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Development of an Interactive Web Portal for Kenyan Tea

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Abstract:

In Kenya the tea sector's growth is dependent on tea production, marketing and research. For better performance of these key areas, information flow is critical. However the information flow is still poor due to lack of an effective information delivery system. Although development of web sites and other cross platform tea information systems have made information sharing easier and faster than ever, their dynamic, unstructured nature and lack of necessary level of interaction limit their potential in the information delivery. The exponential growth of these resource platforms has also resulted to scattering of the information widely which makes it difficult for users to obtain the desired information efficiently. Marketing is also ineffective due to lack of an online marketing tool for the Kenyan tea, and with the increased global market competition posed by the major tea producers in the world including China, India and Sri Lanka, Kenya is faced with major threats in maintaining its tea market share. In this project an interactive web portal was developed as a resource platform for tea, that would bring together the tea information into an integrated "one-stop shop" for improved efficiency in information access and retrieval, and to provide a marketing platform for the Kenyan tea. The development process involved; designing of web portal architecture, development of the system components, system testing and hosting the program on World Wide Web. The following utilities with outstanding features were used to develop the portal; Joomla! 3.2, XAMPP, PHP5.3.1, MySQL 5.1.41, PhpMyAdmin, Adobe Dreamweaver CS6 and site extensions including; PixSearch, Joom!Fish, VirtueMart and JomSocial. The web portal was then evaluated in JKUAT based on organization of information, friendliness of the user interface and efficiency in information access and retrieval.

Keywords: Kenya's tea sector, web portal, Information flow, Vision 2030

1. Introduction and Literature Review

1.1. Background Information

Tea (*Camellia sinensis*) is an extremely important crop because of its popularity as a beverage and as a source of beneficial secondary metabolites (Kerio *et al.*, 2011). Tea was discovered in China by an emperor Shen Nung in 2737 B.C and is currently the most widely consumed beverage in the world just after water. In Kenya it is an important commodity and is ranked as the third major foreign exchange earner, behind tourism and horticulture, contributing to about 26% of all foreign exchange earnings and 4% of the gross domestic product (TBK, 2010).

Tea production, marketing and research are the key factors that determine growth of the tea sector in Kenya. Performance of these key areas is dependent on availability and access to information. However the information flow within the tea industry is poor due to lack of an effective information delivery system. Marketing which is also an essential integral element of the tea sector development in Kenya is ineffective due to lack of a reliable marketing platform for the Kenyan tea. Although web-based tea information systems have, in a great deal, improved the information flow within the tea sector, these resource platforms are limited in terms of their

efficiency in the information delivery due to their unstructured nature. This project was therefore aimed at developing an interactive web portal as a resource platform for tea that would consolidate the scattered information into a single place, with a personalized interface through which users can access all the information resources and services in a secure, consistent and customized manner, and which would provide a marketing platform for the Kenyan tea.

A web portal is an online service that brings information together from diverse sources in a uniform and organized format, owing to its design (Davidson *et al.*, 1995). It provides a personalized, single point access to resources and has features that offer services such as forums, e-mail, entertainments, news, search functions and links to other web resources.

1.2. Review on the tea industry in Kenya

Tea was first introduced in Kenya from India in 1903 by G.W.L, Caine, a European settler who planted the seedlings in Limuru, near Nairobi (TBK, 2010). Since its commercialization in 1924, the tea industry has experienced significant growth and today tea plantations cover over 157,720 hectares, with production of about 345,817 metric tonnes of made tea, most of which is black tea. However green tea, Oolong, yellow tea and white tea are produced on order (TBK, 2010).

Tea in Kenya is grown on the highlands within altitudes of between 1500 metres and 2700 metres above the sea level. The tea growing regions include areas around Mt. Kenya, Nyambene hills, the Aberdares, Mau escarpment, Kericho Highlands, Nandi, Kisii Highlands and the Cherangani Hills. These regions are endowed with ideal climate; tropical, volcanic red soils, well distributed rainfall ranging between 1200 mm to 1400mm per annum and long sunny days that give the Kenyan tea a unique quality and taste, attributes that makes it the most sought after beverage in the world. The growing regions are as shown in figure 1.



Figure 1: Tea and Forestry Map of Kenya

1.2.1. The tea sector institutional structure

The tea industry operates under the auspices of Ministry of Agriculture that bears responsibility to the government. There are several institutions that play different roles ensuring excellence of the industry, they include; Tea Board of Kenya, Tea Research Foundation of Kenya (TRFK), Kenya Tea Development Agency Ltd (KTDA), Kenya Tea Growers Association (KTGA), Nyayo Tea Zones Development Corporation (NTZDC) and East African Tea Trade Association (EATTA) (TBK, 2010).

Tea Board of Kenya is a statutory body under the ministry of Agriculture that manages the tea industry on behalf of the government. It regulates the tea industry through policy guidance, trade development, registration and licensing. The Tea Research Foundation of Kenya facilitates tea research. Kenya Tea Development Agency Ltd is the management agency of the small holder tea growers that manages the small-holder tea sub-sector. Kenya Tea Growers Association is an association of large-scale tea producers that promote the common interests of the members. Nyayo Tea Zones Development Corporation is a state corporation established to manage the tea belts around the forest zones that buffers the natural forests protecting it from human encroachment. And finally the East African Tea Trade Association which is an association of tea producers, brokers, buyers and packers and is the auspices under which Mombasa tea auction is conducted.

1.2.2. Market challenges facing the Kenya tea industry

On the production front China is the major tea producer and exporter of tea in the world followed by India, Kenya, Sri Lanka, Turkey, Vietnam then Indonesia (TBI, 2012). China stands at 36.8% of total world tea output and 30% of total world tea consumption. India accounts for 31% of global production, while Kenya contributes 10% of the total global tea production and 21% of the global tea exports outside producing countries (EPZA, 2005). Although Kenya is the world leader in production and export of black tea, its heavy reliance on a few export partners and low domestic consumption relative to production is one of the challenges that face the Kenya tea industry. About 95% of the tea produced in Kenya is exported, and about 60% of exports go to only three countries: Pakistan, United Kingdom and Egypt. The danger of over reliance on a few markets was demonstrated in 2008 by Pakistan decision to reduce tea imports from Kenya which resulted to shrinking of Kenyan tea export from ninety eight million to eighty million (Chan *et al.*, 2010).

Another challenge is the over-dominance of China and India which have huge influence on worldwide tea industry and have now risen as global economic powers posing stiff market competition for the global tea. While their performance in the tea sector has been impressive, they have the potential to maintain this trend due to their wealth of technology and the massive population, which represents a cheap labour source.

Other threats facing the Kenya's tea market are; increased production of black tea by India and Sri Lanka which produce most of the black tea just after Kenya, round-the-year production of tea in Sri Lanka and Vietnam, better developed packaging and bagging capacity of Sri Lanka, and low cost of production of teas from Vietnam and Indonesia. Therefore the Kenyan tea industry needs to be competitive in production, marketing, logistics and product forms. This is necessary to give Kenya a firm footing in the world tea market ensuring growth of the industry.

1.2.3. Information flow within the tea industry and the need for a tea web portal

There has been demand in the tea sector to promote information exchange and access which is still poor due to lack of an effective information delivery system. For example, the Tea Research Foundation of Kenya has developed forty five varieties of tea (TBK, 2013), of which farmers are yet to adopt due to lack of information about their availability and potential. There is need to improve the information delivery through adoption of Information technology (IT) which in Agriculture increases the effectiveness and efficiency of information flow and use in the sector (Thompson *et al.*, 1997). The potential of web portals in information delivery is incredible and would therefore facilitate the information flow, ensuring growth of the industry.

Interest in portals has been developing in the recent years and many institutions are now benefiting from them. Global research conducted by Accenture (Englert, 2003) reflects the growing importance of portals in institutions around the world. The rapid development of web based information resources and accessibility of internet at a worldwide level has resulted to establishment of web portals as one of the paradigms which are implemented to provide integrated access to a huge number of heterogeneous and autonomous information resources.

1.3. Statement of the problem

Access, efficiency and affordability of information in the tea industry in Kenya continue to be the major impediment for improving its performance. While the tea web resources have improved information sharing, their unreliability, dynamic and unstructured nature limit their potential. With the increasing number of these resource platforms, users have to manually browse through several web pages in order to obtain the desired information which is quite tedious, time consuming and costly hence negatively affecting the information flow. Marketing is also ineffective due to lack of an online marketing platform for the Kenyan tea which is still traded as an agricultural commodity making it vulnerable to supply and demand pressure (Kilele *et al.*, 2013).

The main challenge is to organize the available large amount of information on tea to suit different end-users, to improve efficiency in information access and retrieval, to provide a marketing platform for the Kenyan tea and the necessary level of interaction.

1.4. Justification

Kenya depends on Agriculture for its sustainability and good Agricultural performance translates into measurable improvements in the quality of life (Kimenyi, 2002). The tea sector in Kenya provides employment and livelihood to many of people across the value chain (TBK, 2010). To facilitate coordination between the supply chain partners, information sharing is essential (Elias *et al.*, 2012). Information technology (IT) offers the ability to increase the amount of information provided to all participants in the agricultural sector and to decrease the cost of disseminating the information (Lancioni *et al.*, 2000).

In dealing with the said problems of ineffective information flow, it was necessary to develop the tea web portal that would consolidate data from multiple sources into a local warehouse, enhance capability to effectively store, process, provide uniform access to the information thus limiting redundancy, increasing efficiency in dissemination of information and facilitating a dynamic exchange of the information. The portal would also facilitate marketing of the Kenyan tea through conveying the information to a wider audience globally. This would ensure increased sales and achievement of a sustainable competitive advantage giving Kenya a firm footing in the world tea market which is currently faced with stiff market competition. Information promotes competition and improves market performance (Thompson *et al.*, 1997).

The web portal would greatly benefit the tea industry in Kenya which the government of Kenya lists as one of the pillars of realizing the government's Vision 2030 (GoK, 2007).

1.5. Objectives

1.5.1. General objective:

To develop an interactive web portal as a resource platform for Kenyan tea

1.5.2. Specific objectives

- To create and manage the portal database.
- To design and develop system components.
- To test and validate the requirements of the portal based on organization of information, friendliness of the user interface and efficiency in information access and retrieval.

- To host and manage the web portal on World Wide Web.

2. Material and Methods

2.1. Study area/ Materials

This project involved development of a web portal as a resource platform for the Kenyan tea. The development process involved the following stages; requirement analysis, designing the portal architecture, development of the system components, system testing and hosting the program on World Wide Web. The web portal was developed using the following utilities; Joomla! 3.2, XAMPP, PHP 5.3.1, MySQL 5.1.41, PhpMyAdmin, Adobe Dreamweaver CS6 and site extensions for improving the portal functionalities, including: PixSearch, Joom!Fish, VirtueMart and JomSocial.

Joomla! is an open source content management system (CMS) built to run on the Mysql database, and is primarily written in PHP. The system was used because it is easier to manage and update and has a large support for databases and codes.

XAMPP (A cross platform Apache Mysql Php Processor) is an open source cross-platform web server package including the Apache HTTP Server, Mysql (My Structure Query Language) database and interpreters for scripts written in PHP (PHP: Hypertext Processor) and Perl programming languages. The program was used because of its contents, small size and portability.

PHP is a server-side scripting language and was used because of its text processing features that enable outputting of HTML, image, PDF files and even any text such as XHTML and XML, and because it works well with Mysql(My Structured Query Language) databases.

PhpMyAdmin is an open source utility which is written in PHP. It was used because of its user friendly interface and the ability to connect the PHP script with the database by using the phpMyAdmin service.

Adobe Dreamweaver CS6 is a template editor for editing the template's HTML (Hyper Text Markup Language) and CSS (Cascading Style Sheets). It was used because it enables designing websites visually on the computer.

2.2. Designing of the web portal

2.2.1. Requirement analysis

In the requirement analysis both functional and non-functional requirements were determined. The functional requirements analysis involved determining what the program should do such as information content management, search functions, content single sign-on (SSO), e-Auction, news and updates and interactions. The non-functional requirements analysis involved determining other requirements that were important but not related to the functions of the program such as user friendly interface, security, web clipping, and the credential vault among others. This was important to allow the most important functionalities to be developed first and then other parts to be added subsequently.

2.2.2. Designing the portal architecture

Designing of the portal architecture involved defining the portal layout, coming up with the navigation scheme, defining access control for the different resources and determining personalization needs. It also involved information and graphics designs. In the information design, organization of database contents and its presentation on the front page was determined. The front page was designed to have key menus for ease of access to the intended information. The graphic design which is "look and feel" aspect of the portal involved designing of the screen layout, colours, images and animations on the front page.

Some of the technical considerations put in place were the page size and the number of portlets to be developed on a page, in order to provide optimum performance.

2.3. Development of the portal components

2.3.1. Database creation and management

Database was created using XAMPP which was downloaded from www.apachefriends.org. Under the localhost/PhpMyadmin upon running the XAMPP, a database named "kenyatea" was created using the system on the text field labeled 'create new database'. The database was then automatically created using the MySQL.

The database management was done using Joomla! 3.2 that was obtained from its main site <http://www.joomla.org>. Joomla was also used to create and manage other contents of the portal. It was installed on a local server to allow creating and testing the site on the computer prior to deploying it on a live server to avoid moving files back and forth from a remote web server when making changes to the site, making the development efforts easy. A new directory for the Joomla! site was created and named "kenyatea". The files in the Root of the directory (htdocs) were then unzipped to ensure that start page for XAMPP was the ROOT of the directory.

2.3.2. Web page development

HTML tags incorporated in XAMPP were used as the basic building-blocks of the web pages that describe how the web page is displayed by the web browser. To be able to create the web pages, the files were copied into a directory placed inside the/htdocs directory. These files included: index.php, template.css, templateDetail.xml and template_thumbnail.png. The HTML elements contained in the template index.php file was used for the page layout and the statements that included the component and module

output. CSS enabled the actual display of these pages. The template's HTML was edited using the Adobe Dreamweaver CS6. This package was used as a development environment in setting functionalities of the page such as the page layout. It was possible to access the site by opening the URL in the browser upon running XAMPP, as follows: <http://localhost/kenyatea>. XAMPP enabled running of the programs on the web browser without access to the internet because it is unified software package that bundles the entire necessary server environment.

2.3.3. Creating and managing portlets

Portlets were developed to create the principal navigation links on the pages of the portal. These menu icons included; Home, Stakeholders, Marketing, Production, Research, and the Contact menu. The Menu Manager in the Joomla! was used to create and manage all the front-end portlets, while the module handled the actual display of the portlets on the page.

2.3.4. Developing a search box

An Ajax-based search box was created using PixSearch downloaded from <http://labs.pixpro.net>

The Ajax-based search box functions in such a way that as the user type, it searches and displays results immediately in a pop-up window.

2.3.5. Developing an e-Auction system

The e-Auction system was developed using the VirtueMart system which is an open source e-commerce plugin for the Joomla! CMS. The VirtueMart was obtained from its main site, www.virtumart.com and was configured to handle multiple products and categories, and to support a wide range of shipping and payment options. The system was customized to cover all the most common needs of an online shop manager, including currencies, taxes, shipping, discounts, and order management.

2.3.6. Developing the interaction/ social place

The social place was created using JomSocial downloaded from www.jomsocial.com. This is an extension for Joomla! comprised of a number of elements that provide an assortment of functionalities for creating a social networking place.

2.3.7. Multilingual content management

Joom!Fish was downloaded from www.joomfish.net and incorporated into the system for language translations. This site extension for multilingual content management enabled running the front-end content in multiple languages. This allows users to switch easily between languages when visiting the portal.

2.3.8. Creating the external Links

The web links were added using the Web Link component under the external Link menu item type in the Joomla! Manager. URLs for external web site were input in the link field that the menu item linked to. The web link component also provided parameters needed to control the appearance and behavior of the links.

2.4. System testing and requirement validation

System testing was done at every stage of the portal development but it was more critical at the end of the development process. It involved checking the component interactions of the portal by running the program on the computer. This was carried out to ensure that each of the functionality was incorporated into the system and worked as expected. The following aspects were tested: Performance, load and stress, HTML/CSS validation, accessibility and security.

Requirement validation involved testing the efficiency of the tool in searching and retrieving given information and critically evaluating the portal against the set objectives.

2.5. Hosting the program on World Wide Web

Web hosting was done to ensure that the web portal is accessible via the World Wide Web (Www). Apache was used to manage the program on the World Wide Web. It was used to serve both static content and dynamic web pages on the Www. Its design ensured reduced latency and increased throughput by handling more requests. This was critical to ensure consistent and reliable processing of requests within the reasonable time-frames.

3. Results and Discussion

3.1. Template files structure for the system

The template file structure is as shown in figure 2 below.

File/Folder Name	Type	Size	Created Date
kenyateaportal	Folder		11/17/2013 5:01 PM
css	Folder		12/14/2013 5:12 PM
images	Folder		11/10/2013 1:11 AM
favicon.ico	2KB Icon	2KB	7/28/2013 4:43 PM
index.php	5KB PHP Script	5KB	11/17/2013 5:01 PM
template_previe...	328KB PNG File	328KB	7/28/2013 4:43 PM
template_thumbn...	31KB PNG File	31KB	7/28/2013 4:43 PM
templateDetails.xml	2KB XML Doc...	2KB	11/1/2013 9:30 AM

Figure 2: Template files structure

These files contain the all the necessary elements for the functionalities of the portal. The key files in this template file include: Index.php, Template.css, Template_thumbnail.png, and TemplateDetails.xml.

The index.php is the key file in the template. This file contains the HTML formatting for the page layout and the statements that include the component and module out put. It is the file responsible for placing all the output on the page.

Template.css is the file that determines the page width and margins, the placement of the elements on the page, and the look of the fronts, background, borders, and so on. The actual display of the HTML content is done by CSS contained in this file.

Template_thumbnail.png file is the thumbnail image of the template that is shown inside the Template Manager. The file is in png format because this is the preferred format.

TemplateDetails.xml is the file that contains information needed by the Joomla! installers and the Template Manager. It also includes the definition of the template parameters for the Template Manger and the declaration of the module position holders for use by the Module Manager.

3.2. MySQL for the web portal

The following MySQL codes were created to be used as the relational database management system (RDBMS) for database of the portal. This contains the entire necessary query to be executed by the system.

MySQL codes:

```
-- phpMyAdmin SQL Dump
-- version 3.2.4
-- http://www.phpmyadmin.net
--
-- Host: localhost
-- Generation Time: Jan 19, 2014 at 04:37 PM
-- Server version: 5.1.41
-- PHP Version: 5.3.1
```

```
SET SQL_MODE="NO_AUTO_VALUE_ON_ZERO";
```

```
/*!40101 SET @OLD_CHARACTER_SET_CLIENT=@@CHARACTER_SET_CLIENT */;
/*!40101 SET @OLD_CHARACTER_SET_RESULTS=@@CHARACTER_SET_RESULTS */;
/*!40101 SET @OLD_COLLATION_CONNECTION=@@COLLATION_CONNECTION */;
/*!40101 SET NAMES utf8 */;
```

```
--
-- Database: `kenyatea`
--
```

```
-----
--
-- Table structure for table `nkmsu_assets`
--
```

```
CREATE TABLE IF NOT EXISTS `nkmsu_assets` (
  `id` int(10) unsigned NOT NULL AUTO_INCREMENT COMMENT 'Primary Key',
  `parent_id` int(11) NOT NULL DEFAULT '0' COMMENT 'Nested set parent.',
  `lft` int(11) NOT NULL DEFAULT '0' COMMENT 'Nested set lft.',
  `rgt` int(11) NOT NULL DEFAULT '0' COMMENT 'Nested set rgt.',
  `level` int(10) unsigned NOT NULL COMMENT 'The cached level in the nested tree.'
);
```

```

`name` varchar(50) NOT NULL COMMENT 'The unique name for the asset.\n',
`title` varchar(100) NOT NULL COMMENT 'The descriptive title for the asset.',
`rules` varchar(5120) NOT NULL COMMENT 'JSON encoded access control.',
PRIMARY KEY (`id`),
UNIQUE KEY `idx_asset_name` (`name`),
KEY `idx_lft_rgt` (`lft`,`rgt`),
KEY `idx_parent_id` (`parent_id`)
) ENGINE=InnoDB DEFAULT CHARSET=utf8 AUTO_INCREMENT=95 ;

```

3.3. The database structure of the portal

The created database contains all the information of the portal including texts, images, username and passwords. The database structure of the portal is as shown in figure 3 below.

The screenshot shows the phpMyAdmin interface for a MySQL database named 'kenyatea'. The 'Structure' tab is active, displaying a table list with columns: Table, Action, Records, Type, Collation, Size, and Overhead. The table list includes:

Table	Action	Records	Type	Collation	Size	Overhead
nkmsu_assets		94	InnoDB	utf8_general_ci	64.0 K.B	-
nkmsu_associations		0	InnoDB	utf8_general_ci	32.0 K.B	-
nkmsu_banners		0	InnoDB	utf8_general_ci	96.0 K.B	-
nkmsu_banner_clients		0	InnoDB	utf8_general_ci	48.0 K.B	-
nkmsu_banner_tracks		0	InnoDB	utf8_general_ci	64.0 K.B	-
nkmsu_categories		17	InnoDB	utf8_general_ci	128.0 K.B	-
nkmsu_contact_details		1	InnoDB	utf8_general_ci	144.0 K.B	-
nkmsu_content		50	InnoDB	utf8_general_ci	368.0 K.B	-
nkmsu_content_frontpage		1	InnoDB	utf8_general_ci	16.0 K.B	-
nkmsu_content_rating		0	InnoDB	utf8_general_ci	16.0 K.B	-
nkmsu_core_log_searches		0	InnoDB	utf8_general_ci	16.0 K.B	-
nkmsu_extensions		127	InnoDB	utf8_general_ci	144.0 K.B	-
nkmsu_finder_filters		0	InnoDB	utf8_general_ci	16.0 K.B	-
nkmsu_finder_links		0	InnoDB	utf8_general_ci	112.0 K.B	-
nkmsu_finder_links_terms0		0	InnoDB	utf8_general_ci	48.0 K.B	-
nkmsu_finder_links_terms1		0	InnoDB	utf8_general_ci	48.0 K.B	-
nkmsu_finder_links_terms2		0	InnoDB	utf8_general_ci	48.0 K.B	-
nkmsu_finder_links_terms3		0	InnoDB	utf8_general_ci	48.0 K.B	-
nkmsu_finder_links_terms4		0	InnoDB	utf8_general_ci	48.0 K.B	-

Figure 3: Mysql database structure

3.4. The Front-end/User interface

This is the target for output and the place where the visitors access the site's content and functionality. Visitors to the site are able to see and use the front-end content and functionality with any of a wide range of browsers, both current and older editions. The front-end contains menus, search box, e-Auction system and the social place. The user interface/ front-end is as shown in figure 4 below.

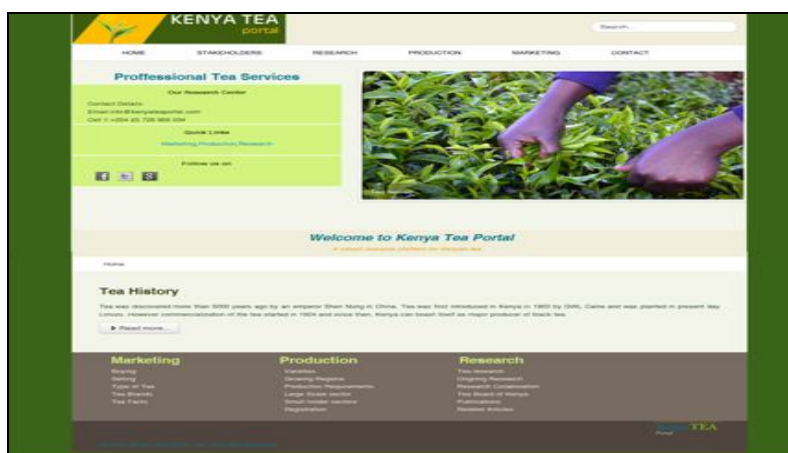


Figure 4: Front-end/user interface

3.4.1. Menus

Menus were created to provide principal navigation links on the pages of the portal. The information is organized and categorized into the different menus to suit different users of the portal for ease of access and retrieval. These menu icons included; Home, Stakeholders, Marketing, Production, Research and the Contact menu.

Under the home icon the home page is displayed which is the landing page/user interface. The Stakeholders' menu contains: Manufactures, Regulators and Licensing, Tea Traders, Tea Warehouses and Registration management agency. The Marketing icon contains: Tea Buying, Tea Selling, Type of Tea, Tea Brands and Tea Facts. The Production menus contain: Tea growing regions, Tea Production requirements, Tea varieties, large scale sub-sector, smallholder sub-sector and Registrations. The Research menu contains: Ongoing research, Research collaborations, Publications and Related articles.

3.4.2. The search box

All the information stored in the database can be accessed and retrieved using the search box. This search box functions in such a way that as the user type, it searches and displays results immediately in a pop-up window.

3.4.3. The e-Auction system

This e-Auction system is able to integrate the transaction process starting from creation of invoices till the delivery of tea from the warehouses. Front-end visitors (shoppers) can access features that enable finding items and tracking of their orders. For the site administrators, they can manage the catalog and the users.

3.4.4. Interaction/ social places

The created social place offers site users a full range of social networking tools and activities, thereby greatly enhancing the interactivity and stickiness of the site.

3.5. The Back-End /Admin Interface

The back end is the administration interface where the majority of the site management activities occur. Access to the admin system is controlled by a login form and is restricted to only those users who are assigned to user groups higher than publishers.

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