

WEB PERSONALIZED INTELLIGENT USER INTERFACES AND PROCESSES

An Enabler of Multi-Channel eBusiness Services Sustainability

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Abstract: The explosive growth in the size and use of the World Wide Web as a communication medium has been enthusiastically adopted by the mass market to provide an electronic connection between progressive businesses and millions of customers bringing to light the eBusiness sector. However, the nature of most Web structures is static and complicated, and users often lose sight of the goal of their inquiry, look for stimulating rather than informative material, or even use the navigational features unwisely. Hence, practitioners need to alleviate such navigational difficulties and satisfy the heterogeneous needs of the users to allow web applications of this nature to survive. Main emphasis is given at saving costs, improving efficiency and growth, competitiveness, expanding markets and creating more business opportunities, for local and regional governments which aim at providing better and affordable public services to citizens and building “smart communities” by attracting business investment while guaranteeing both quality of life and economic health in the European e-Economy. The rapid growth of the Communication Developments and Technologies has had a profound economic and social impact and has introduced a wide variety of new channels over which different forms of contact and service delivery can take place. A predominant trend in the field of eBusiness research concerns the creation of new infrastructures, methodologies and techniques to support high-level business-to-business and business-to-consumer activities on the Web. This paper presents the research implications and challenges of the Web Personalization concept as an enabler of eBusiness Services sustainability with the development of Personalized Intelligent User Interfaces and processes.

1 INTRODUCTION

Since 1994, the Internet has emerged as a fundamental information and communication medium that has generated extensive enthusiasm. The Internet has been adopted by the mass market

more quickly than any other technology over the past century and is currently providing an electronic connection between progressive businesses and millions of customers and potential customers whose age, education, occupation, interest, and income demographics are excellent for sales.

The explosive growth in the size and use of the World Wide Web as well as the complicated nature of most Web structures result in orientation difficulties, as users often lose sight of the goal of their inquiry, look for stimulating rather than informative material, or even use the navigational features unwisely. As the eBusiness sector is rapidly evolving, the need for such Web structures that satisfy the heterogeneous needs of its users is becoming more and more evident.

To alleviate such navigational difficulties, practitioners have put huge amounts of effort to identify the peculiarities of each user group and analyze and design methodologies and systems that could deliver up-to-date personalized information, with regards to products or services.

With the growing maturity and diffusion of Information Communication Technologies (ICT) based applications and methodologies, a new challenge emerges for firms. The eEurope 2005 Action Plan confirmed the goal “to promote take-up of e-business with the aim of increasing the competitiveness of European enterprises and raising productivity and growth through investment in information and communication technologies, human resources and new business models” (COM, 2002). Doing business electronically, that is automation of business processes both intra- and inter-firm over computer mediated networks (eBusiness Watch, 2004), implies a primary focus on commercial transactions and services delivery between companies and their customers (consumers (B2C) or other companies (B2B)), and processes within a company and between companies. Even if the “electronic” enhancement, especially in quality eServices delivery, becomes a “must” to stay in business, the underlying concepts are still changing fast, which translates into a constant “adopt and adapt” for many firms.

Two different strategies for improvement of eServices are identified, *process integration* (back-end) and *service delivery* (front-end). The first one refers to the degree to which the service is reengineered in the transformation from an off-line service to e-service, while the second refers to the channel and distribution strategies in the provision of business services (Top of the web, 2003). Relevant channel and distribution strategies are critical for future advancement of eServices to achieve accessible, customer-focused and responsive services. Following the growing user demands and requirements as well as the rapid development of the

technological advancements and infrastructure capabilities the development of eServices should not only focus on making the service available on the Internet, but also examine the different delivery platforms. A multi-channel (WAP, MMS, SMS, Web, Satellite etc.) and a multi-device (PC, mobile phones, PDA, tablet PC, Satellite handset etc.) access mix will improve the access of the services offered, since will be available anytime, anywhere and anyhow through a single point of access entry increasing consequently the business eServices sustainability. Indisputably, this is the vision of an interoperable, transparent and secure continent whereby multi-channel service delivery integration is considered fundamental.

New communication platforms beyond PC-based Internet access are now becoming available allowing the businesses to meet these challenges by reengineering their front and back office and business processes, implementing new ways of interaction through a variety of channels (i.e. interactive digital television and third generation (3G) mobile systems driven by common standards open up possibilities for multiple platforms access to services), and restructuring services that accommodate their customers’ needs. “Two new developments will have a major impact on the further development of the Internet: multi-platform access / convergence and broadband” (COM, 2002). Broadband stimulates the use of the Internet and enables the usage of rich applications and services. Its benefits emphasize in the areas of e-business, e-learning, e-health, and e-government, improving the functionality and performance of those services, and further extending the use of the Internet.

eBusiness aims to deliver better quality of eServices increasing productivity with focused services to be provided by various channels, at a lower cost and time and in a personalized style. To succeed this, customers must not be spatially disoriented and be able to have continuous and adapted access on information and services requested.

The aim of this paper is to focus on the eBusiness services delivery sector and analyze these concepts and factors that could affect their continuous quality provision in a multi-channel and widely diverse environment securing their sustainability. An extensive reference will be made to the new technological emergent environment and the resulted changing customer requirements, arguing that Web personalization and the developed Intelligent User

Interfaces and processes are nowadays considered fundamental for the provision of adapted and personalized eServices, via any medium, increasing this way one-to-one service delivery and integrity enabling businesses to retain their customers and therefore to gain a substantial competitive advantage.

The paper is structured in 6 sections. Section 2 presents roughly the eBusiness sector. Section 3 outlines the new customer services requirements. Section 4 refers to the emergent multi-channel technological environment. In Section 5 the impact of Web personalization concept in eBusiness services sustainability is described, and section 6 concludes this paper.

2 THE EBUSINESS SECTOR – TRENDS AND OPPORTUNITIES

There are on-going debates about the best way of defining eBusiness. Within the Digital Europe the following definition is primarily used, “The eBusiness sector comprises companies which deliver digital technology products and services as a significant part of their core business or use digital technologies as their primary channel to market. EBusiness as a concept refers to transactions using these technologies, such as eWork, eCommerce and eGovernment” (Digital Europe, 2002). In the changing business environment of today, mainly because of the rapid growth of the ICT challenges the eBusiness services sector faces new opportunities. Main emphasis is given hereafter on the development of multi-channel (especially mobile) and broadband services to provide more interactive business services that match the customers’ needs in terms of easy-to-use, personalized and timely delivered services. However, for a better understanding of the impact of ICT in the eBusiness services and the actions to be undertaken, the related trends and opportunities embedded in the internal mechanisms and operational procedures of the various enterprises have to be realized.

More broadly, eBusiness is often described as the Small to Medium Enterprises (SMEs) gateway to global business and markets exploiting the opportunities provided by ICT to improve performance. Attention is devoted to SMEs evolution and to the ‘external’ factors, related to the digital economy which directly affects SMEs success and development. This focus will result in addressing any

structural changes in SMEs’ organization and management, changes in the competitive scenario that may affect SMEs evolution, and interventions and policy instruments that have contributed to foster SMEs adaptation to the digital economy (European Commission, 2004).

Nevertheless, SMEs find the opportunities difficult to grasp. While many SMEs have now a basic Web presence, available indicators suggest that the majority are still reluctant to use the internet as a business tool. Some of the main obstacles are focused upon the facts that SMEs lack the crucial technical and management skills needed to capitalize on the new technologies; they lack access to standardized and fully compatible ICT solutions that stay relatively stable over time, and so run the risk of becoming “locked-into” inappropriate technologies; regulatory frameworks are complex and not attuned to cross-border eBusiness; they are not yet convinced of the appropriateness of eBusiness for their particular circumstances; they have great difficulty finding the time and resources to become informed about and understand the benefits and implications of new technologies and so on (European Commission 2004).

The important trends and challenges introduced by the new technological advancements and methodologies, though, are underlining some specific guidelines for the improvement of the digital SMEs and consequently of the eBusiness sector. More particular, such actions are emphasizing upon the improvement of networking and new infrastructures to support more effectively high-level B2B and B2C activities on the Web; the improvement of innovation within an organization (innovation of products and services as well as integration of business processes); the improvement of the effectiveness of human and knowledge resource; and last but not least, the adoption of new interaction channels, such as mobile business (mBusiness), cutting the cost and increasing employee productivity, providing information and services using mobile devices.

3 SERVICE REQUIREMENTS AND DELIVERY

3.1 General User Requirements

To get the right information at the right time and the right place is not so easy for the customers. The eBusiness sector working at its front or back office, it has encountered in several times and occasions the particular problem. Customers' interaction with the services has to be improved, and a serious analysis of customers' requirements in the area of eBusiness has to be undertaken and documented and furthermore examined taking into consideration its multi-application to the various delivery channels and devices.

This paper will present, based on studies conducted (Top of the web, 2003; PRISMA, 2002; CAP Gemini Ernst & Young, 2004), some of the user (customer) requirements and arguments anticipated. They could be clearly distinguished into:

3.1.1 General User Service Requirements

- *Flexibility: anyhow, anytime, anywhere.* (a) Technological developments have introduced a wide variety of new channels over which different forms of contact can take place (i.e. web technology, has introduced e-mail, which in many situations has replaced regular mail, or has opened the possibility of consuming services by means of self-service on a 24x7 basis; moreover, mobile technology makes it possible to consume services irrespective of location); and (b) many service delivery processes consist of two more interaction sessions between the customer and the provider (i.e. if the organization is flexible in terms of its service delivery, it will allow the user to choose the channel or location for the interaction processes, and allow him to switch between channels at any preferable time).
- *Accessibility.* (a) Customers should be able to locate the required services (awareness); (b) customers should be able to identify the channels that they can use to access the service they need; (c) once a service is located and accessed, customers should be able to consume the information provided by the service; (d) the legal basis of eServices stipulates that they must be accessible for all potential users; and (e) a pricing

policy for services should guarantee that the intended target groups can afford the services.

- *Quality.* (a) There are many situations in which a customer needs more than just one service to deal with a particular situation. In a one-stop shop approach, a single interaction would be able to address all requirements, thus saving the customer's considerable amount of time; (b) eBusiness services are usually regulated by means of strictly defined specifications. Quality can be described as satisfactory if the service is provided in conformance with the relevant specifications; (c) in user-centric approach, services must be offered pro-actively. A timely service is a service that is offered at the moment a customer may need it, even though he may not yet be aware of it; and (d) quality comes at a price (i.e. faster delivery of a service may involve more costs than delivery at a regular speed).
- *Security.* (a) A trusted exchange of information depends on an assured security level. If a channel is not secure, or if customers do not trust its security, the channel will not be used for services that involve sensitive information; (b) security is not only a technical matter, it is also one of perception. Due to a lack of trust in security matters, relatively large segments of the user population are less inclined to use channels that they do not fully trust, especially when payment is involved.

3.1.2 Requirements for a Friendly and Effective User Interaction

- *Information Acquisition.* Support active involvement.
- *System Controllability.* Give the customers the control.
- *Navigation.* Provide easy means for navigation and orientation.
- *Versatility.* Support alternate interaction techniques.
- *Errors.* Tolerate customer's errors and support error system-based and context-oriented correction of customer's errors.
- *Personalization.* Enable customization of multi-media and multi-modal user interfaces to particular user's needs.

The convergent perception of many studies seems to be that customers are different in their perceptions, reactions, and demands. In addition, it is

almost universally accepted that, “where misunderstandings in a human-machine interaction are possible, then misunderstandings will occur” (Europe’s Information Society, 2004). Therefore, a consistent optimized approach incorporating all the positive and negative outcome viewpoints is considered vital for the most optimum fulfillment of customer needs.

3.2 Multi-Channel Service Delivery

As can be observed from the customers’ requirements above, it is difficult to draw a clear line between a service (product) and the means of service delivery (channel). A channel can change the customers’ perception of a service. When a customer has a free choice between different channels to access a service, he will choose the channel that realizes the highest relative value for him, by means of a high quality, accessibility, flexibility, and cost-efficiency and effectiveness. On the other hand, to increase the value of its service, a provider, should have its service processes and delivery channels more integrated, i.e. by re-organizing its organizational structure or by a more intensive cooperation between its internal and external departments. If channels are integrated, the introduction of a new channel is not merely an additional channel but a new opportunity to improve service delivery. With regards to the customer, the integration of channels means more accessible and more flexible service delivery (which leads to better services).

Separate development of different channels for a single service (multi-channel delivery) can lead to inconsistencies such as different data formats or interfaces. To overcome the drawbacks of multiple-channel service delivery, the different channels should be integrated and coordinated (Caldow, 2001). To enable this, the common data that are used by the *front office* applications should be stored centrally so that they can be shared by the applications. Storing data centrally means that they need to be collected only once and that they can be accessed by back office applications. When data are stored centrally, users can also access the services they want from the location(s) and medium they want (desktop or mobile), as all the relevant information retrieval is taking place from the same databases. When *back office* processes are also integrated, full service integration becomes possible,

which raises the quality and number of services significantly.

3.2.1 Channel Selection

Services can be delivered through a wide variety of channels (the term ‘channels’ is often used as a concept that includes ‘channel type’, ‘technology’, ‘platform’, ‘media’, ‘device’ and ‘touch point’). As in previous sentences have briefly been mentioned certain channels are more suitable than others for meeting particular customer requirements. Factors such as cost and management make it impractical for an organization to implement all channels. A realistic set of channels must, therefore, be selected from the available range of potential channels. Since success in eServices delivery depends on a vast range of parameters, there is no single formula or solution that fits all situations. However, there have been reported particular steps (IDA, 2004) that could guide a provider throughout the channel selection process. Among other these could include:

1. Rate the features of the available channels.
2. Rate the service provision requirements for each service type.
3. Match the channel features and the service provision requirements.
4. Investigate the channel preferences of potential users and use the results to fine-tune the selection of channels that meets the general user requirements.
5. Determine whether the remaining channels are technically and organizationally appropriate to deliver the services.
6. Determine which channels will realize the best public value, based on (expected) costs and benefits.

Ultimately, it should be mentioned that the suitability and usefulness of channels depends on a range of factors, out of which technology is only one element. Additional features that could affect the service channels assessment could be: *directness, accessibility and inclusion, speed, security and privacy and availability*. To realize though their potential value, channels also need to be properly implemented and operated.

3.2.2 Channel Limitations

The Internet is today one of the most important information retrieval resources affecting directly the on going people’s quality of life. The demand for

service consumption anytime, anywhere and anyhow has emerged the evolution of the wireless networks (wireless Internet) and mobile devices adding not only even more value to the specific medium but increasing at the same time the number of channels liable to convey the requested information. Since the number and variety of these channels (networks and devices) is really huge, with different capabilities and limitations, the design and implementation complexity is rising significantly. With regards to the networks some of the added issues and concerns are the low bandwidth, the unreliable connectivity, the lack of processing power, the limited interface of wireless devices and the user mobility.

The mobile devices have nowadays been proliferated dramatically and they are usually used to keep the users to a continuous interaction with the rest of the "world". In parallel to the wireless networks evolution, they are also used to provide customers with information and services on demand. Nevertheless, many restrictions and limitations characterize them not only because of their restricted computational power but of their small size as well. More specifically, one mobile device could be distinguished from a desktop one because of its:

- *Size*. One mobile device must be small enough so to move easily and ideally.
- *Processor*. Usually mobile devices processors have less computational power and different architectural design.
- *Memory and Storage space*. The memory is significantly restricted due to the small size of a mobile device.
- *Screen*. The screen is of very small sizes with low resolution capabilities, that is why in many cases there are only monochrome panels.
- *Data entry*. Most of the mobile devices either they do not have keyboard at all or they have one of restricted size. Therefore, the data entry for processing becomes even harder. Additionally, in these devices could be inserted data via voice or image recognition techniques.

4 THE DEVELOPMENT OF THE MOBILE COMMUNICATION SECTOR – THE MBUSINESS EMERGENCE

The "New Adaptive Web" generation strives to move eBusiness beyond traditional borders of desktop business systems embracing such modern Web trends as "mobile Web", "open Web", and "Semantic Web" (eBusiness Watch, 2004). In this reference to mobile business (mBusiness) will be made, from mobility emergence to physical constraints and challenges that should be addressed by new advanced adaptive presentation and navigation support techniques. The plethora of networked devices and platforms that continuously come to light, as well as the emergence of alternative ways to access the internet have increased the demand for multi-channel access to applications. The anticipation of faster and cheaper W4 (Wireless World Wide Web), the third generation (3G) wireless networks as well as the more sophisticated mobile devices will soon establish mobile broadband services as the future trend. At the same time there is a growing number of organizations that plan to deploy parts of their traditional Web sites for multi-channel access.

This can be an overwhelmingly difficult task, since several problems have derived in building and maintaining business applications for access by heterogeneous platforms. Businesses nowadays not only have to deal with the challenges that classic business applications pose, but also have to face numerous considerations with respect to multi-channel delivery of the applications and services. The mobility emergence has brought to light mBusiness, which could be easily considered as the logical extension of eBusiness. mBusiness will create tremendous opportunities for most innovative companies allowing them to promote their products and services effectively and efficiently, by cutting the cost, increasing employee productivity (working while they are off-site) and addressing return on investment on their applications and services. At the same time, mBusiness will enable them to increase customer retention, by establishing valuable direct links with them and strengthen important relationships by improving to an "anywhere, anytime and anyhow" interaction achieving the competitive difference. Moreover, mBusiness could be considered as a new kind of front-end access to Adapted and Intelligent Web-Based Systems with specific capabilities of delivering on demand real time information, orders, products, and payments adapted to the individual customer as well as the context of customer's work.

5 WEB PERSONALIZATION AS AN ENABLER FOR EBUSINESS SERVICES SUSTAINABILITY

Further to the extended needs and requirements imposed by the new multi-channel (wireless and mobile) environment of the “new” customer, it is essential to refer to the challenges and implications that companies have to adopt to enable eServices sustainability to keep delivering quality services and hence gain the competitive advantage in the market segment. Therefore, in this section it is argued that eServices sustainability is primarily achieved by the employment of web personalization intelligent user interfaces.

5.1 General Mobility and Adaptive Personalization Cross-Road Considerations

As the above sections describe, it is evident that the demands of mobile users differ significantly from those of desktop users. Getting personalized information “*anytime, anywhere and anyhow*” is not an easy task. Business Analysts and Practitioners have to take into account new adaptivity axes along which the personalized design of e- and mBusiness services would be built. Such services should be characterized by flexibility, accessibility, context-awareness, quality and security in a ubiquitous interoperable manner. User interfaces must now be friendlier enabling active involvement (information acquisition), giving control to the customer and provide easier means of navigation supported by the small screens of the mobile devices and enable adaptation of hypermedia, multi-media, and multi-modal user interface. Various attempts have been made so far to comply with such requirements and are based on re-engineering existing Web sites and services.

However, creating and maintaining a Web site to support multi-channel access is proved to be quite costly and also requires a significant amount of work (Synodinos, & Avgeriou, 2003; Freire et al. 2001). Further to this, mobility applications can suffer from a handful of noteworthy problems such as: local mobility, limited mobility, closed mobility and interrupted mobility. Local mobility describes the situation when some mobile applications have been successfully delivered in a local environment, but are

not cost-effective when applied at a trans-national mobility level. Limited mobility describes cases where an impressive coverage has been reached nevertheless encountering local problems, non-covered local areas or not enough capacity. Closed mobility describes situations where mobile services are restricted for example to GSM technology (both CSD and SMS), without any generalized use of complementary mobile technologies for local environments as well as non-terrestrial areas. And finally, interrupted mobility describes cases where there is a lack in the availability of frameworks that make possible business models in which complex interactions between different sectors are performed by means of mobile applications.

To overcome these problems personalized intelligent techniques have to be implemented to enable the development of an open Adaptive Personalized Mobile Web (Brusilovsky, & Nejd, 2004), with fundamental characteristics the directness, high connectivity speed, reliability, availability, context-awareness, broadband connection, interoperability, transparency and scalability, expandability, effectiveness, efficiency, personalization, security and privacy (Lankhorst et al., 2002; O’Connor et al., 2004; Volokh, 2000; Korkea-aho, 2000).

The “Mobile” generation is now extending the basis of adaptation by adding models of context such as location, time, computing platform and bandwidth to the classic user model and exploring the use of known adaptation technologies to adapt to both an individual user and a context of their work (Brusilovsky, 2003). Adding to the challenges of classic business services the new advanced e- and mBusiness techniques will need to address considerations having to do with the heterogeneous nature of the multiple platforms as well as the position in space (and time) of the user in order to produce an effective adaptive and personalized result. Now, by customer needs it is implied both, the *thematic preferences* (i.e., the traditional notion of profile) as well as the characteristics of his mobile device, the *device profile*. Therefore, adaptive personalization here is concerned with the negotiation of customer requirements and device abilities.

5.2 Multi-Channel eBusiness Services and Web Personalization

Indisputably, the user population (customers) is not homogeneous, nor should be treated as such. To be able to deliver quality services, eBusiness Services should be tailored to the needs of individual customers providing them with personalized and adaptive information upon request. Although one-to-one service provision may be a functionality of the distant future, customer segmentation is a very valuable step towards that direction. Customer segmentation means that the customers are subdivided (ideally per service or group of related services), into more or less homogeneous, mutually exclusive subsets of customers who share an interest in the service. The subdivisions are based on one or more customers characteristics; *demographic characteristics* (i.e. age, gender, urban or rural based, region), *socio-economic characteristics* (i.e. income, class, sector, number of employees, volume of business, channel access), *psychographic characteristics* (i.e. life style, values, sensitivity to new trends), or *individual physical and psychological characteristics* (i.e. disabilities, attitude, loyalty).

The issue of personalization is a rather complex one. Some of these issues become even more complicated once viewed from a moving user's perspective, i.e. when constraints of mobile channels and devices are involved (Panayiotou, & Samaras, 2004). Such issues include, but are not limited to, the following: *what content to present to the user, how to show the content to the user, how to ensure the user's privacy, or how to create a global personalization scheme*. In addition to these considerations, there are also many approaches and each one of them usually focuses on a specific area, i.e. whether this is profile creation, machine learning and pattern matching, data and web mining or personalized navigation. Personalization varies from Link to Content to Context to Authorized to Humanized levels, with several paradigms to implement them. Among others these include, content-based filtering, rule-based filtering, collaborative filtering, Web-usage mining, demographic-based filtering agent technologies, and cluster models.

Eventually, customer characteristics, determining customer segmentation and thus provision of the adjustable service information, differ according to

the circumstances and they change over time. This is one of the reasons why customers should be offered a choice of channels when they access services. Having these in mind Business Analysts and Practitioners should develop new intelligent user interfaces advanced with adaptive presentation and adaptive navigation techniques that would take advantage of these constraints to the benefits of their customers whenever applicable and provide them uninterrupted sustainable eServices.

6 CONCLUSION

The rapid expansion of the adoption of the Internet as a communication medium, as well as the explosive growth in the size and use of the World Wide Web and the need for eBusiness Services to retain their customers and therefore gain a substantial competitive advantage results in the inference that Web Personalization techniques, like intelligent user interfaces, enable eBusiness services providers to adopt successfully the new multi-channel (wireless and mobile) technologies increasing their eServices provision sustainability across their market segments. Key questions and arguments converging to the customers' requirements for multi-channel service provision anywhere, anytime and anyhow, re-enforcing this way core functionality issues related to mobility, and thus mBusiness, were analyzed. Furthermore, it seems that nowadays two contradictory objectives direct the services providers:

- To improve the methodologies in which they serve the users, incorporating new channels for services delivery;
- To reduce the costs providing their services.

To meet these objectives the user requirements (i.e. be able to access services anywhere, anytime and anyhow, through proper multi-channel devices, be able to have direct interaction with a service provider when this is needed, the services provided to be of certain quality, findable, usable, and affordable, and delivered efficiently in terms of response time) have to be analyzed thoroughly and balance the efficiency improvement with their organizational requirements (i.e. cost savings can be realized by multi-channels that require little or no staff involvement, and efficiency can be improved by the redesign of processes).

All of the above activities, related to eBusiness Services and eServices delivery, should always be aligned to the customers' perceptions and

requirements. Once these are thoroughly realized taking advantage of the adaptive and personalized user interfaces and processes, eBusiness services providers will be in position to retain their customers by targeting their individual needs, offering quality adaptive and personalized on demand multi-channel services delivery, and hence intensifying eServices sustainability gaining the competitive advantage in their market segment.

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