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Abstract. *Placed in magazines, newspapers, billboard, subway stations, airports, public places, advertising panels, public or private institutions, QR codes meet an increased popularity by instantly connecting any consumer to details of products, discounts, events, payment and purchasing services or direct access to any web address. All of these aspects already exist in any consumer's life but in an unstructured process which now can be summarized by a single code scan, using a common camera based device. In this paper we determine whether the massive implementation of QR codes would accelerate virtualized consumption and perform towards profitability as a new strategic resource.*

Keywords: QR code, consumption, barcode, virtualization, market behavior.

JEL Classification: E2, M3, L86, O30

REL Classification: 5I, 14G, 14H, 18D

1. Introduction

By definition, a Quick Response Code (QR code) represents a trademark for a two-dimensional code, designed as a fast interpreter for the information that is displayed as a standardized matrix barcode, which actually creates a connection between real products and their virtualized information (Adelmann, 2006: pp.4). The QR codes are read by consumers through their mobile smartphones, using the integrated digital camera which turns the device into a portable independent scanner.

The feature that actually makes possible such an implementation is the ability to connect to the internet and use a browser for further search results. (Al-Khaifa, 2010: pp. 427 - 428) The further interpretation of the code is completed by specific software installed on the smartphone, which decodes the information displayed in this particular way and shows the result via an internet browser.

The question now stands about how a QR code can act more efficiently towards the stimulation of consumption than the standard utilization of barcodes does. Information is encoded in both the vertical and horizontal direction which adds a huge advantage when it comes to holding up several hundred times more data than a traditional bar code. (Kieseberg, 2010: pp.

1). Therefore, in this paper we try to determine whether a QR code based marketing strategy is able to bring in new customers to a certain business or to increase the consumption of the present ones by means of competitiveness advantages.

The usage of barcodes usually refers to identify products, goods or deliveries (Wachenfeld, 2008: pp.1). The expansion of QR codes is obviously perceived by various targeted consumers; we find these codes placed on magazines, newspapers, brochures, flyers, posters, invoices, bills or internet sites to support not only the business sector but public services as well. Whenever a customer needs references and details about a product or a service of any kind, it is now in his power to do this at high speed, using the mobile phone; information is far more accessible this way, fulfilling the client's particular need of mobility and real time response.

2. Particularities of QR codes

The increased interest of consumers for mobile phones that connect to the internet and have an integrated camera able to take pictures at a fair quality represent the foundation in camera-based barcode recognition (Wachenfeld, 2008: pp.1). The purpose of a code, no matter of its nature is to bring portability to the recipient of the message, so that this acquires packed information with a shortened time response. In other words, instead of manually typing an URL address (usually of an uncomfortable length), the consumer just scans the QR code using the smartphone, while the QR software recognizes the URL address and instantly turns on the browser. The usage of QR codes is extremely popular as it can encode characters, music, images, URLs, emails and others, while storing ten times more amount of data than the traditional bar codes (Al-Khaifa, 2010: pp. 427 – 428, Kieseberg, 2010: pp. 1-2).

Any kind of carrier, whether it regards public transportation surfaces, business cards or advertising panels, can be associated with a QR code and can hold a large amount of data that would normally take a lot of space to be displayed. Visually, they consist of black and white blocks located on a grid that is readable by a smartphone due to the cornered position of three squared modules; the readability is not affected by physical damage or by the angle of scanning, unless one of the modules is damaged, as torn apart if printed.

Data is encoded into QR codes with the mean of a specific generator, and the interpretation of it is possible if the mobile phone has installed a software application able to realize it (Al-Khaifa, 2010: pp. 427 - 428). Whether it is about web addresses, names and addresses, contacts, e-mail addresses or any other kind of information, the QR code stands as a personal assistant for the customer by having a precise utility.

The disadvantage of using the mobile phone to scan these kinds of codes is related to the incapacity of the human eye to detect what is beneath it, the address that the customer is being redirected to or wheatear the related information is relevant for the customer or not. The practical advantages of QR codes when it comes to marketing strategies are undeniable, but we believe that one of the most challengeable features is earning customer's attention more than an open magazine or any other kind of traditional advertising would do. Of course, there is sometimes a barely perceptible difference when it comes to advantages and disadvantages especially in the technological area; some of the features can seem positive to some customers, while to others it can be exactly the opposite. For instance, when a campaign let's say is being promoted on the social medias by means of a slogan and a QR code, some customers might consider it an interesting approach and scan the code led by curiosity, while others might not be

sure of their further participation because of the uncertain content. The risks that the customers are exposed to when scanning a random QR code are malicious content like spyware, malware, viruses that often lead to stealing identities, phishing, SQL injection, fraud or social engineering attacks (Kieseberg, 2010: pp. 1,2,6). There are researches regarding QR codes security which reveal ways of prevention; we do not want to insist on this, but we recommend customers to avoid scanning codes placed in suspicious locations and run preventive specialized software applications on the mobile's operating system.

3. Behavioral needs for QR codes usage

Customers find themselves in situations when they need to know the available menu of one restaurant, the prices and promotions of a supermarket, the available stock of an item in a library, the nearest hotel and its latest offer or any other kind of information. Therefore, it has been encountered a significantly raise of QR codes popularity among business owners; for example, restaurant managers decide to place QR codes near each menu item to let customers have detailed description, the airports place the QR codes in their area, so that hotels and other tourist oriented services are synchronized with the passenger's arrival.

As we can see most of the QR codes are used as queries for different needed references of the customer; the need as a concept has an extremely dynamic feature that place the environment under the urge of permanent development of technology (Rouillard, 2008: pp. 4-5). Therefore, we do not face only the inquiry approach of the QR codes usage, but their ability to create patterns in the customer's behavior.

The QR Scanner software installed on the mobile phone recognizes the visual format of the code interprets it and performs an action towards its purpose. We have previously mentioned the basic applicability of enabling QR codes in the economic environment, mostly talking about the fact that a consumer now has the possibility to scan a code and find out information beneath it, within seconds. The truly important feature of the QR codes usage is not just based on successful inquires and real time response, but on further available actions like payments or purchasing. Although in the increase, we believe the online shopping cart as a concept to become already a classical approach because of the standardized sequential steps the customer needs to follow in order to purchase an item or to make a payment.

4. QR codes and online shopping

In this paper we have developed a script that is integrated in an e-commerce based website that sells furniture. We have used a MySQL database and PhP language to place generated QR codes for each item that is being sold on the website.

```
//display QR code for each product public
function displayQrCode($url, $FileName) {
$baseUrl = Mage::getBaseDir();
$baseUrl = str_replace('index.php/', '',
$baseUrl);
$PNG_DIR = $baseUrl .
'/frontpage/Qrcode/images/';
if (!is_dir($PNG_DIR))
{ mkdir($PNG_DIR, 0777, true)}
$idproduct = $FileName;
$productUrl = $url;

$size = '150x150';
$content = $productUrl;
$correction = 'M';
$encoding = 'UTF-8';
```

```
$filename = $FileName . '.png';
//Generate QR code Using Online generator
$rootUrl =
"http://qrcode.kaywa.com/chart?cht=qr&chs=$
size&chl=$content&choe=$encoding&chld=$c
orrection";
```

We have displayed the most important parts of the script, regarding the display of main product categories on the website's frontpage (Figure 1), along with the detailed products and their equivalent QR codes. We mention that we have not been involved in the process of creating the QR codes, but we have appealed an online standardized generator, by providing information like desired size or encoding.

```
//display product categories on the frontpage
$querry1 = db_query("SELECT idcategory,
name, products_count, image FROM
".CATEGORIES_TABLE." WHERE
idcategory<>0 and parent=0 ORDER BY
name") or die (db_error());
$root = array();
while ($row = db_fetch_row($querry1))
{if (!file_exists("./products_pictures/$row[3]"))
$row[3] = "";
$root[] = $row;}
//display product on the frontpage
$query2 = "SELECT idproduct FROM
".PRODUCTS_TABLE." WHERE idproduct<>0
";
$result = array();
for ($i=0; $i<count($root); $i++)
{$querry1 = db_query("SELECT idcategory,
name, products_count, image FROM
".CATEGORIES_TABLE." WHERE
idcategory<>0 and parent=0 ORDER BY
name") or die (db_error());
while ($row = db_fetch_row($q))
$result[] = $row;}
```

In the traditional online sales, customers often make their searches by typing keywords in the search engines, the name of the exact shop, or the name of a good or service; no matter what the result is and even if the customer is finally led to a certain online shop's website, the probability that he interacts with some specific items the shop wants to highlight, decreases as the number of clicks rises. Of course, featured items enjoy special treatment by the online strategy but this extremely detailed subject does not stand for our interest in this paper.

Figure 1 – QR codes integrated in e-commerce website

The three phased process that consists of scanning the QR code, interpreting the QR code and showing the result, actually restricts the area of devices that are capable to do this, in terms of mobility. The user is allowed to scan and pay with his virtual wallet that reduces interactions with the merchant and is based by the user's transactions history (Starnberger, 2009: pp. 579-581).

Of course, any kind of activity which implements the usage of QR codes as a strategy towards its customers, must take into consideration forecasts regarding the local smartphones market.

Any company that decides to sell a good or a service must think the QR code implementation as a two-dimensional process with a common foundation regarding the customer's ability to scan. After the customer scans the code with the smartphone, the rest of the process relies on two separate actions of buying and paying. Of course, if it is to point out the advantages of a QR code implementation as a separate layer of the business, then many of their owners would probably face a narrow understanding about why the customers would choose this kind of interaction.

5. Conclusion

The QR codes usage turns out to be an extremely effective tool especially in marketing, having a significant impact not necessarily on the existent technological architecture, but on the understanding and perceiving of the actual approaches. That is why we have to mention the famous example of a virtualized grocery store implementation in a Seoul subway from South Korea, where people face virtual shelves that look alike a real store and products are listed with their related QR codes underneath the image (Bethlahmy, 2011: pp.3-5).

The payment and the purchasing of these products that have been transferred from an online platform to a quotidian virtualized stage, is just one scan away from happening; customers purchase and pay these items with their phone mobile, while the products are delivered to their addresses right after their arrival.

The implementation of a module that generates QR codes for each item that is being sold online is not a fundamental change of the basic online sales architecture, but it creates a competitive advantage towards other businesses of the same kind. It is not the online environment only that has to deal with a change of perspective, but the traditional check-in store sales as well; discount policies, coupons or any other kind of money transfers that a customer deals with, are more virtualized but more accessible at the same time.

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