Applying knowledge extracted from communicating with customers in Mass Customization process: the role of Human-Computer Interaction

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Mass Customization is one of the production methods companies try to implement and answer customers' requirements in a more flexible way. To deliver the favourite products to customers, mass customizers need to have enough knowledge from customers to apply in design manufacturing processes. To achieve this objective, mass customizers have choices to extract knowledge from customers. Traditional methods of information gathering like questionnaires and even online questionnaires have a little knowledge about customers. This paper also investigates richness of communication channels and confirms that voice conversations, video conferences and face to face communications have more richness and therefor more knowledge. The Idea of this paper rises from the question that "how we can use Human-Computer Interactions to help Mass Customization processes". This paper suggests that mass customization could apply the hidden knowledge from communication with customers and interactions between customers and computers in virtual spaces in its processes and make more favourite choices for customers. We will see that knowledge flow could be started from customers and trough interacting with computers and communicating through e-commerce (internet) could be entered in Mass Customization processes like designing and manufacturing.

Mass Customization, knowledge, e-commerce, communication, Human-Computer Interaction.

1. INTRODUCTION

In the previous decades, companies were in challenges to attract market with respecting to mass production approaches. In this area, some new techniques that are, in general forms, communication and IT techniques were emerged and introduced mass customization approach to large-scale companies. Respecting to this concept and extending new techniques make it more possible for companies to adapt to the customers and survive in the competitive environment.

Imagine companies produce their products in different approaches just like a spectrum so that beginning of it is mass production and the other side is product perfect customization. In this case mass customization is the strategic solution for companies. Companies that choose mass customization as their competitive advantage

require to standard their products and services possess modular production processes and provide services (Skipworth and Harison 2006). So many solutions have been suggested for analysing the customers' needs and requests, but companies usually have a problem in communicating with customers. The purpose of communication is not clear for them and they don't know how to extract their required knowledge.

Human-Computer Interaction (HCI) is a field of research and development, methodology, theory, and practice, with the objective of designing, constructing, and evaluating computer-based interactive systems including hardware, software, input/output devices, displays, training and documentation so that people can use them efficiently, effectively, safely, and with satisfaction (Harston, 1998).

The purpose of this paper is to consider ways which a company can apply to extract hidden knowledge of customers interacting with computers for the progress of company towards mass customization path in e-commerce area.

The Idea of this paper rises from the question that "how we can use Human-Computer Interactions to help Mass Customization Processes". It is essential to say that we are looking for answers from the perspective of Knowledge Management. Figure 1 shows the above question and it can be understood from the figure that using HCI for Mass Customization in any way is a process.

Figure 1: the idea of this paper: How HCI can help Mass Customization?

2. MASS CUSTOMIZATION: A STRATEGIC APPROACH TO THE PRODUCTION

As Pine defines it (1999), mass customization is the use of mass production techniques to quickly assemble goods and services that are uniquely tailored to the demands of individual customers at prices comparable to mass-produced goods and services.

To be effective, it must combine the cost-saving efficiencies of mass production with the value-added processes associated with customizing (Berman, 2002). According to Zipkin (2001), executives must understand each of the system's three major components to implement mass customization successfully: elicitation, process flexibility and logistics.

Elicitation is a mechanism for marketers to interact with customers and obtain information about their specific needs.

Although there are some companies around the world that provide their products through mass customization approach, but we think many other products can be produced using this approach. For instance, today's big automobile companies and also large-scale computer-producing companies produce their products through mass customization and sale them via the Web. They can present some prototypes of the products which are ordered by

customers in their sale website pages. That is what HP acts in its website for tablet computers (see www.hp.com).

3. KNOWLEDGE MANAGEMENT

As mentioned before, a company must provide appreciate choices for customers that adapted with their needs. To obtain this goal, it is necessary to respect the dependency between mass customization and extraction of information and knowledge of environments and customers. Before emerging the World Wide Web (Internet), the extraction of the information was done by salesmen and distribution channels and the most important factor was marketing. The development of the Internet would make this task easier and cheaper than before.

In this paper we assume knowledge as a result of communicating with customers in the way that could extract hidden knowledge about their needs and ideas about products. We need something to know mass customization customers much better.

4. E-COMMERCE: A BRIDGE BETWEEN MASS CUSTOMIZERS AND CUSTOMERS

Electronic commerce is the process of buying, selling or exchanging goods, services or information through a network of inter-related computers as Internet (Turban & King, 2006).

According to Zwass (1994) e-commerce follows three objectives: 1-sharing business information, 2-maintaining commercial relationships and 3- doing commercial exchanges (data, goods, information, etc.) through the internet-based technologies.

E-commerce runs the mass customization online by achieving order and sale the products. As an example you can see HP website and observe that how personal computers and notebooks are sold to the customers using this method. Mass customization as a competitive strategy has to use e-commerce in order to extract knowledge from customers and apply it to create value in supply chain.

Communicating in e-commerce domain can inform producers of their customers' requests. By the use of the internet, information of people can be extracted and analysed easily. Since it is easy for producers to have customers' information, retailers can collect their information by communicating them. Then the analysis of this information can identify the customers' needs and requests. Using this information, e-retailers can create a profile for each customer. For instance, *amazon.com* and also *ebay.com* which are two large e-retailers in the

world suggest books and merchandises according to customers' interests based on the acquired knowledge. In this area, we can also mention Brokerage firms such as Charles Schwab (www.schwab.com). This firm have implemented customizable e-mail "alert" systems to notify investors of events specific to securities of interest.

4.1 The role of Internet as an e-commerce tool and communication channel between firm and customer

Because of having attractive nature of online buying, in the beginning of e-commerce studies on usage capability of companies websites, studies was directing to answer this question that how physical and layout designing can lead to facilitate e-commerce easily and desired for users. But after a while, researches focus on answering this question that what social factors can affect buying procedure and meeting e-commerce. This means that researches have changed their attention from physical designing to answering the question of how to present the area that customers feel better in e-business procedure (Nelson et. al, 2001). Another important dimension in interactions with customers is communication.

To know the role of the internet in e-commerce and mass customization better, it is necessary to know about communication. Internet works as a media

that provide communication between user's PC and Mass Customization.

5. COMMUNICATION

There are various definitions of communication which have common elements. Some researchers believe that communication is the process through which information flow, while others believe it is transmitting message. Robbins and Judge (2009) define communication as transference and the understanding of meaning. In his opinion when a German speaks in team, while others don't know this language, no communication has been happened. Because members have been received the message, but its meaning.

According to Robbins' definition, communication in e-commerce means sending and receiving messages between a buyer and a salesman for making the purposed subject.

Disadvantages	Advantages	Communication type
Distortion of the message	Speed and feedback	Oral communication
Time-consuming and lacks feedback	Tangible and verifiable	Written communication
Misperception of body language or gestures can influence receiver's interpretation of message	Supports other communications and provides observable expression of emotions and feelings	Nonverbal communication

Table1: types of communication, advantages and disadvantages

Source: Robbins, S. P, Judge, T. A. 2009. "Organizational Behavior," 13th edition. Pearson: Prentice Hall. Page 389

5.2 Various types of communication

Communication can have various types. Oral or written communications are two common types. Oral communications are faster, but the meaning can be distorted. Written communications can be referred to. Table 1 shows the advantages and disadvantages of these kinds of communications. In mass customization executive organizations, communication between organization and customer can be categorized in one of the mentioned forms. For instance many of e-commerce sites provide writing communication for their customers. In addition to writing communication, there are many websites that customers can have a conversation

with sale agents or after sale service centers. This conversation is often done by telephone. The communication technologies provide the ability of making image contact which some companies use that by regarding its cost. By using image contact, some of body postures like face postures which have important role in it, can be transferred. There is much information of customer's needs and requirements in writing and oral communication that is occurred before buying process. Customers usually are more comfortable with the organization web site than its salesmen (Helms et. al, 2008) and they would not filter their needs and requirements sensor in meeting of website.

Figure 2: Information Richness of Communication channels

Source: Based on R. H. Lengel and R. L. Daft, "The Selection of Communication Media as an Executive Skill: Academy of Management Executive, August 1988, pp. 225-232; and R. L. Daft and R. H. Lengel, "Organizational Information Requirements, Media Richness, and Structural Design," Managerial Science, May 1996, pp. 554-572. Reproduced from R. L. Daft and R. A. Noe. Organizational Behavior (Fort Worth, TX: Harcourt. 2001). p. 311.

5.1 internet tools: supporters of effective communication with customers

Mass customization is producing goods in the way that could satisfy particular customer requirements in predefined features. So communicating with customer in a user-friendly interface is a critical factor. For a powerful designing, powerful communication between company and customer is needed. One of the major developments facilitating this communication process has been the Internet (Berman, 2002). Internet provides interaction and communication with customers at low cost.

Communication formats like "marketing researches and goal groups" that were used to collect

customers' data and knowledge are not enough for the complex competitive environment. In addition, new methods like completing forms by customers, using cookies and software agents do not provide enough information from customers and only explore customers' search pattern through internet. This amount of information is not sufficient for customer identification in mass customization process (Helms et.,at, 2008). By promoting technologies, web 2 could enter in e-commerce and web space.

5.3 Functions of communication in Web

Robbins and Judge (2008) indicated the functions of communication in their book "Organizational

Behavior". As they have mentioned, the functions are:

- (i) To control member behaviour: although this function is not the first event that occurs, but through this function marketers can track customer's behaviors in the web and control her/his behavior by some means. For example, cookies can inform analysers about customer's interests and websites can have arrangements to guide customers to particular options. For instance visit www.amazon.com and www.ebay.com.
- (ii) To foster motivation for what is to be done: marketers could advertise their products and services and motivate customers through communication. Agents or Decision Support Systems could do it as well.
- (iii) To provide a release for emotional expression: the most important benefit of this function in mass customization is to know customer's ideas and senses about a product. As Alsup has mentioned, knowledge of customer's needs and their purchasing approach appear most in informal discussions (Alsup, 1993).
- (iv) To provide information needed to make decisions: maybe here we have the most important function of

communication for mass customization. Acquiring knowledge through communication can help decision makers in mass customization to improve their products according to customers' needs.

Internet as a network of inter-related computers is a media that facilitate exchanging mass communication. Although these theories are useful in identification of users' choosing procedure, they are not useful about internet (Coughlan, Macredie, & Patel, 2007).

It seems there are more researches about the "media richness theory" than other theories and Internet is compared with face to face communication which is the richest media. Although it has multimedia facilities but it is known as a weak media.

Some tools which companies use for communicating with customers include websites, the votes of sites and online questionnaires. They are weak communication channels as shown in figure 2. Some web sites provide online conversations to make consultations and providing services easily. Although oral communication is richer than writing, it is not an effective and efficient communication tool yet. As it is shown in figure, video conference channel is considerable in communication and can ensure company that a strong communication is made with customers. So it is forecasted that firms can attract more efficient knowledge from customers.

Table2: Methods of extracting knowledge from communicating with customers

Mass customization tools for communicating and acquiring knowledge	Applying method in extracting knowledge from customers	Description	Knowledge acquiring method
Web 2 based technologies (blogs, online conversations or video conference)	Communicating directly with customers to know their needs and finding a good for them	Direct interaction between knowledge engineer and expert and extracting knowledge	Gathering knowledge by knowledge engineers
Blogs, Wikies and predefined forms on the websites	Encouraging customers to write their ideas	Codifying knowledge by experts to system language	Codifying knowledge by experts
Cookies and software agents, intelligent agents	Using information about customers' needs and buying by machine to extract needs and buying patterns.	Extracting knowledge by computers from patterns	Acquiring knowledge by machines
Online conversation, voice mail and video conference	Using online conversation, voice mail and video conference for interview to customers or sending questions for them to answer	Interview with experts (discussion or written) and extracting knowledge	Interview
Cookies and software agents, intelligent agents	Using cookies and following customer's behaviour in websites. Here we can use from software agents	Recording how an expert do his job and analyze and extracting knowledge by knowledge engineering	Analysis of work by experts
Sale agents (human or software), intelligent agents	Suggesting different alternatives to customer to choose between every alternative.	Suggesting 3 alternative to experts to compare them	RGM Method

5.4 Extracting knowledge from communicating with customers

Customers are the best expert about their needs and requirements. They can teach a company and give knowledge about themselves. This knowledge is hidden in their searches for finding a product, descriptions of goods and etc. Marakas (2002) in his book (Decision Support Systems) believes that knowledge engineers are responsible for gathering and structuring knowledge. He also mentions methods of knowledge acquisition in six categories:

- (i) Gathering knowledge by knowledge engineers: knowledge engineer communicate directly with experts and acquire their knowledge.
- (ii) Codifying knowledge by experts: experts codifying knowledge in the system language through trainings.
- (iii) Acquiring knowledge by machines: in this method computers are responsible of acquiring knowledge through communicate and interact with experts.
- (iv) Interview: knowledge engineer directly interview with experts.
- (v) Analyse of work by experts: recording the process of doing a particular work (video film) and

extracting the methods and patterns of doing it.

- (vi) RGM Method: in this method 3 options will be offered to expert and he is asked to compare them together. There is hidden knowledge in this comparison.

We can generalize these methods to the process of knowledge acquiring from customers. This categorization is especially useful for the companies that believe "customers teach us".

6. THE ROLE OF HUMAN-COMPUTER INTERACTION IN EXTRACTING KNOWLEDGE

Human-computer interaction, as mentioned before, is the study of interactions between humans and computers. We think that using this area, companies can extract Significant knowledge.

In previous sections, we suggested using video conferences to help conduct a better communication. Here we can refer to the work of Ward (2004) who suggests analysing facial movement tracking. He explores the association between facial and physiological responses to computer-based events, and the viability of facial movement tracking in detecting and distinguishing

qualitative differences in users' facial movements under normal conditions of computer use. We believe that in interacting with websites; even the facial movements have important knowledge about customer's feelings about product and its component. For example when a customer is choosing the components of product (like a car) and compare between them, his facial movements could reflex her feelings about those components.

The application of HCI is in designing interfaces. Until now HCI have been applied in computer and software design. But today, businesses need to know about this interaction to manage communication with customers by computers through internet

Figure 3: The role of Human-Computer Interactions in Mass Customization.

7. DISCUSSION AND CONCLUSION

In this paper firstly Mass Customization was introduced and it was mentioned that to deliver favourite products to customers Mass Customization have to acquire knowledge about customers' requirements. More we discussed that although this knowledge can be gathered from various sources in different ways (like questionnaires and even online questionnaires), but this knowledge does not reflect all of customers' needs and is not enough to design and produce goods in this way. For example this knowledge could not represent customers' feelings about goods. Desired knowledge is not acquirable from traditional methods. Then this idea raised that our considered knowledge could be Somewhat hidden in communication with customers.

Mass Customization needs electronic commerce's infrastructures to communicate with customers.

Thus companies could use these infrastructures to extracting required knowledge for Mass Customization. After it, the idea of using Human Computer Interactions raised. Customers use their computers to communicate with producers through e-commerce. This paper suggests Mass Customizers must monitor patterns of interaction between customers and computers to discover their feelings and ideas about products and components.

Also we suggest researchers could focus on this subjects for future researches:

1. What kind of knowledge can we extract from human-computer interactions?
2. Design and production processes in mass customization to what knowledge they need?
3. How Mass Customizer's website can extract knowledge using its interface?

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