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TO WHOM IT MAY CONCERN

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Germany

Further enquiries:

Prof PA van Brakel
Conference Chair: Annual Conference on WWW Applications
Cape Peninsula University of Technology
Cape Town
+27 21 469 1015 (landline)
+27 82 966 0789 (mobile)

Customer evaluation of personal customer profiles

L. Barnard

Department of Computer Science and Information Systems
Nelson Mandela Metropolitan University
South Africa

A.P. Calitz

Department of Computer Science and Information Systems
Nelson Mandela Metropolitan University
South Africa

F. Ntawanga

Department of Computer Science and Information Systems
Nelson Mandela Metropolitan University
South Africa

Abstract

The Internet and its related technologies have significantly changed the way businesses operate. As a direct result of these technologies, on-line businesses now have access to customers on a global scale. The nature of the Internet prevents direct personal contact with a customer as an individual. In order to provide a customer with products and services that best suit the needs of each individual customer, the on-line company needs to know its customers individually. Customer profiling is a method used by on-line companies to collect information about customers and to get to know the individual customer's needs and preferences. Obtaining information regarding the needs and preferences of each individual customer is a major challenge facing on-line businesses. Questionnaires and various web-based technologies are used to collate this information. Once this information is obtained, initial customer profiles are created. The purpose of the customer profile is then to enable the on-line business to provide each individual customer with personalised products and services. The current research project investigated methods to create and maintain customer profiles. An e-commerce web-site was developed to cater for the creation and maintenance of customer profiles. The customer profiles were used to provide personalised product information. Customers evaluated their personal customer profiles created by the e-commerce system. The results indicated that Internet customers do prefer personalised product information based on an individual customer profile and customers appreciate to be familiar with their own customer profile.

Key words: Customer profile, E-commerce, Internet marketing

1. Introduction

The utilisation of the Internet, in order to buy and sell products and services is commonly referred to as electronic commerce (e-commerce). The Internet and all its related technologies have significantly changed the way business is conducted and subsequently have enabled on-line businesses to easily reach potential customers globally (Bai, Chou, Yen and Lin, 2005: 67). The Internet is increasingly being used for

the buying and selling of products and services. In South Africa, on-line retail has grown from R685 million in 2006 to R929 million in 2007 (Goldstuck, 2007).

The only point of contact with the customer when conducting on-line transactions is the web-site utilised by the on-line store. There is no one-to-one personal contact between the buyer and the seller as in a traditional brick and mortar store. The absence of personal contact with customers places pressure on on-line businesses to provide products and services that distinguish their business from their competitors'. Therefore, it is imperative for businesses to understand their on-line customers and to be able to effectively determine their customers' needs and preferences. Obtaining information regarding needs and preferences about each individual customer is one of the major challenges facing on-line businesses. Once an on-line business has compiled this information about its customers, it is possible to provide each individual customer with personalised products and services (Chang, Changchien and Huang, 2006: 682; Eirinaki and Vazirgiannis, 2007: 21:2; Hofgesang, 2007: 214; Lai, Liang and Ku, 2003; 225; Masand, Spiliopoulou, Srivastava and Zaiane, 2002: 126).

Personalisation is the use of technology and available customer information to tailor e-commerce interactions between an on-line business and each individual customer. Reducing information overload on the part of the customers, on-line businesses are enabled to develop long-term relationships with their customers (Zhang and Jiao, 2007: 366). One effective method of understanding customers is by collating comprehensive information about the customers and converting this information into a set of knowledge contained within a customer profile (Adomavicius and Tuzhilin, 2005: 85). According to Adomavicius and Tuzhilin (2005: 84), personalisation of products and services, often based on the information contained within the customer profile, can enhance customer satisfaction levels and increase customer loyalty to a specific business, consequently increasing the sales of the specific business (Chang, Changchien and Huang, 2006: 683).

This paper discusses the purpose and use of customer profiling in order to determine the needs and requirements of individual on-line customers. As part of the research for this paper, the process of customer profile creation and maintenance is explored. The results of empirical studies conducted on the use and implementation of customer profiles on an e-commerce web site are discussed. Customers were requested to evaluate their individual customer profiles and compare the computer system profiles with their own perceptions of their personal product knowledge. The research findings are discussed and personal customer profile evaluations are provided. The limitations to the research as well as further research opportunities are also identified.

2. Customer profiling

Customisation and personalisation are often used interchangeably; however, there is a distinct difference between the two techniques. Customisation refers to the adjustment of the structure and presentation on a site according to the preference of each individual user. Customisation requires the loading of a customised homepage every time a user logs in. This process can either be manual or semi-automatic. Personalisation allows the content, and in some cases the structure, of the web-site to be modified dynamically (Eirinaki and Vazirgiannis, 2003: 2).

Personalisation can be used to predict user needs and to provide user specific information. The purpose of personalisation is to improve the usability of and user retention on a web-site. Web personalisation is described as actions that change information on a site to meet the needs of a particular user (Anand and Mobasher, 2007: 18). In order to facilitate personalisation, four types of information must be

managed, namely content, structure, log data and user or customer profile data. Content data is the data actually recorded in a web page, whilst structure data refers specifically to the organisation of the content on the page. Log data records usage patterns and user actions whilst customer profile data provides information about the users of the site.

A customer profile can be defined as a snapshot of who a particular customer is, how to reach the customer and why the customer purchases from a particular site – all with reference to a specific site (Adomavicius and Tuzhilin, 1999: 377-378). Customer profiles assist with the filtering and analysis of information in order to meet the needs and preferences of each specific customer (Liu, Lin, Chen and Huang, 2001: 209). Customer profiles consist of two types of profile data, namely static and dynamic data. Static data includes, for example, demographic information that is rarely altered whilst dynamic data includes information about customer preferences and activities and is updated every time a customer accesses a site.

2.1 Customer profile creation

On-line businesses need to obtain information about their customers. Web-site developers utilise two major methods for collecting information and establishing customer profiles, namely explicit and implicit feedback (Eirinaki and Vazigiannis, 2003: 2; Jokela, Turpeinen, Kurki, Savia and Sulonen, 2001: 7046).

Explicit feedback requires customers to register on a site and to complete on-line forms requesting biographical detail information, for example, name, age, gender and contact details (Eirinaki and Vazirgiannis, 2003: 6; Kim, Lee, Shaw, Chang, Nelson and Easley, 2006: 5).

Figure 1: Customer profile creation (Kalahari.net, 2008)

The screenshot shows a web form for creating a customer profile. It is divided into two main sections: 'My details' and 'My delivery address'.

My details section:

- Title:** A dropdown menu with 'Mr' selected. A red asterisk indicates it is a required field.
- First name:** A text input field with a red asterisk.
- Last name:** A text input field with a red asterisk.
- Email address:** A text input field with a red asterisk.
- Communication:** A dropdown menu with 'English' selected.
- Daytime phone no. and code:** A text input field with a red asterisk.
- Cellphone:** A text input field.
- Tick for SMS Communication. For SA deliveries only.
- Date of birth:** Three dropdown menus for DD, MM, and YYYY. Values shown are 1, 1, and 1900. A red asterisk indicates it is required for SA addresses.
- ID Number:** A text input field with a red asterisk. A link 'Click here for more info' is provided.
- Password:** A text input field with a red asterisk. A note says 'Minimum of 5 characters.'
- Confirm Password:** A text input field with a red asterisk. A note says 'Minimum of 5 characters.'

My delivery address section:

- Address line:** A text input field with a red asterisk. A note says 'Maximum 30 characters'.
- Address line:** A second text input field with a red asterisk. A note says 'Maximum 30 characters'.
- City/Suburb:** A text input field with a red asterisk. A note says 'Maximum 30 characters'.
- Postcode/ZIP:** A text input field with a red asterisk. A note says 'Maximum 15 characters' and 'Unsure of your postal code? Click here.'
- Country:** A dropdown menu with 'South Africa' selected.

At the top right of the 'My details' section, there is a link: 'Create a company profile. [Click here.](#)'

Figure 1 is an example of such a registration form used by kalahari.net. Some sites further request customers to complete a questionnaire about preferences and product ratings (Lee, Park and Park, 2008: 3055), as can be seen in Figure 2. Although the explicit method of collecting information about customers is the easiest way of collecting information, it places the burden of providing accurate information on the customer.

Figure 2: Customer to select preferences (Kalahari.net, 2008)

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Implicit feedback indirectly collects customer information without explicit input from the customer. While the interaction between the user and the system is monitored, information is collected by means of a learning algorithm. The details collected implicitly is used to model the customer's on-line behaviour and subsequently to build up a customer profile over a period of time (Jokela, Turpeinen, Kurki, Savia and Sulonen, 2001: 7045; Kim, Lee, Shaw, Chang, Nelson and Easley, 2006: 9). Examples of implicit feedback include customer purchasing patterns, web page visits and web surfing paths.

2.2 Customer profile maintenance

Customers' needs and preferences change over time, therefore it can be concluded that customer profiles will also change over time (Jokela, Turpeinen, Kurki, Savia and Sulonen, 2001: 7045). As mentioned previously, obtaining information regarding needs and preferences about each individual customer is one of the major challenges facing

on-line businesses. The fact that this information might change, poses another challenge to on-line businesses, as it becomes necessary to keep track of these changes (Yu, Ou, Zhang and Zhang, 2005: 55).

On-line businesses can utilise several methods for tracking and discovering changes in customers' needs. A successful way of tracking changes is to implicitly keep track of customers' browsing behaviour whilst they are interacting with the site (Zenebe, Ozok and Norcio, 2005: 5). These activities are captured in web log files. Web log files are commonly used sources of customers' activities on sites.

Web log files are generated either by the web server or by clickstream software. Information contained within the web log file includes information about the site visitors and all the activities the visitors have performed on the site (Woon, Ng, Li and Lu, 2003: 2). The type of information typically recorded in web log files includes, but is not limited to, the following:

- IP address of client machine;
- User's logon name;
- Date and time of request;
- Requested pages and results of requests; and
- Size of data transferred.

Each click the user makes when interacting with the web-site is recorded and this information is collected and analysed. Since this information is collected upon each click, the information is often referred to as clickstream information. Web log data can be used for several purposes (Yu, Ou, Zhang and Zhang, 2005: 55):

- Customisation of web content towards individual customers' preferences;
- Targeting customers, based on behaviour pattern or customer profile;
- Improving web server performance by analysing web traffic; and
- Enhancing service delivery to end users.

Customer profiles can subsequently be updated by means of the data collected in the web log file. Navigation patterns can be analysed for each specific user and this information can be used to update the individual customer profile.

3. Focus of research

The main focus of this research was the following:

- Creation and maintenance of a dynamic, up-to-date customer profile for on-line customers;
- Use of a dynamic customer profile to meet the specific product information needs for individual customers; and
- Customers evaluating their own personal customer profile created by the system.

4. Research Design and Method

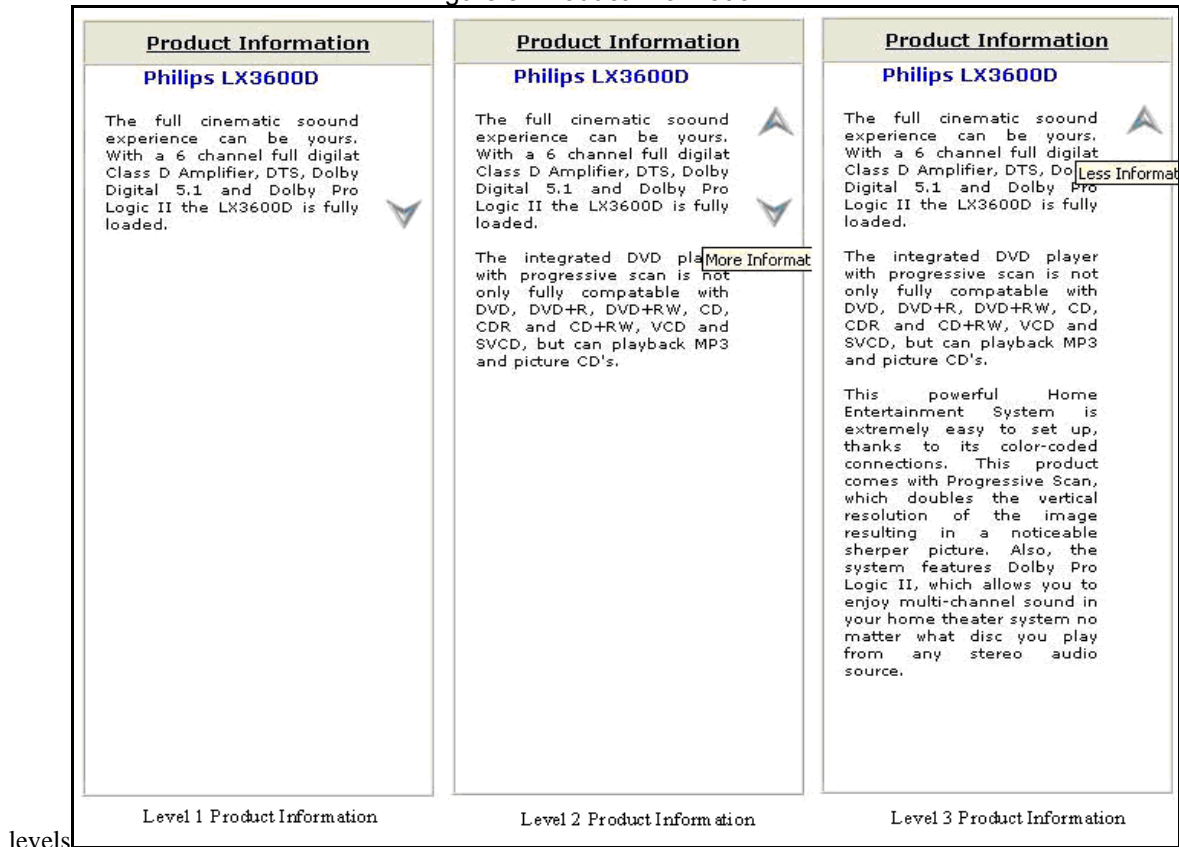
In order to facilitate the creation and maintenance of an on-line customer profile, a test web-site was created. Customers were required to register on the site and then had to perform a set of tasks on the site. A customer profile was then created, based on the individual customer's activities on the site. Thereafter customers were required to log out of the site, and log in again, as existing customers. Customers had to perform another set of tasks and the original customer profile was then updated, if required, again based on the activities performed by the individual customers on the site. This section discusses the web-site, customer registration and the two sets of customer tasks. Customer profile creation and maintenance are discussed in Section 5.

4.1 E-commerce web site

An e-commerce web site was created to test the effectiveness of the customer profile. For the purpose of the research, the created web site contained only three product categories, namely electrical goods, grocery products and wine. When research in this area initially started, groceries and wine were some of the products that were most frequently purchased on-line in South Africa (Goldstuck, 2002; Goldstuck, 2004). Although electronic goods did not feature on the bestsellers lists initially, by 2007 these goods (often referred to as *gadgets*), have emerged to be at the top of the on-line bestsellers. These electronic goods included GPS, Playstations, iPods, LCD monitors, cellular phones and digital cameras (Goldstuck, 2007).

For each product within each of the three product categories, the web site maintained three levels of product information (Figure 3).

Figure 3: Product information



The customer profile of each individual customer determined the level of product information to be displayed to a particular customer. (See Section 5 for a discussion on the implementation of the customer profile.) Despite being provided with a specific level of product information, customers still had the freedom to change the level of product information displayed by using the “More information” or “Less information” buttons provided.

All customer activities on the site were recorded. These activities were written into a customer log file (

Figure 4). A drawback of using, for example, web server log files is that large volumes of data are recorded (Lee, Park and Park, 2008: 3055). This data needs to be pre-processed to extract only the relevant data for the purpose of updating the customer profile.

Figure 4: Customer log file

```

File Edit Format View Help
User Name: Felix

TOTAL TIME ON SITE: 43

TOTAL TIME ON EACH CATEGORY:
  Total time on wine: 12
  Total time on Groceries: 24
  Total time on Electrical: 6
NUMBER OF PRODUCTS BROWSED PER CATEGORY:
  Products browsed for wine: 3
  Products browsed for Groceries: 4
  Products browsed for Electrical: 1
TIMES ASKED FOR MORE INFO PER CATEGORY:
  More info for wine: 2
  More info for Groceries: 4
  More info for Electrical: 0
LEVEL OF INFO ASKED FOR EACH CATEGORY:
  Level 1 info for wine: 2
  Level 2 info for wine: 0
  Level 3 info for wine: 0
  Level 1 info for Groceries: 2
  Level 2 info for Groceries: 1
  Level 3 info for Groceries: 1
  Level 1 info for Electrical: 0
  Level 2 info for Electrical: 1
  Level 3 info for Electrical: 0
UNITS BOUGHT PER CATEGORY:
  Units bought for wine: 0
  Units bought for Groceries: 3
  Units bought for Electrical: 0
RAND VALUE OF TOTAL PURCHASES PER CATEGORY:
  Rand value for wine: 0
  Rand value for Groceries: 165.9
  Rand value for Electrical: 0

```

The main purpose of implementing a customised log file was to prevent this pre-processing of data. Another benefit of implementing a customised log file is to ensure accuracy when updating the customer profile. In some cases, customers are required to rate themselves, and research has found that customers often assign arbitrary ratings when asked to do self-ratings (Lee, Park and Park, 2008: 3057). Such arbitrary selected values negatively influence the accuracy of the customer profiles. The log file recorded, among others, the following details:

- Customer name;
- Time spent on a particular product category page;
- Number of products browsed per category;

- Every instance where “More information” or “Less information” buttons were clicked within a category;
- Products purchased; and
- Amount of purchase.

The log file variables were used by a decision model to update individual customer profiles. Updates were done according to the recorded customer activities and in some cases updates were not made, precisely because of the values recorded in the log file variables. The process of updating the customer profile is discussed in Section 5.2.

4.2 Customer registration

The first time a customer accessed the shopping web site, the customer was requested to register on the site. Registration took place by means of an on-line questionnaire that the customer had to complete.

The questionnaire contained two sections. The first section was a biographical details section (Appendix A) where customers had to provide the following details:

- Name;
- Highest qualification;
- Age;
- Ethnicity;
- Home language; and
- Gender.

The second section of the questionnaire contained questions regarding the three product categories represented on the site, namely electrical goods, groceries and wine (Figure 5).

The information provided in the on-line questionnaire was used to create the initial customer profile of each individual customer (see Section 5).

Figure 5: On-line questionnaire

Create your profile:

Please select what applies to you in the questionnaire below.

2007/11/01

Wines

Wines						
	1 Not at all	2 To some extent	3 To a moderate extent	4 To a large extent	5 Always	
1	I purchase wine on regular basis.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2	I know most of South African wines.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3	I purchased the Platter wine guide.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4	I attend wine tasting.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5	I understand the wine analysis (Alc., RS., pH, TA) on a bottle of wine.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Groceries

Groceries						
	1 Not at all	2 To some extent	3 To a moderate extent	4 To a large extent	5 Always	
1	I purchase groceries on regular basis.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2	I know most groceries in the local grocery store.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3	I purchase groceries in order to prepare food.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4	I know how groceries are grouped in aisles.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5	I know the layout of local grocery store.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

New User

Local intranet 100%

4.3 User Tasks

Once registration was completed, customers were required to complete two separate sets of tasks on the site. Both task sets required the customers to purchase products from all three categories on the site. The purchasing task lists are given in Appendix B. The products to be purchased were selected in such a way so as to get customers to find products that would not always be part of a normal product selection, as very specific product detail was provided. The purpose of this was to ensure that customer profiles would have to be updated.

5. Customer Profile implementation

During the customer registration process, the customers had to complete an on-line questionnaire in which customers had to answer questions on the three featured product categories. The answers to these questions were used to create an initial customer profile. Thereafter, customers were required to log out of the system and log back in again to start a new session. During the new session, customers had to complete a set of purchasing tasks. Once these tasks were completed and the customer logged out of the system, the customer profile was updated by means of a decision model that was developed. The decision model took into consideration the customer activities and customer behaviour whilst the customer was on the site. Thereafter the customer had to log in again as a return customer, complete the second task list of purchases and log out again. Depending on the customer activities, the decision model might have to update the customer profile again. This section discusses the creation of the initial customer profile, the decision model used, and the two sets of customer updates.

5.1 Customer profile creation

An on-line questionnaire was used to determine the level of knowledge a customer had for each of the featured categories. For each product category, five general questions were asked. Each of the questions had five possible answers. Customers were required to select only one answer for each of the questions. The system calculated a rating for each of the customers within each of the product categories, based on the responses provided in the on-line questionnaire. The option weightings are given in Table 1.

Table 1: Weighting assigned to responses

Response	Weighting
Not at all	1
To some extent	2
To a moderate extent	3
To a larger extent	4
Always	5

The weights for each of the selected response options in each question per product category were summed. A customer thus received a rating per product category, meaning that each product within a specific product category was assigned the same rating. The customer profile was linked to the registration details as provided by the customer so that the customer can be uniquely identified every time the customer logged in. Based on the ratings assigned to each of the product categories per individual customer in the customer profile, the customer will then be given a specific set of product details per product category.

The level of product detail given to a customer is based on the customer rating, as can be seen in Table 2. A customer with a Novice rating within a particular product category will receive the most comprehensive product information (Level 3) for products within that product category. The Novice rating falls within the scoring range of 5 – 10. A minimum of 5 can be obtained when a customer selected 1 (the “Not at all” option) for all the questions within the product category. On the other hand, an Expert-rated customer will receive the most summarised product information (Level 1) for the products within the product category for which the rating is Expert. Customers at the Intermediate level (Level 2) will receive product information that is more detailed than the information provided to an Expert level customer, but less comprehensive than that provided to a Novice level customer. Figure 3 is an example of different product information levels for a product.

Table 2: Score, rating and level of product information

Score range	Rating	Product information level provided
5 – 10	3 (Novice)	Level 3 product information (most comprehensive)
11 – 19	2 (Intermediate)	Level 2 product information
20 – 25	1 (Expert)	Level 1 product information (most summarised)

The ratings indicated in Table 2 were used to create initial customer profiles for customers once they have completed the registration process.

5.2 Decision model for updating customer profile

A decision model was created to analyse each individual customer's activities that were recorded in the customer log file (Section 2.2). Based on the customer activities, the customer profile was updated, where necessary, through the decision model.

5.2.1 Decision model parameters

The customer log file recorded several sets of activities as performed by the customers while interacting with the site. The decision model determines whether there is a need to update the customer profile. The following parameters were used to determine if a customer's profile needs to be updated:

- Time spent on a specific product category page;
- Number of products browsed within a particular category; and
- Number of times "More information" was requested within a particular category.

Customer clickstream information is collected during the interaction period. In normal clickstream data, changes of URLs are recorded, but for the purposes of this research, more than simply a change in the URL is required. Updating customer profiles are normally done based on time and date of requests as well as requested pages and results (Eirinaki and Vazirgiannis, 2003: 2). The purpose of the recording of the time and date requests was to show the times customers spent on a specific page before navigating to a different page. Tracking the requests and results is an indication of the customer's navigation pattern on the site.

A special timer was designed for the purposes of this research. The purpose of this timer was to record the time a customer spent on a particular product category page, and not only on a particular page. This timer was designed in a similar way to how researchers normally collect time and date data from web log files. The calculation of the number of products browsed was done similarly to analysing the navigation patterns of customers by making use of page requests and the resultant pages.

Every time the "More information" button was clicked, it implied that the customer did not have enough information about the product to make a purchasing decision. The implication of this was that, should a customer be an Expert rated customer in a product category, and the customer had to request additional product information to become familiar with the product, the customer's rating for that product category could be downgraded to, for example, Intermediate. The number of times the customer clicked the "More information" button was counted, and depending on the number of times this was done, the customer profile might be updated.

5.2.2 Decision model parameter values

Through an iterative feedback loop process (Adomavicius and Tuzhilin, 2005: 85) log files were collected and manually analysed. The purpose of this analysis was to identify parameter values to be used in the decision model. The following three dimensional association rule, making use of the time spent, number of products browsed and more information option selected, was developed to determine valid and relevant parameter values to be used in the decision model to assist with the updating of the customer

profiles.

$\text{TimeSpent}(X, s_1 \dots s_t) \wedge \text{ProductsBrowsed}(X, p_1 \dots p_n) \rightarrow \text{MoreInfo}(X, h_1 \dots h_n) [S, C]$, where:

- X is any customer
- $s_1 \dots s_t$ represent a specific time interval in seconds
- $p_1 \dots p_n$ represent a specific range of number of product browsed
- $h_1 \dots h_n$ represent a specific range of number of more product information buttons clicked
- S and C represent support and confidence of the rule

After an iterative process, the following values for time spent on a specific product page returned the highest support and confidence levels:

- Electrical products : slots of 60 seconds
- Wine products : slots of 40 seconds
- Grocery products : slots of 30 seconds

The decision model values used to update the customer profile is summarised in Table 3.

Table 3: Decision model values

Product Category	Time spent on a page (Seconds)	No. of Products Browsed	Times asked for more product information	Profile Rating
Electrical	0-60	1 to 2	0	1
	61-120	1 to 4	1 to 2	2
	121-180	1 to 6	-	3
	> 180	Or > 6	-	No change
Wine	0-40	1 to 2	0	1
	41-80	1 to 2	1 to 2	2
	81-120	1 to 4	-	3
	> 120	Or > 4	-	No change
Groceries	0-30	1 to 2	0	1
	31-60	1 to 2	1 to 2	2
	61-90	1 to 4	-	3
	> 90	Or >4	-	No change

During the iterative process it was found that, if time spent on a particular page exceeded the average time spent on a page, then the customer is doing something other than browsing the site. Similarly, it was found that when the number of products browsed exceeded the average, then the customer is merely browsing the site and the customer is not paying attention to the actual product information, hence the “No

change” options in the Rating column in Table 3.

5.2.3 Decision model implementation and profile updating

Initially, when a customer logs into the system, two modules are used – one module is used specifically to load the customer’s current rating (*loadProfile*) and another module to determine the level of product information required for each product category for the specific customer (*generateInformation*). Whenever a customer clicks a product to view product information, the *generateInformation* module determines the level of information to be displayed. The *generateInformation* module calls the *loadProfile* module to determine the current customer rating for the specific product category the customer is viewing. The *loadProfile* module sends the rating, and thus the required level of product information, through to enable the correct level of product information to be displayed for the specific product category the customer selected. In cases where more than one entry is found, the entry with the latest date stamp is used to ensure that the most recent profile information is applied.

Whenever a customer logs out of the system, the decision model class is called. The system then checks the log file for any entries for each product category for the individual customer. If any values for the customer are found for any of the decision model parameters (as discussed in Section 5.2.2), the parameter values are checked against the values contained within the decision model. The parameter values are tested against the relevant nodes within the decision model until a leaf or decision node is found. The output of the comparison is used to determine whether the customer profile should be updated. When there are no entries for a particular decision model parameter, the previous rating for the product category is retained.

Regardless of the testing results, a new row is added to a table containing the customer profiles. Each new row contains a date stamp to ensure a clear distinction between current individual profiles and previous versions of such profiles.

6. Evaluation and results

The purpose of the evaluation was two-fold, namely to evaluate the accuracy of the created customer profiles (both the initial and the updated versions) and to determine the customer satisfaction with the customer profiles. The sample selected was a convenient sample of 25 potential on-line customers. The sample included academic and administrative staff as well as postgraduate and undergraduate students from different departments at the university.

6.1 Self-rating and initial profile

Users were required to complete a paper-based background questionnaire to collect biographical information, Internet and on-line shopping experience. The questionnaire is shown in Appendix C. The purpose of collecting information on the Internet experience of the users is to categorise the users as either beginners, intermediate or expert Internet users. Internet experience categories are given in Table 4.

Table 4: Internet experience categories

Category	Years experience	Internet access
Beginner	0 – 2	One place of access
Intermediate	2 – 5	At least two places of access
Expert	5 +	More than two places of access

The composition of the sample used during evaluation is shown in Table 5. The majority of the sample population has intermediate and expert Internet experience. Only 12% of the population had a beginner's level of Internet experience. Thirty two percent of the sample population was staff members, while 40% was postgraduate students. The remaining 28% was undergraduate students.

Table 5: Position and Internet experience of sample population

	Position			Internet Experience		
	Staff	Postgraduates	Undergraduates	Beginner	Intermediate	Expert
		32%	40%	28%	12%	44%
N=25	8	10	7	3	11	11

Users were also required to do a self-rating on their product knowledge by indicating if they had limited, moderate or extensive knowledge for each product category. Once the background questionnaire was completed, users were required to register on the system, by completing an on-line registration form and an on-line questionnaire.

The purpose of the paper-based self-rating was to compare the users' self-rating with the initial profiles the system created, based on the answers the users submitted to the questions on the on-line questionnaire completed during registration (Section 5). The results of the self-rating and initial profile comparison indicate that the initial profiles were very similar to the self-rating. There were slight differences, with the highest level difference occurring in the groceries category at intermediate and advanced level and at the advanced level in the wine category, as indicated in Table 6.

Table 6: Initial customer profile and self-rating comparison

Initial customer profile and Self-rating									
	Wine			Groceries			Electrical		
	Novice	Intermediate	Advanced	Novice	Intermediate	Advanced	Novice	Intermediate	Advanced
Initial profile (N=25)	17 (68%)	5 (20%)	3 (12%)	0 (0%)	13 (52%)	12 (48%)	4 (16%)	14 (56%)	7 (28%)
Self-rating (N=25)	18 (72%)	6 (24%)	1 (4%)	0 (0%)	15 (60%)	10 (40%)	3 (12%)	15 (60%)	7 (28%)
% Difference	4	4	-8	0	8	-8	-4	4	0

6.2 Initial profile and updated profile 1

The initial profile was created once the users had registered on the system and they had completed the on-line questionnaire. The updated profile 1 was created once the users had completed their first set of purchasing tasks. The initial profile was created from user responses and scores obtained from completing the on-line questionnaire.

The updated profile 1 was created based on user actions and activities undertaken during the first on-line session.

The comparison of the initial profile and updated profile 1 is given in Table 7. The comparison of the initial customer profile and the updated customer profile 1 results in Table 7 shows that there were changes in each of the three product categories. The wine category had a decrease of Novices from 68% to 48%; an increase in Intermediates from 24% to 40%; and an increase in Advanced customers from 8% to 12% in the updated customer profile 1. These results in the wine category came about because as novices in the initial customer profile, the system provided the customers with enough product information in the wine category in the first session and as a result customers conducted their tasks efficiently and subsequently their profiles were updated accordingly.

Table 7: Initial customer profile and updated profile 1 comparison

Initial customer profile and Updated profile 1									
	Wine			Groceries			Electrical		
	Novice	Intermediate	Advanced	Novice	Intermediate	Advanced	Novice	Intermediate	Advanced
Initial profile (N=25)	17 (68%)	6 (24%)	2 (8%)	0 (0%)	12 (46%)	13 (52%)	3 (12%)	15 (60%)	7 (28%)
Updated profile (N=25)	12 (48%)	10 (40%)	3 (12%)	2 (8%)	13 (50%)	10 (40%)	3 (12%)	18 (72%)	4 (16%)
% Difference	-20	16	4	8	4	-12	0	12	-12

In the grocery category, there was a decrease of Advanced ratings from 52% in the initial customer profile to 40% in the updated customer profile 1. The Novice level increased from 0% in the initial customer profile to 8% in the updated customer profile 1. These changes came about since initially more customers were rated as advanced customers and using the profiles the system created, customers were provided with less detailed product information. This resulted in customers requesting additional information and thus taking longer to finish their tasks. This behaviour resulted in customers' profiles being updated accordingly.

The electrical products category's results show no change in Novice knowledge level and a shift from Advanced to Intermediate. In the initial customer profile, 28% of the customers were rated as Advanced. Subsequently, the customer profile ensured that customers were provided with the most summarised product information. During the shopping task, some advanced level customers requested additional information, resulting in their profiles being changed to the intermediate level.

6.3 Updated profile 1 and updated profile 2

As discussed in Section 0, updated profile 1 was created once customers had completed the first set of purchasing tasks. Updated profile 2 was created once customers had completed their second set of purchasing tasks on the site. A comparison between updated profile 1 and updated profile 2 is given in Table 8. In the

wine category, there was a change in all three levels. Novice decreased from 48% to 40% and Intermediate from 40% to 36%. Advanced increased from 12% to 24%.

Table 8: Updated profile 1 and updated profile 2 comparison

Updated profile 1 and updated profile 2									
	Wine			Groceries			Electrical		
	Novice	Intermediate	Advanced	Novice	Intermediate	Advanced	Novice	Intermediate	Advanced
Initial profile (N=25)	12 (48%)	10 (40%)	3 (12%)	2 (8%)	13 (52%)	10 (40%)	3 (12%)	18 (72%)	4 (16%)
Updated profile (N=25)	10 (40%)	9 (36%)	6 (24%)	5 (20%)	12 (48%)	8 (32%)	5 (20%)	15 (60%)	5 (20%)
% Difference	-8	-4	12	12	-4	-8	8	-12	4

The grocery category displays an increase at Novice level, but a decrease in both Intermediate and Advanced. At the Novice level, there was an increase from 8% to 20%. The decreases in the Intermediate and Advanced levels were from 52% to 48% and 40% to 32% respectively. Retrospectively, it was found that the product specifications in the grocery category task list were very specific and it was for products that are not generally grocery products, for example dietary food, nutritional supplements and health foods. In the process to try and locate these products, customer performance was influenced in terms of time taken to complete the task. This resulted in the increase at Novice level. Although customers might not agree with their profiles being updated to Novice in the grocery category, this update is a clear indication that the decision tree does accurately update customer profiles since updates are based in the behaviour logged in the customer log file.

In the electrical products category, Novice increased from 12% in the updated profile 1 to 20% in updated profile 2. At the Intermediate level there was a decrease from 72% to 60% and at the Advanced level, an increase from 16% to 20% was observed.

6.4 Customer satisfaction

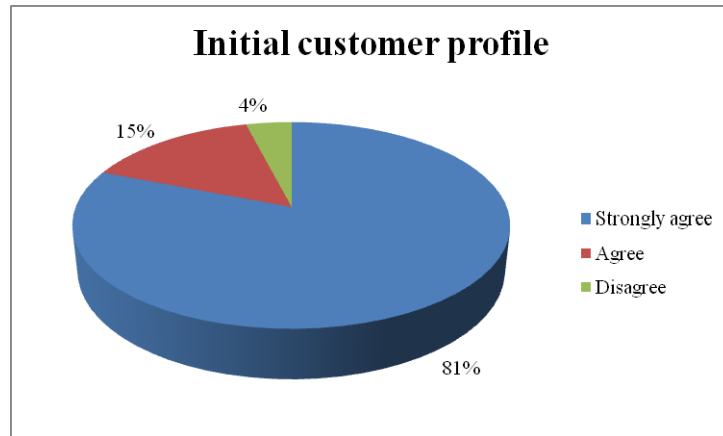
Customers had the opportunity to view their customer profiles at any point during their shopping sessions. At the end of each shopping session, customers were requested to specifically view their profiles and comment on the accuracy of each of the profile ratings. For each profile (initial, updated profile 1 and updated profile 2), customers had a set of ratings per product category. This section gives an overview of the results of customers' assessment of their individual customer profiles (initial and updated profile 2).

6.4.1 Initial customer profile

The initial customer profile was created upon registration on the site. After registration, customers were requested to record their initial customer profiles on a questionnaire. Thereafter, customers had to indicate whether they agreed with the initial profile. The questionnaire had a 5-point Likert scale per category on which customers had to indicate their agreement per category rating. The quantitative results from the customer

assessment indicate that the initial customer profile that was created was accurate in providing a sufficient level of product information for each product category. The majority (96%) of customers agreed with their initially created profiles. Only 4% of customers disagreed with their initial profiles. Figure 6 shows the results of the initial customer profile assessment by customers.

Figure 6: Initial customer profile assessment

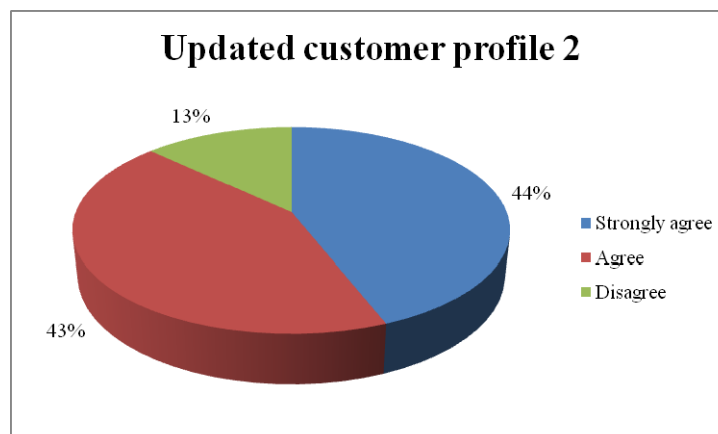


6.4.2 Updated profile 2

For the second updated profile fewer customers completely agreed with their customer profiles. A total of 87% of customers agreed with their second updated customer profiles while the remaining 13% of the customers disagreed with their updated profiles. From these results it seems as if the initial customer profiles that were created were more accurate than the second updated profiles.

The reason for this disagreement with the second updated customer profiles can be found in the task list that was set for the grocery products in the second on-line shopping session, as was discussed in Section 6.3. Customers might not have agreed with the second updated profile, but the decision tree correctly updated the customer profiles based on the customer activities and behaviour on the site during the second shopping session. Figure 7 shows the customer assessment of the second updated profile.

Figure 7: Updated profile 2 assessment



6.4.3 Product information levels

Customers were requested to provide their opinions on the level of product information that was provided to them, based on the up-to-date customer profiles during the different on-line shopping sessions. Customers had to indicate if the level of product information was sufficient and whether the product information provided influenced their buying decisions. Furthermore, customers were asked to compare the levels of product information provided during the two shopping sessions.

The results indicated that the level of product information provided during the initial customer profile was more sufficient than the product information provided by the second updated profile. Thirty eight percent of the users said that the information that was provided during the initial customer profile was very sufficient and 39% said the information was fairly sufficient. A total of 23% said the provided information was fairly insufficient. These results correlate with the results from the customer assessment of the customer profiles as was discussed in the previous two sections. Figure 8 and Figure 9 show the customers' assessment about the level of product information provided, based on the customer profile ratings.

Figure 8: Assessment of product information for initial profile

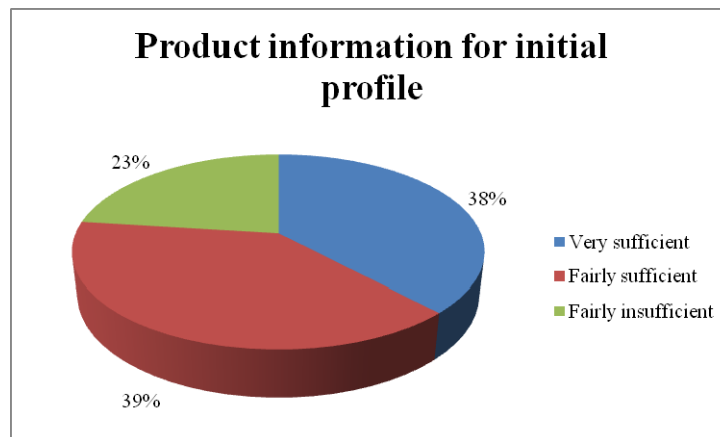
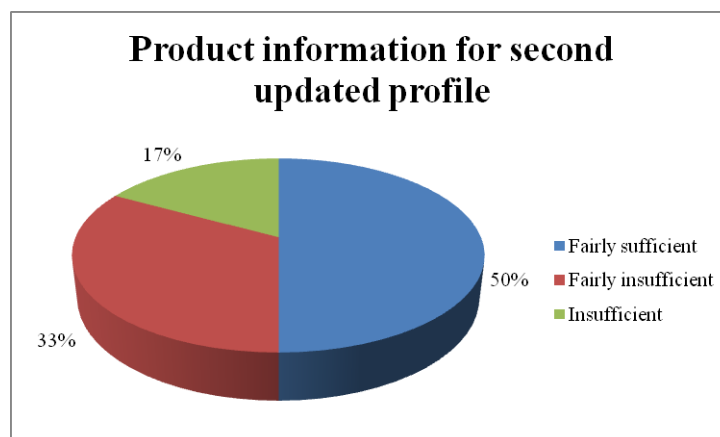


Figure 9: Assessment of product information for second updated profile



6.5 Limitations of the study

Since the random sample that was selected only used people from an academic institution, although the sample included both academic and administrative people, conclusions drawn from the study cannot necessarily be applied across the board. Results obtained did indicate that the decision tree was usable and managed to update the customer profile based on customer actions and activities on the site. However, if a bigger, more representative sample of actual on-line customers is used, more relevant

conclusions regarding usage patterns, age groups, Internet experience and the interdependencies between these criteria could be made.

The products used in the on-line store were only a sample of a range of products that are available in on-line stores. The possibility exists that some customers may not be familiar with the range of selected products, although they might be familiar with another set of products. For a more reliable study, a larger, more representative sample of products should be used.

The updating of the customer profile takes place if there is a change from the current customer profile to the next on-line shopping session. This might result in an inaccurate updating of the profile if a customer, for example, encounters a single product within a product category that the customer is not familiar with. This will result in the customer profile being changed to a lower level of expertise, as was observed specifically in the grocery category in the second shopping session. A solution to this might be to take a number of shopping sessions into consideration and then averaging out the time spent on the pages across a number of shopping sessions before updating the customer profile.

7. Conclusions and Recommendations

Customer retention in e-commerce is challenging, as there are a wide range of easily accessible competitors on-line. Customers can move to competitors within the comfort of their own homes and thus customer loyalty is often lower in e-commerce than in traditional brick-and-mortar commerce (Chang, Changchien and Huang, 2006: 691). This is one of the reasons why on-line businesses are adopting one-to-one marketing strategies to provide individual customers with information, products and services tailored to the specific customer's needs.

One of the ways of employing one-to-one marketing is to make use of customer profiling where profiles are created for individual customers, based on the knowledge an individual customer has of a certain product or group of products. Customer profiles enable on-line businesses to filter and analyse customer information in order to gain an understanding of the needs and preferences of individual customers (Liu, Lin, Chen and Huang, 2001: 215). Subsequently, these customer profiles can be used to create business and marketing strategies that can be employed to provide customised information, products and services to individual customers. Knowledge about an individual customer is fundamental in enabling on-line businesses to establish effective personalised services.

E-commerce has levelled the playing field for many businesses. In order to survive and take advantage of the levelled playing field, regardless of the size of the on-line business, it is of vital importance for on-line businesses to gain a competitive advantage over other businesses by providing personalised products and services to customers in order to increase customer retention rates and customer loyalty, and effectively increasing profits in the long run. This competitive advantage is made possible by the implementation and utilisation of customer profiles, as proposed by this research.

An extension, and possible further research opportunity, is to couple customer profiling with cross-marketing, up-selling and recommender systems.

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APPENDIX A – CUSTOMER REGISTRATION

Section A: Biographical Details

Full Name:			Highest Qualification:		
Age:	17-20	21-25	26-30	31-35	35+
Ethnicity:	White	Black	Indian	Other (Specify)	
Home Language:	Afrikaans	English	Xhosa	Other (Specify)	
Sex:	Male	Female			

Section B: Product Questionnaire

<i>Legend for completing questionnaire:</i>	1 Not at all	2 To some extent	3 To a moderate extent	4 To a large extent	5 Always
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Electrical goods						
1	I purchase electrical goods on regular basis.	1	2	3	4	5
2	I own a number of digital appliances.	1	2	3	4	5
3	I know how to operate all electrical appliances at home.	1	2	3	4	5
4	I can preset a video machine.	1	2	3	4	5
5	I can fully operate a digital camera or a cell phone.	1	2	3	4	5
Groceries						
1	I purchase groceries on a regular basis.	1	2	3	4	5
2	I know most groceries in the local store.	1	2	3	4	5
3	I purchase groceries in order to prepare food.	1	2	3	4	5
4	I know how groceries are grouped in aisles.	1	2	3	4	5
5	I know the layout of the local grocery store.	1	2	3	4	5
Wine						
1	I purchase wine on a regular basis.	1	2	3	4	5
2	I know most of South African wines.	1	2	3	4	5
3	I purchased the Platter wine guide.	1	2	3	4	5
4	I attend wine tastings.	1	2	3	4	5
5	I understand the wine analysis (Alc., RS, pH., TA) on a bottle of wine.	1	2	3	4	5
Rate Yourself						
How much do I know about						
1	Electrical goods.	1 Limited knowledge	2 Moderate knowledge	3 Extensive knowledge		
2	Groceries.	1 Limited knowledge	2 Moderate knowledge	3 Extensive knowledge		
3	Wines.	1 Limited knowledge	2 Moderate knowledge	3 Extensive knowledge		

APPENDIX B – EXTRACT OF TASK LISTS GIVEN TO PARTICIPANTS

3.1 Session one

3.1.1 Task one

If you are a new user, go to the registration page by following the links provided on the login page. Register on the system by completing the biographical details form and an initial customer profile questionnaire.

Note: You must make sure that you enter all required entries and answer all questions on the questionnaire. Click “**Proceed**” to enter the on-line website.

Click on “**View Profile**” and **record your initial profile** on User Evaluation Questionnaire, *Appendix B*. Complete question 1 and 2 on the questionnaire and proceed with the tasks.

During purchasing change the quantity to 1 before adding the product to the basket.

Go to the wine category and do the following purchases:

- a. Purchase 1 bottle of wooded white wine.
- b. Purchase 1 bottle of red wine matured in oak for 12 months.

3.1.2 Task two

Go to the groceries category and do the following purchases:

- a. Purchase a Weigh-less approved food.
- b. Purchase a low fat diet food.
- c. Purchase a health supplement food.

3.1.3 Task three

Go to electrical products category and do the following purchases:

- a. Purchase a digital camera that can record a video.
- b. Purchase home theatre system with 700 Watts power output and 5 CD/DVD changer.
- c. Purchase a DVD player with a built in HDD.
- d. Purchase a flat screen TV.

3.1.4 Task four

Proceed to “**Checkout**” and submit your order. Click on “**View Profile**” and complete Question 3 on Appendix B.

3.1.5 Task five

Complete question 4 to 7 of the User Evaluation Questionnaire, *Appendix B*. Logout of the system.

3.2 Session two

Login to the system using the e-mail address and password you have registered on the system and perform the following set of tasks.

During purchasing change the quantity to 1 before adding the product to the basket.

3.2.1 Task one

Go to the wine category and do the following purchases:

- a. Purchase 1 bottle of sparkling wine that has lighter alcohol content and is made of the shiraz group variety.
- b. Purchase 1 bottle of white wine that complements chicken and fish dishes.

3.2.2 Task two

Go to the groceries category and do the following purchases:

- a. Purchase a nutritional supplement food that is low in sugar.
- b. Purchase dietary food enriched with vitamins A & D and ideal for strong bones.

3.2.3 Task three

Go to the electrical products category and do the following purchases:

- a. Purchase a home theatre system with front tall boy speakers.
- b. Purchase a digital camera with a sound recording function.

3.2.4 Task four

Proceed to “**Checkout**” and submit your order.

3.2.5 Task five

Go to “**View Profile**” and record the profile on User Evaluation Questionnaire, *Appendix C* and complete the questionnaire. Logout of the system.

APPENDIX C – BACKGROUND INFORMATION QUESTIONNAIRE

Section A: Biographical Details and Previous Internet Experience

Surname and Initials:			Highest Qualification:	
Position:	Lecturer	Staff	Postgrad	Undergrad
Ethnicity:	White	Black	Indian	Other (Specify)
Home Language:	Afrikaans	English	Xhosa	Other (Specify)

- Where do you have Internet access? Mark all that apply.
 Home University Work School
 Other(s) specify: _____
- How many years of Internet experience do you have?
 0-1 Year 1-2 Years 2-5 Years 5 + Years
- How would you describe your Internet knowledge and experience?
 Beginner Intermediate Expert

Section B: On-line Shopping Experience

- Have you browsed through an on-line shopping website before?
 Yes No
- If yes, how many on-line shopping websites have you visited?
 1-3 stores 4-6 stores 7-9 stores More than 9 stores
- Have you ever purchased a product on-line before?
 Yes No
- If yes, how many items have you purchased on-line?
 1-3 items 4-6 items More than 6 items
- What product categories did you purchase on-line? (E.g. music, books, food, etc.)

- From which website(s) did you purchase these items?
