consumer, and the customer relationship after purchasing. Then the paper identifies the range of the information analysis capabilities and the contribution of each group of EC technologies to make customer insights and orient marketing decisions.

2 E-commerce Technologies

We present the e-commerce technologies following three main stages of the e-commerce business project: The website development, the transactional process and the customer relationship especially after purchase.

2.1 EC Technologies Related to Web Development

Various technologies can be deployed to develop the website, to publish it and to promote it in the search engines. Online shopping sites can be developed by CMS (Content Management System) or other development platforms. User-friendly systems are used in the design of the front end websites. Electronic product catalogs (EPC) are one of the main components of e-commerce applications. An E-catalog is mainly structured as a set of indexed XML-based documents. It is based on a powerful search engine that operates efficient processing queries. Many solutions exist to design professional product catalogs and companies need to provide flexible product catalogs to get customer satisfaction.

Even the physical stores have been digitalized to increase traffic in the store. They are commonly called web to stores. Web stores include augmented reality and digital walls. Augmented reality mirrors enable the user to try the product before purchase. For example, a potential client can "try on" eyeglasses or clothes. This technology enables the user to upload a personal photo in a social media. In fact, studies assess that the personal experience of each shopper is of utmost importance (Barilliance 2014).

In addition to their website, many business companies provide their services through mobile platforms (app store, windows store, google play). There is a growth of

mobile applications that meet customers' needs such as uber app (Uber 2018). They are called "on-demand" applications.

For managing and monitoring an online shopping site, many technologies are used. Optimizing websites involves techniques and tools with SEO, SEA and SMO. Recently, companies use cloud computing as the technology that stores and performs the collected data. Cloud computing provides the network platform, the infrastructure with high performance also as services. Moreover, collected data are stored and performed with cloud solutions.

2.2 EC Technologies Deployed in the Transactional Process

EC includes promotion, selling and distribution of products and services in an online environment. In this section, we detail first the electronic commerce transaction process in phases, then we present the technologies deployed in each phase.

The Electronic Commerce Transaction Process

Different models of electronic transaction process are defined in litterature, especially the consumer buying behavior for BtoC context and the Electronic Reference Model for Marketplace which focus on the BtoB context (Giovanoli et al. 2014).

According to these models, we describe an electronic transaction process in three phases: an information phase, an agreement phase and a settlement phase.

The Information Phase is the phase of information gathering or evaluation phase of requirements and products from various sellers. In this phase, the consumer explores many sites in order to identify what to buy and from whom. It includes all analysis done to check the suitability of a product to customer needs. From the business view, it is important to attract consumers. This phase includes marketing and catalog management. The information phase ends when the product(s) and the seller are chosen.

The agreement phase may take place when the seller enables the negotiation. In this phase the conditions, pricing and other delivery related issues are negotiated. The agreement phase ends with submitting an order or the signing of a legal contract between the customer and the supplier.

The settlement phase focuses on issues related to the order processing and fulfillment, the delivery and payment of the final goods according to the agreement. It includes also the post – purchase services that any e-seller should takes into consideration.

We depict e-commerce technologies that can be deployed in each stage of an electronic transaction process.

Technologies Deployed in the Information Phase

Companies start collecting data from the browsing and surfing through web pages. Consumer's data are also collected when filling the registration form, the cart, the stage of payment until the stage of fill in the feedback ratings. The online site presents various application forms to the surfer (Registration forms, …). Whereas, even without applying these forms the user behavior is traced via cookies. The navigation process and other information are usually traced in logs. The activities on the site are often reported on information called Key Performance Indicators (KPI). This section describes mainly cookies and solutions based on cookies.

Cookie
Cookie is a text file (piece of javascript of code) created by the web server and stored in the user's web browser either temporarily or permanently. Cookies are used (anonymously) when the visitor is surfing through the different pages of a website. Later, when the cookied visitors browse the Web, the cookie will let the retargeting provider know when to serve ads, ensuring that ads are served to only to people who have previously visited your site. There are different uses of cookies. Cookies provide a way for the website to recognize the client and keep track of his preferences. Web servers use also cookies to personalize content, serve visitors with relevant ads, and to analyze traffic. The client can block or allow cookies in its browser. There are many cookie-based technologies (for branding and conversion optimization tool). These technologies are effective when it is a part of a larger digital strategy. Retargeting tool relies on collected data. We consider it as a marketing decision based on collected data.

Software Agents
Software agents are widely deployed in ecommerce context. Since the early 1990s, cooperative multi-agent systems and intelligent agents are of increasing concern within software engineering of large scale distributed systems (Wyai et al. 2018). Agents are programs to which a user can delegate one or more tasks. They operate on behalf of a user. Agent technologies can be applied to any of these areas where a personalized, continuously running, semi-autonomous behavior is desirable. We cite agents of interest, agent of search, negotiation agent..

Technologies Associated to the Agreement Phase
To provide negotiation services, the shopping site can implement various technologies to communicate with consumers. The negotiation can be held with negotiation support systems based on software agents. In the following, we focus on technologies used to carry out communication between customers and the online shopping site.

We cite email, Chat, Forums, Chatbots, assistant robots in stores. Chat bots are increasingly deployed in order to communicate with customers in collecting requests and responding.

Technologies Associated to Settlement Phase
Payment Stage
Companies can offer to their consumers many payments options: electronic payment systems, online credit cards, electronic wallets, etc. Electronic payment system needs to be secure and fast. Digital payments are increasingly used as a tool by government to create transparency and legitimacy. Mobile payment platforms and the payments options may influence consumers on the selection of the seller.

Delivery Stage
In order to monitor product delivery, many technologies are deployed such as GPS and IoT. In plus, various web-based solutions and mobile solutions are developed for tracking and shipping (FedEx 2019).

The Internet of Things (IoT) could contribute significantly to improve product delivery services (time delivery, quality of delivery, ..) because it allows for remotely controlling the location and conditions of shipments and products. We cite as an example perishable products (Verdouw et al. 2018). Many companies call for 3rd party delivery services.

Experience Evaluation
Various Post-purchase services can be provided, for experience evaluation. E-commerce sites offer various technologies such as feedback ratings, comments and likes on social media, CRM (Customer Relationship Management) tools to communicate with the online shopping site, email, instant messaging and chat bots. Chat bots are used by the online shopping site to enable clients to chat. The answers are made by robots. They are based on Artificial Intelligence. So, the bot is learning from a knowledge base. The business company can save costs and reduce time response.

Once the client is traced in the e-commerce site, software agents can inform customers about promotions via multiple channels (social media, email address, applications such as messenger, whatsapp,..). Emails newsletters are also used. In fact, conducting email campaigns is largely deployed such as product recommendation emails. Barilliance's study shows that there is an increase of 30% in conversion rates after adding personalized product recommendations to the email newsletters (Barilliance 2018).

2.3 CRM Technologies

From a managerial perspective, EC technologies offer valuable opportunities to the firm current value chain for enhancing inter-functional collaboration and efficiency in its relationships with customers, suppliers and the main social economic and governmental partners

Applications for supply chain management SCM and the customer relationship management CRM are important for the growth of any e-commerce project. In addition, promotion management applications can help to plan and carry out promotions to attract buyers.

Following the emergence of relationship marketing and the development of EC technologies, this paper focuses on the important role of the CRM data in providing a valuable source of competitive advantage and producing knowledge that guides decision makers especially in commercial and marketing processes (Stein et al. 2013; Lindman et al. 2012).

CRM Systems
CRM can be studied as a process, a strategy or a technology. Lefebure and Venturi (2001) present CRM as "*The management of customer relations combines technologies and business strategies to provide customers with products and services that they expect. The management of customer relationships is the ability to identify, acquire and retain the best customers with the goal of increasing sales and profits.*". According to this definition, the CRM systems and technologies are implemented to support the business strategy processes.

The quality of the CRM system refers to the performance characteristics of a system including reliability, flexibility, being user-friendly and response time. The quality of the CRM system has a direct and indirect positive influence (via customer satisfaction) on profitability (Khlif and Jallouli 2014).

The CRM architecture includes three segments namely: operational CRM, collaborative CRM and analytical CRM (Teo et al. 2006). Operational CRM focuses on the daily management of a relationship with the client through the contact points

(customer service, call center, sales force …). The collaborative CRM covers all the communication and interaction channels with customers and partners as well as work technology groups, such as workflow and e-mail. Finally, analytical CRM is the integration and processing of data to produce useful information for the analysis of customer relationships and project improvement (Chalmeta 2006).

As a conclusion, the CRM success is influenced by a dual value creation:

- Increasing profits with the identification of the most profitable segments, improvement of the performances of the sales force, customization of products and services.
- Increasing the visibility and the quality of the information to all stakeholders thanks to the integration of information in a single database (Krasnikov et al. 2009).

3 Data Analysis Capabilities

The previous section identifies the main EC technologies and classifies them according to the stages of the website development, the transactional process and customer relationship management. This paragraph analyses the importance of data analysis capabilities to unlock customer insights and orient in time marketing decisions based on data collected with EC technologies.

Data science in its broadest sense is defined as "a multidisciplinary field that deals with technologies, processes, and systems to extract knowledge and insight from data and supports reasoning and decision making under various sources of uncertainty" (National Academies of Sciences, Engineering, and Medicine 2017).

The data stored in companies and shared in social media is still growing at a high speed. The challenge for managers is mainly to cope with the high volume, variety and velocity of data. Core business systems such as marketing, finance and production produce structured data. However, with the increasing number of audio and video applications and the large participation of customers in social media to comment or rank a product, a brand or a company, the proportion of unstructured data has increased in a significant rate.

Structured and unstructured data have high commercial value. The challenge for companies is therefore to develop the underlying data infrastructure in order to make it more robust and agile and to extract consumer insights that enlighten the future decision in marketing area (HBR Survey 2018).

Data treatment and analysis are based on Algorithm, Visualization, machine learning or cognitive technologies as examples of tools that could help in extracting customer knowledge to orient marketing decisions (Kumar 2018).

The application characteristics include the following steps: First, Data should be queried or in some cases be moved between different platforms. Second, Data needs to be summarized, grouped and sorted. Natural language processing and video analysis are techniques that help to convert unstructured Data to structured Data. Data helps to edit business indicator statistics, predictive analysis, deep data mining and exploration reports. Finally, there are different timeliness of using such as different frequency of index statistics, Ad-hoc query, and self-service data exploration (Song et al. 2018).

Data science is a multidisciplinary field that deals with technologies, processes, and systems to extract knowledge and insight. Data Analytic techniques include exploratory analysis, predictive analysis and prescriptive analysis (Strengthening Data Science Methods Report 2017). Data sources are all types of data to support decision making under various sources of uncertainty.

The survey of Harvard Business Review (2018) on real time analytics reveals three relevant interrelated capabilities that guide consumer experience strategy:

1/Unified customer data platforms: This capability unifies mainly the company's customer data from the online and the offline channels.

2/Proactive analytics with machine learning and artificial intelligence: The purpose is to incorporate insights on customers, marketing programs and related functions.

3/Contextual interactions: This capability integrates real time insights on digital and physical costumer journeys to draw subsequent actions to pursue in the benefit of the brand or the company.

The current key tools and approaches used in companies to orient strategic and tactical decisions are the following: Segmentation tools, Survey-based choice models, Aggregate marketing mix models, Pre-test market models, Marketing metrics, New product models, Customer life time value models, Panel-based choice models, Perceptual mapping, Customer satisfaction model, Sales force allocation models, Game theory models and the Average Perceived Impact (Roberts et al. 2014).

A good example that shows the importance of developing new tools to treat the vast quantities of panel scanner data and extract customer knowledge is the large use of the logic modeling to guide responses to changes in the marketing mix (Roberts et al. 2014).

A second example of a trendy data analysis capability is data mining defined as the process allowing a search, for valuable information, in large volumes of data. This data search capability uses statistical algorithms, predictive modeling, forecasting and descriptive modelling techniques and intelligent agent systems to uncover patterns and correlations and extracts knowledge from corporate data platforms (Liao et al. 2012).

Data mining tools combined with CRM output could be an alternative to the approaches and models already on offer to improve strategic decision-making and tactical marketing activities.

The objective is orienting in time and contextual strategic decision either manually or with the help of artificial intelligence.

4 Marketing Knowledge

Scholar journals in the field of marketing research focus on advancing our knowledge by integrating new areas and exploring results confirmed in sister disciplines such as psychology, economics, finance and information systems (Shugan 2004). The role of EC technologies in the marketing research is growing significantly. Based on the Marketing Science Institutes research priorities, the recent topics in Marketing management are the understanding of mobile marketing opportunities, the role of social media and the harnessing of Big Data (Roberts et al. 2014). The study of the best sellers' textbooks of marketing shows the rise of the following topics: Digital and

mobile communication in terms of access to markets and social networks, branding, customer management and integrated marketing (Roberts et al. 2014).

The key marketing decision areas are: Brand management (Developing, positioning and managing brands), New product/service management (Development, management" and diffusion of new products), Marketing strategy (Product line, multi-product and portfolio strategies), Advertising management (Spending, planning and design), Promotion management, Pricing management, Sales force management (size, allocation, and compensation), Channel management (strategy, design, and monitoring), Customer/market selection (Targeting decisions), Relationship management (Customer value assessment and maximization, acquisition, retention), Managing marketing investments (Organizing for higher returns and internal marketing) and the Service/product quality management (Roberts et al. 2014).

Based on the previous sections on EC technologies and data analysis capabilities, Fig. 1 provides an overview of the main EC technologies implemented in different stages and the contribution of these technologies to guide marketing decisions.

The first stage of website development relies mainly on CMS and Web development tools, Web services, Web design tools, Catalog design tools, Database applications, Hosting infrastructure and Cloud computing (IaaS, PaaS, SaaS). The key marketing decision areas that could be guided with these technologies are Brand management, new product/service management, marketing strategy, Advertising management, Promotion management, Pricing management, Channel management (strategy, design, and monitoring) and Customer/market selection.

The second stage concerning the electronic transaction is based mainly on the following technologies: cookies, Email campaigns, Ads channels, Email, instant messaging, chat bots, Feedback ratings, social media, Agent-mediated platforms, the shopping cart application, returns management application, contracting tools, GPS tracking, IoT and Tracking delivery applications. These technologies and applications provide valuable source of structured and unstructured data. The shopping card applications, contracting tools and GPS tracking and Tracking delivery applications are sources of high value demographic, psychological and geographical characteristics of prospects and customers. Agents, cookies and social media provide structured and unstructured data. The firm needs proactive and contextual analytics to integrate real time insights on digital and physical costumer journeys and draw subsequent actions related mainly to Brand Management, New product/service management, Promotion management, Pricing management, Sales force management, Channel management, Relationship management and the Service/product quality management.

Finally, the third group of E-commerce technologies that are studied in this paper is related to the relationship with customers via CRM technologies. Operational, collaborative and analytical CRM systems produce high potential of value creation by integrating information in a unique database used by all the stakeholders. Data mining, proactive analytics and contextual interactions are then capabilities that unify the company's data from the online and the offline channels to produce Marketing knowledge via the identification of the most profitable segments, the performance improvement of the sales force and the customization of the firm products and services.

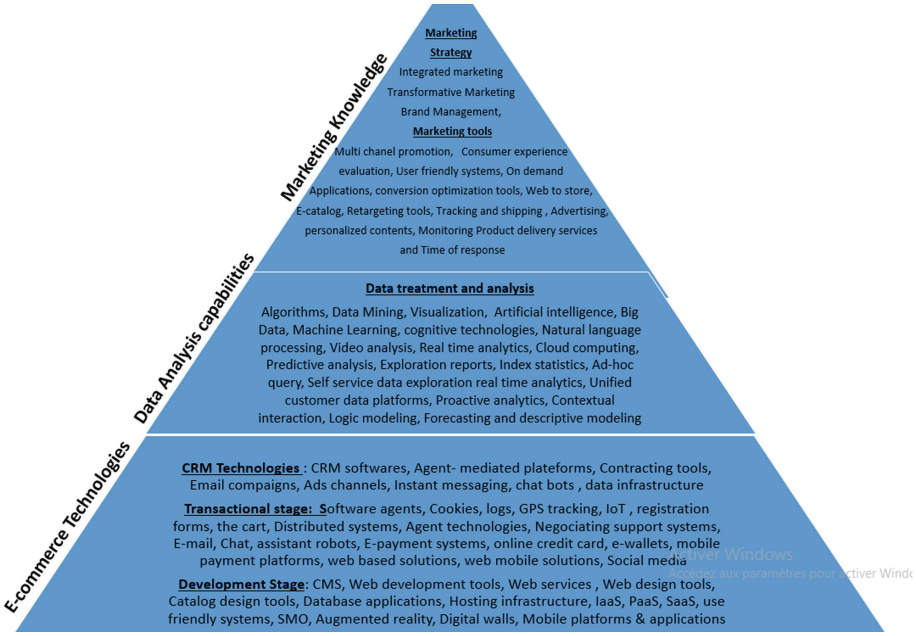

Fig. 1. Overview of e-commerce technologies, data analysis capabilities and marketing knowledge

5 Conclusion

Electronic commerce provides a great opportunity to small and medium-sized enterprises (SME) to improve their competitiveness within the global economy. With the development of information technology, consumer behavior is constantly traced and studied by researchers and developers. Business challenge is about how well it deploys technology to build Market-Winning decisions. Therefore, relying on data analysis capabilities of consumers' personal data and consumer habits, needs and preferences, it is possible to accurately grasp the needs of customers, build personalized customer service systems and lead to higher conversions and long-term customer loyalty.

This paper presents an overview of the main EC technologies implemented in different stages (Development, transactional, relational) and the contribution of these technologies to make customer insights and orient marketing decisions. The paper doesn't include security solutions and technologies deployed in e-commerce such as tokenization and blockchain.

As a final recommendation, this overview of e-commerce technologies in relationship with marketing knowledge highlights the importance of tight collaboration between researchers from Computer science and Marketing fields to develop more case studies and research papers that could be useful for a best-contextual data analysis capabilities. From a teaching perspective also, marketing students need a basic understanding of the e-commerce technologies and the analytical tools since they will need to use these approaches throughout their career as marketers.

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