



## **WEB APPLICATION DEVELOPMENT FOR CONTENT AND INFORMATION MANAGEMENT**

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### **Abstract**

*The ability to access, share, reproduce, improve, and integrate data from various resources through the worldwide web has enabled industries to become globally competitive. This study looks at the development of a software web application project that will aid a group of youth leaders in tracking, monitoring, and upgrading several community projects, in a small barangay in the outskirts of the Metro in the Philippines. The software will enable various stakeholders to upload relevant and timely digital content that eventually will enhance research databases and search engines. This software also finds practical applications in the fields of education, government, finance, health, and e-commerce, serving as repositories for videos, images, and documents in easy to retrieve models and modules. Also presented in this study is the utilization of the same software as a Content Management System (CMS) which facilitated seamless data processing and input from several end users. Improved computer literacy and competence were manifested by high scores evaluating the software's ease of application, sustainability, and user satisfaction. Overall, it showed great promise and potential to be adjunct computer technologies that can enhance online project monitoring, audit, review, and data sharing.*

*Keywords: Content Management System, content, website, web application, database, repository, back-end facility*



## INTRODUCTION

Recording and disseminating information are very significant features of the data life cycle to provide support for documentation and for future use of data and information. Technologies like using the web and mobile applications contributed to effective information dissemination and access to numerous information. The term “content” signifies numerous things to numerous people and may have multiple definitions and applications as well. In the context of information infrastructures, information systems of education and research institutions, and national information service programs, the term means recorded information or knowledge prepared originally in computer-readable media that is digitized information. (Raman Nair, 2001). Hussein et. al (2014) mentioned in their research that content is not a single piece of information, but a conglomeration of pieces of information put together to form a cohesive whole. This technology combined with a management system will result in processes, protocols, and tasks to fulfill the required objectives. In this study, Hussein et al, (2014) accurately described Content Management System (CMS) as:

*... a system to manage content in order to improve the educational process and to create an interactive environment where the content management system plays a role in e-learning.*

A CMS is a helpful web application that allows collaboration by adding content and managing the online information of a website and/or a mobile app content to coordinate the activities of projects or events. It is a very good tool used for collecting, managing, and monitoring information for many end-users. Kohan (2010) stated that the main purpose of a CMS is to provide the capability for multiple users with different permission levels to manage a website or a section of the content. This management system provides features like administration, control panel, and website management functionalities such as create, edit, publish, and archive.

Numerous projects across the continents fail to be successfully completed due to several reasons. Among these are the lack of understanding of the need for proper communication, information dissemination, monitoring, and evaluation. In the context of what is called family literacy, the development of a web app or a website will be a big help to an individual, a family, and a community. As mentioned by the National Center of Families Learning (2010) “Parents who participate in family literacy and family learning programs gain new skills and knowledge through Family Service Learning projects. They increase their social capital and self-efficacy, especially developing leadership and advocacy skills when they focus on issues of concern and relevance on behalf of themselves and their children.”

This project attempts to help address communication and monitoring issues and how they can be applied to ensure the completion of development projects, particularly in relation to family literacy. This project will help researchers and other stakeholders address different issues that to provide a facility for communication, information dissemination, providing repositories of databases for documents, images, and videos as well as managing the events of all family literacy teams to monitor numerous sustainable development projects of a Philippine village or *barangay*, Batia (in Bocaue municipality, Bulacan province) using web and mobile applications. This major milestone will highlight the activities of the project lead for providing the back-end facility for content management and support of the system for the family literacy projects of Batia.

### **Objectives of the Study**

As mentioned above, the primary purpose of this study is the design and development of a web application that will help researchers and other stakeholders to monitor numerous sustainable development projects, aligned with family literacy, of a big community in Batia, Bocaue Bulacan using web applications. Specifically, this study aims to develop a web application with the following features:

1. Receive notifications from new users, updates from projects and messages;
2. Profile updating of the admin, team lead and other identified members;
3. Uploading of documents, charts, pictures, and videos for the updates of the projects
4. Record and view all projects and events of family literacy team of the different countries which includes articles, pictures, documents and videos; and
5. Allow guest users to view the events of project implementers.

### **THEORETICAL BACKGROUND**

There are numerous studies related to the development of a CMS as an Information Management tool. This application is widely used not only in education but also in health and medical resources, cultural, commerce, agriculture, and even in government. Governmeter is an innovative Web application that provides the opportunity for citizens to follow and monitor the national and local government in an easy and convenient way. This web application allows monitoring in relation to three aspects: key statistical indicators, government objectives, and government measures (Sousa, 2010). A CMS with strong ability, flexibility, and extensibility is

being taken as one of the most important Information and Communication Technologies (ICTs) in managing organization information and knowledge. Wan et. al (2016) emphasized that an Open-Source CMS attracts many researchers to explore its ability to manage knowledge and processes, especially unstructured information and knowledge. Shah (2012) also mentioned the core features of content management systems vary widely from system to system; many simpler systems provide only a handful of features, while others, especially enterprise systems, are much more complex and powerful:

1. Allow for a large number of people to share and contribute to stored data;
2. Control access to data based on user role (i.e., define information users or user groups can view, edit, publish, etc.);
3. Facilitate storage and retrieval of data;
4. Control data validity;
5. Simplify report writing; and
6. Define data as almost anything: documents, movies, texts, pictures, phone numbers, articles, etc.

In the medical domain, Krechel et al. (2006) and Masud et al. (2012) have developed CMS's. Krechel et al. (2006) content management system named LENUS. This system can handle the integration of all data needed (including documents, reports, images, and multimedia objects) for medical and other processes. The components of LENUS include electronic archiving, inbound management which supports knowledge-based classification and extraction of documents, and clinical process management which supports continuous and process-oriented activities of medical, nursing, and administrative documents. The Centers for Disease Control and Prevention is one of the major operating components of the US's Department of Health and Human Services. This website increases the health security of our nation. As the nation's health protection agency, CDC saves lives and protects people from health threats. In agriculture, the USDA (Department of Agriculture) Food and Nutrition Service ([fns.usda.gov](http://fns.usda.gov)) aims to increase food security and reduce hunger by providing children and low-income people access to food, a healthful diet, and nutrition education in a way that supports American agriculture and inspires public confidence.

The CMS is also used in the field of education. Rivera et al. (2010) work to accomplish the WikiDIS project. This project aims to implement a collaborative content management system in an educational university organization. WikiDIS features the integration of the educational community that can produce, in a controlled way, the contents for the information system of the organization. Another CMS in the education domain is proposed by Reddig (2008) This CMS

focuses on usability to develop CMS in order to ease non-technical users in managing content. To measure usability, researchers were inspired by IBM usability measurement for systems and the international ergonomic norm.

Xiang (2008) presented the description of CMS features in education. These descriptors include learning content creation, publishing, content management function (tools to support all management aspects of student records, e-learning course, and students' progress and learning objects across dispersed, multilingual environments), presentation (personalized pages to the users in multiple formats such as HTML (web), printed PDF, hand-held (WAP) and more), communication & collaboration function (provide internal email systems) and standard-compliant (must conform to the leading industry standards, including AICC, SCORM, IMS, HTML, and XML).

Governmenter is an innovative Web application that provides the opportunity for citizens to follow and monitor the national and local government in an easy and convenient way. The Governmenter allows monitoring in relation to three aspects: key statistical indicators, government objectives, and government measures (Sousa, 2010).

## CONCEPTUAL FRAMEWORK

In this research, the researcher-developer used the input, process, output theory (see *Figure 1*) that showed how the instruments have been planned (input), and how the research has been executed (process), in order to formulate results (output). The admin and other users known as the people component plays a very important role for providing the necessary information as input. Processes include basic system activities such as adding, editing, deleting records. The output of the framework is the Web Application Development for Content Management System capable of generating reports and databases.

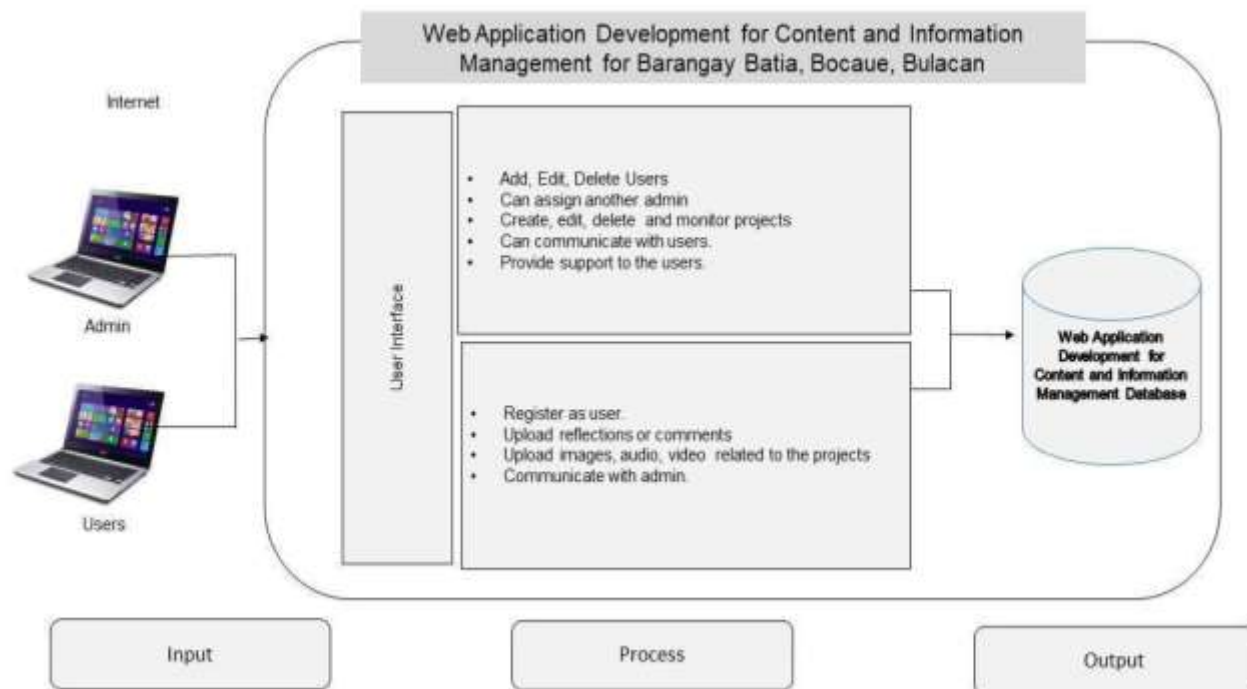


Figure 1: Conceptual Framework for Web Application Development  
for Content and Information Management

## METHODOLOGY

This project is inspired by a project implemented by a Catholic university, the University of Santo Tomas (UST), in the Philippines. This particular project, implemented by the Research Center for the Social Sciences and Education (RCSSED), is called the Sustainable Organic Agricultural Project (SOAP). Family literacy researchers led by Drs. Gina Lontoc, Belinda de Castro and Camilla Vizconde primarily led in the implementation of SOAP (this being under the action research project titled *Exploring the roles of local and indigenous knowledge systems in promoting family literacy and lifelong learning*). The app, which implementers call the “Family Literacy app,” was first implemented by RCSSED in Barangay (or Village) Pinili, San Jose City in Nueva Ecija province (this province being north of Bulacan province). Then this paper’s author adopted the features of the app in Barangay Batia, Bocaue municipality to which this current paper is based.

The locale of the study was composed of barangay officials and *Sangguniang Kabataan* (SK, or youth council) officials who will serve as admin of the web app. These officials were chosen by the barangay captain to run and monitor the system due to their technical capabilities and educational attainment (see *Table 1*).

In the context of software development, the researcher utilized the Agile Method for the development of the web app to ensure transparency with the clients while maintaining high-quality software during and at the release of the finished product. The developer/researcher utilized this methodology for the strategy to develop the application through the use of short development cycles to focus on the improvements in the development phase. The researcher-developer strongly believed that the use of these for every major functionality of the application enabled the team to perform changes whenever potential issues arise. Hence, this methodology was able to help the developer work more efficiently and collaboratively. Also, the use of a database application for storing, accessing, management of materials, users, and administrators is highly encouraged. A single iteration in Agile Software development encompasses a streamlined process starting with a defining requirement, UI design, development, quality assurance, user acceptance test, client feedback, release and incorporate change request as shown in Figure 2.

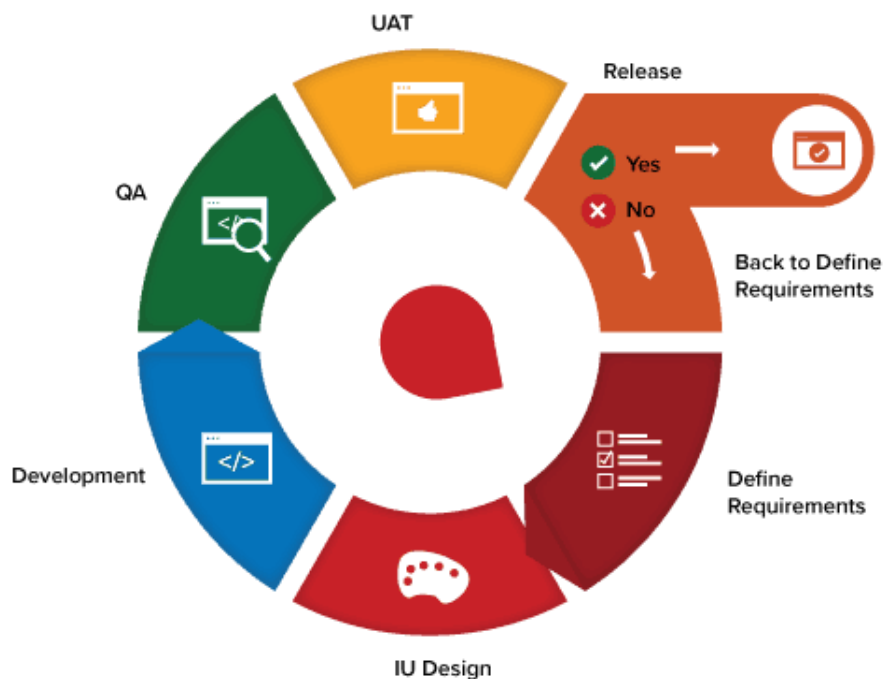


Figure 2: Agile Design Methodology

For the non-functional requirements of the Family Literacy app, the developers conducted SQL injection testing, XSS testing, scalability, and portability testing. Pass marks were obtained after every test case for every requirement was done. For usability, the researcher-developer conducted User Acceptance Testing (UAT) at Batia was able to get 8 respondents. In evaluating the responses, the System Usability Scale (SUS) metric was used.

The researcher-developer computed the average of answers per question by getting the total sum of each question and dividing it into the number of respondents. Figure 3 below shows how the usability score was computed:

To compute the System Usability Scale (SUS) score, the initial procedure would be to compute the average score for all questions between 1 and 5 where 1 indicates a response of “strongly disagree”, while 5 being “strongly agree”. The table consists of an odd and even-number column that corresponds to the number of the listed question. To calculate the needed score for the SUS scale, odd-numbered questions would need to subtract their average score by 1. Even-numbered questions follow the following formula:  $(5 - y)$ , where  $y$  = the average score of the even-numbered question. And to compute for the final SUS score, the total sums from the odd-numbered and even-numbered columns are added and then multiplied by 2.5 to calculate the final score.

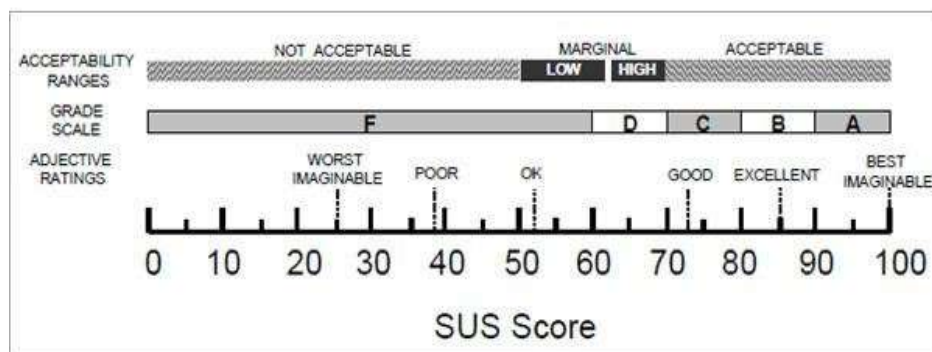


Figure 3: SUS Scoring Scale

## RESULTS AND DISCUSSION

A total of 8 barangay and SK officials participated in this study. Among them, 5 (62.50%) are male while 3 (37.50%) are female; 7 (87.50%) were single while only 1 was married. Also, 7 (87.50%) finished college. Based on the results of Table 1, all 8 of them knew how to use either a desktop/laptop computer or smartphone. On the other hand, 6 (75%) expressed that they can communicate with the researcher/developer via email for communication, set-up, and demonstration. Additionally, all of them can access the internet in their respective places. Regarding the quality of their internet connection, 1 (12.50%) had an excellent internet connection, 6 (75%) had either very good or good quality while there was 1 who expressed having poor internet connection.



**Table 1** *Computer capability of participants*

Questions	Yes (n)	%
Knows how to use a desktop or laptop computer.	8	100
Knows how to use a smartphone (Android or IOS)	8	100
Can access the internet in his/her place	8	100
Can communicate with the researcher/developer via e-mail for communication, set-up, and demonstration.	6	75

**Table 2** *Current knowledge of participants regarding computer hardware*

Questions	Correct Answer	Correctly answered	
		n	%
Which part of the computer takes the text and pictures on your screen and prints them onto paper?	Printer	8	100
Which part lets you point to objects on your screen, click on them, and even move them?	Mouse	8	100
Which part lets you hear different sounds created by the computer?	Speaker	8	100
Where are all of your documents saved?	Hard Drive	7	87.5
Which part looks like a TV screen and lets you see your work and your files?	Monitor	8	100
What is used to type words and numbers on a computer?	Keyboard	8	100
What type of software helps you find information on the Internet?	Search Engines	8	100

The current knowledge of the participants regarding computer hardware are presented in Table 2. Based on the said table, all of them were able to correctly answer 6 out of 7 questions. Only 1 incorrectly answered the question as to where the documents are being saved. In general, their responses indicated that they are very familiar and can easily identify the hardware to use based on the tasks they need to complete.

To assess if the participants would-be-users found the Family Literacy app acceptable, the System Usability Scale (SUS) was used. Based on the responses to the SUS (see Table 3), the system has yielded a score of 93.2, which can be interpreted as “excellent” or B+ to A on the

grade scale. Results of the participants' assessment of system usability indicated that higher scores lean toward the overall utility of the system. The overall utility of the system includes the system's functions as well as how well integrated and consistent those functions are. Likewise, the participants thought that they would like to use the system frequently ( $M = 4.88$ ), that the system was easy to use ( $M = 4.88$ ) and would imagine that most people would learn to use the system very quickly ( $M = 4.88$ ), with little or no assistance at all. Additionally, they felt confident using the system ( $M = 4.88$ ). were confident in using the system and even found it easy to learn.

**Table 3** *Participants' assessment of the system's usability*

Questions	Mean	Odd Numbers	Even Numbers
1. I think that I would like to use this system frequently.	4.88	3.88	
2. I found the system unnecessarily complex.	1.625		3.38
3. I thought the system was easy to use.	4.88	3.88	
4. I think that I would need the support of a technical person to be able to use this system.	1.13		3.88
5. I found the various functions in this system were well integrated.	4.63	3.63	
6. I thought there was too much inconsistency in this system.	1.00		4.00
7. I would imagine that most people would learn to use this system very quickly.	4.88	3.88	
8. I found the system very cumbersome to use.	1.38		3.62
9. I felt very confident using the system.	4.75	3.75	
10. I needed to learn a lot of things before I could get going with this system.	1.63		3.38
	Total:	18.66	5.64
		Final Score: $[(19.02+18.26)*2.5]$	
		<b>93.2 ~ Excellent</b>	

The researcher-developer was able to develop the defined major and minor functional requirements and non-functional requirements accompanied with corresponding test cases for each requirement. For the functional requirements and reliability, the researcher-developer integration and system integration testing to test whether both major and minor functional requirements align to the web application.

For integration testing, one version was conducted for the Family Literacy app since when tested, all test cases planned obtained pass marks when executed. In the first version, 8 out of 10 test cases obtained pass marks. Again, errors were minor in nature and were resolved after debugging leading to a 10 out of 10 pass mark in the second version. Lastly, for system integration, the Family Literacy app was enclosed in one version of system integration testing since there were no failures documented when the testing was done.

## **CONCLUSION AND RECOMMENDATIONS**

In summary, the researcher-developer was able to collate substantial information that evaluates and assesses the functionality, applicability, and reliability of the “Family Literacy app” that was done in the Philippines and tested in a rural village, Barangay Batia. Feedback from end-users were likewise obtained to analyze positive and negative utilization encounters.

Based on gathered results, this “Family Literacy app” has successfully met the defined objectives with the development of a web application that will not only help researchers and other stakeholders to monitor numerous family literacy projects and but also provide a web application for content management that can be used to receive notifications from new users, updates/messages from project teams, administrative and member profile updates, uploading documents, charts, pictures and videos of project updates particularly similar computer literacy enhancement programs from different countries. All these were met not exceeding the scope and limitations of the Sustainable Organic Agriculture Project (SOAP) itself.

Valid findings from this research will be useful for future studies aimed at improving data dissemination on global platforms. Virtual excursions and online navigations would be easier with integrated software that facilitates access to updated, real-time data inputs and changes allowing research inference in a timely manner benefiting almost all industries.

The feedback and suggestions of the users call for the improvement of the system and its functionality. The user experience could be further eased and simplified by allowing them to upload multiple photos as well as the customization and enhancement of the features of the uploaded photos through the addition of stickers, texts, and effects. Furthermore, the application should include censorship of words placed by certain users through automatic modification, deletion, and filtering. It was also indicated that the users would find it valuable if a

mobile application will be developed so that they can have the accessibility of the app to upload photos, videos, audios, and reflections without using a computer. When all of these adjustments to the app were incorporated, another test by the users of the functionality of the system should be done to assess if their propositions have been met.

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