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A Case Study on Enterprise Content Management using Agile Methodology

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CASE STUDY ON ENTERPRISE CONTENT MANAGEMENT USING

AGILE METHODOLOGY

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ABSTRACT

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AGILE METHODOLOGY

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Every organization has the need to create, classify, manage and archive information so that it is accessible when they need it. The amount of data or information needed for an organization to build their business and for them to be more positive in today's exponentially increasing business world, which also includes unstructured data or unstructured content. In this modern world it's not appropriate only to "manage" content, but whether the correct version of the data or document or record can be accessed.

Enterprise Content Management is an efficient collection and planning of information that is to be used by a very particular type of audience for pure business objectives. It is neither a single type of technology nor a methodology or a process, it is a combination of strategies, methods and tools used to preserve, store and deliver information supporting key enterprise processes through its entire lifecycle. This research is classified into the case study research because it takes a particular focus on a certain area, i.e., the ECM implementation in XYZ organization where I completed my summer internship this year. Besides research, this study also helped me understand the in-depth implementation of ECM in an enterprise for which I had considered the working environment and methodologies in XYZ.

ACKNOWLEDGEMENTS

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CHAPTER 1

INTRODUCTION

1.1   Enterprise Content Management

The ECM Association (AIIM International) defines ECM as "the strategies, methods and tools used to capture, manage, store, preserve, and deliver content and documents related to organizational processes. There exists many ECM tools and methodologies which typically allows the unstructured data of an organization wherever they exist.

Computer scientists consider ECM as a pure evolution from CMS (Content management Systems). According to them, ECM mainly focuses in proving organizations a simplified heterogeneous and structured processing of data.
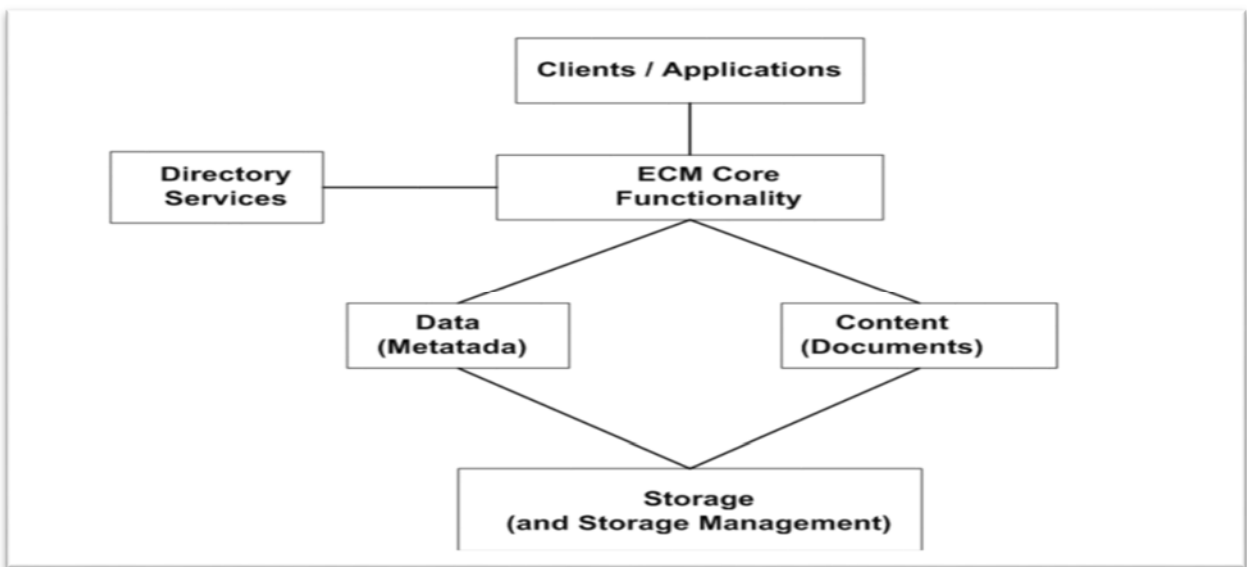
Figure 1 - Generic Enterprise Content Management Architecture

ECM is generally considered as the combined version of two technologies which were used earlier as a solution for management of unstructured data or unstructured information in organizations:

1.1.1 Document Management

Document Management was a very popular process that enjoyed a considerable rate of success in the 1990's. It mainly aimed at organizing the information such that if is easily accessible. The whole DM process was divided into simpler sub-parts as follows:

- **File storage and Categorization:**

DM takes full control over the physical location of the data or the files that contained the data keeping the end user convenient of not handling the same and they were also given special authority by the DM processes to assign the file types and groups based on the criteria that they choose.

- **Collaboration Services:**

End users were given the facility of checking in and checking out data files simultaneously.

- **Versioning services:**

The end users were given the facility to save a particular version of their edition into the file as a metadata each time they save or edit a particular data file. The versioning service enabled them to detect any kind of errors or mistakes as soon as they appeared.

- **Access services:**

The users were allowed to get the specific data using indexes and text searches. It was not necessary that the data should be in a particular type of file only although most users needed

the system to give more importance towards word and other office files. The system was bound to have no restrictions about the file in which the data was contained.

1.1.2 Content Management

Content Management mainly dealt with Web - based Applications and so concentrated in Web Application Development. In this modern Era the need for integrating more structured content into Web based applications is increased as the need for a strong managing these specific content also increased. This made the demand for a better methodology for Content management in the market and many vendors started offering Content management tools.

Content Management is almost similar to data management with a difference in the audience that it gets its results to. These two methods are similar in most of the aspects but Content Management Systems mainly aimed at filtering and managing the data and outputs it to a different outlet such as a web application around the internet.

Both Data Management System and Content Management System concentrates on categorizing information, applying Metadata, organizing the content creation through a workflow and giving the end user a complete access method. But there are differences which are as follows:

- Data Management Systems - files while Content management systems - content components.
- Data Management systems came into existence to help manage files that were created by other applications. Both these systems promote the basic functionality which is to be followed but only CMS defines the ability to create data/content.

- CMS consists of processes which help in creating publications which combines all the components under its control. For this to be done, it will get all the management powers of DM system and combine it with its extra abilities.

- Content Management has a distinctive importance which is re-use. If a content component needs to be in multiple places, then CMS puts the same content component in those many places giving the fantastic advantage of content re-use.

- Severe cost cutting by using the data in multiple places, which in turn not only decreases duplicate writing but also reduces the time required for error correction and reviews. The data once written will be easy to be reviewed and tested as it will be appearing in multiple places. For example: If a computer vendor selling a laptop and a desktop can create different manuals for each by just interchanging the modules. The vendor can use similar content for the overlapping core modules in both the products.
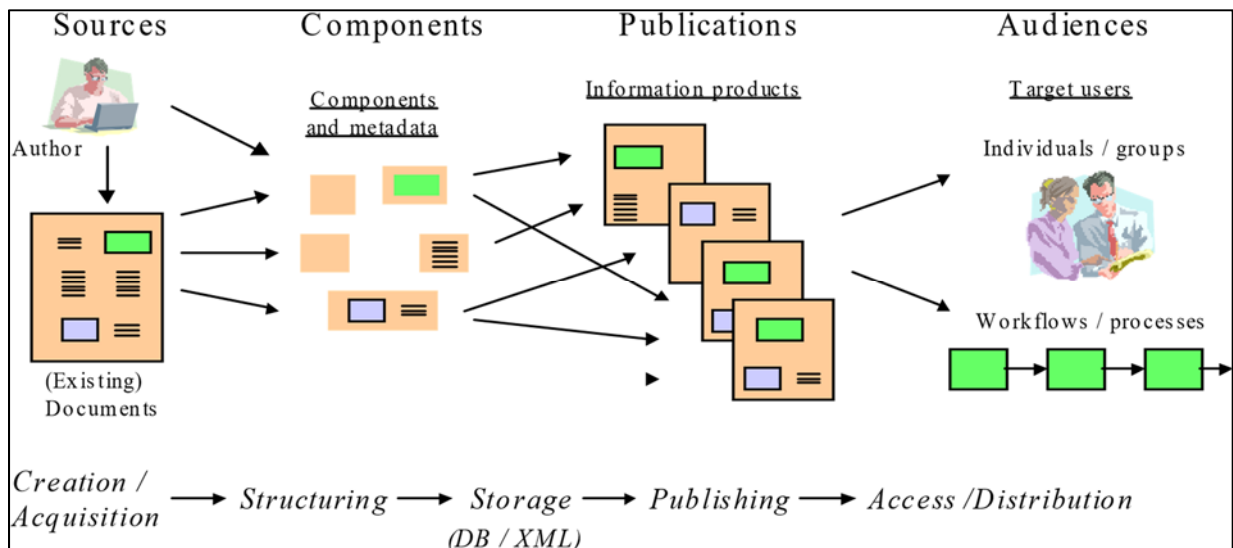
Figure 2 - Content Flow involved in Enterprise Content Management

As said above, ECM combines both the concepts of both Document Management and Content Management. ECM can be described as the scheme and techniques utilized for enriching the usage of the enterprise's data in the best way possible. It's considered as both a strategy and a methodology. Figure 3 elaborates the scope of ECM better:
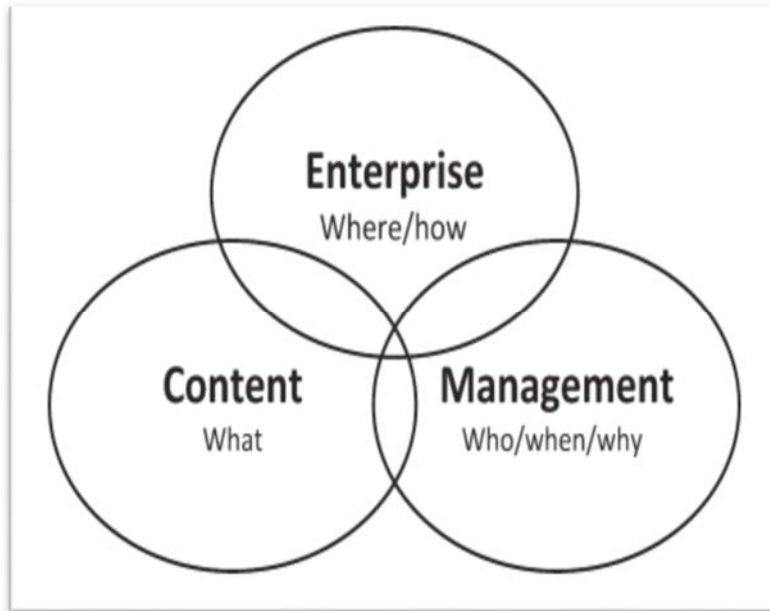
Figure 3 - Scope of Enterprise Content Management

1.2   ECM History Note

ECM has been a growing idea abiding international standards and usefulness gathered over many years. It has the ability to keep updated to the on growing market with the introduction of latest technological enhancements and directly meets the needs of the improving business needs too. It has been developed on top of the latest business conditions and queries of improvements put forward by the clients themselves.

Near to the 1990's the concept of document management completely took a different route which mainly turned out to be divided into two main phases. Document management was taken by the severe change in the evolution of electronic media and the internet as a medium for publishing. This evolution made a big difference and came forward with a single question of how to manage the data via the internet and through electronic media.

This followed the consideration of document management into two trends. These were the substitution of electronic documents and media for paper and the use of the internet as a publishing medium. This made the evolution of the concept of ECM. And since then ECM has evolved with a very good rate with constant improvisations. Today ECM has changed the way of managing content and made the organizations adopt to a complete easy mechanism handling the total enterprise content in one shot.

1.3   Background

The term ''ECM'' was introduced in 2001 by the Association for Information and Image Management (AIIM) International (Blair 2004, p. 65), a non-profit community of professional information and knowledge workers (http:// www.aiim.org). Here are some of the truths put forward by influential people which holds the basic reason for organizations to take up ECM as a major priority.

Quote Derivatives	Authors
ECM can enable huge savings in the terms of data processing.	2005 Munkvold and Paivarinta 2011 vom Brocke
ECM makes it easy to support knowledge management.	2011 vom Brocke
ECM often ends up in fulfilling the exact requirements.	2006 Dillnut 2009 Usman 2011 vom Brocke
Bringing together and eliminating redundancy in various Content Management Systems.	2009 Usman
ECM tackles the burden of vast growing data in an Enterprise	2006 Dillnut 2009 Usman 2011 vom Brocke
Reduces the time complexity of Data Retrieval.	2006 Dillnut 2011 vom Brocke
ECM keenly puts a step forward for improving External an Internal Collaboration.	2011 vom Brocke
ECM helps in removing the unexpected errors in Services provided by an Enterprise	2005 Munkvold and Paivarinta

Table 1 : ECM Background

Current Organizations face a lot of challenges due to the heavy growth in the data lying underneath its own umbrella. This results in the employees constantly spending a huge amount of time searching a particular data component and finally re-creates the existing content when the search goes unsuccessful. The re-creation of an existing content is one of the main reasons behind the increasing amount of content getting out of organization's control. The workers who are unable to realize the availability and importance of reusing the existing content cannot

contribute to the development of that enterprise. The problem grows as major part of the documents are built on top of existing contents which is spread across the organization and not made from scratch.

Many approaches and software solutions for dealing with similar type of challenges have been discussed in researchers and practitioners. The solution is ECM always had an upper hand than most traditional approaches like Document Management System, Web Content Management, Content management system and Record Management which focused only of specific aspects of managing Data. ECM on the other hand was basically the combination all these and further extending to provide a total solution for an enterprise (vom Brocke et al. 2010) providing a ''modern, integrated view on how to manage information'' (Päivärinta and Munkvold 2005). ECM had its hand all over the market as it was considered as a major solution and had its hand beyond single applications to most of the business areas, functions and processes and was able to gain all the information assets of an enterprise regardless of the source, format or type (Smith and McKeen 2003). Gartner's magic quadrant report forecasted that the market for ECM software and services would grow more than 10 percent annually between 2015 and 2016 (as cited in Roe 2010).

Strategic Planning Assumptions

By 2016, content management will be personalized, with foldering and process needs tailored to each individual user.

By 2017, nearly 50% of all business content will be nontextual, which will require organizations to invest more widely in analytics as part of content management.

Market Definition/Description

The term "enterprise content management" (ECM) describes both a strategic framework and a technical architecture that supports all types of content (and format) throughout the content life cycle.

As a strategic framework, ECM can help enterprises take control of their content, and thereby boost productivity, encourage collaboration, help meet compliance initiatives, enable better content-centric processes and make information easier to share.

As a technical architecture, ECM consists of a platform or a set of applications that interoperate but that can be sold and used separately.

An ECM platform's core components, and their associated functional weightings for the purpose of scoring in this Magic Quadrant, are as follows:

Figure 4 - A view of Gartner's magic quadrant report

ECM is also considered as a very important topic in the field of Information Systems research (Tyrväinen et al. 2006). ECM still continues to be a strategy which most organizations undertake as a step to meet technological challenges (Munkvold et al. 2006). The market currently responds to the product and services provided by the vendors as one of the major criteria in order to adopt to ECM strategy. The success of ECM is wide spread as its implementation has proven to be a great reason for financial exhilaration of many organizations. Today's market makes major ECM adoption decisions with the influences spreading around by business magazines and online survey partners.

CHAPTER 2

BASIC COMPONENTS OF ECM

A simple overview of the major steps involved with ECM methodology is shown better in the figure 5:
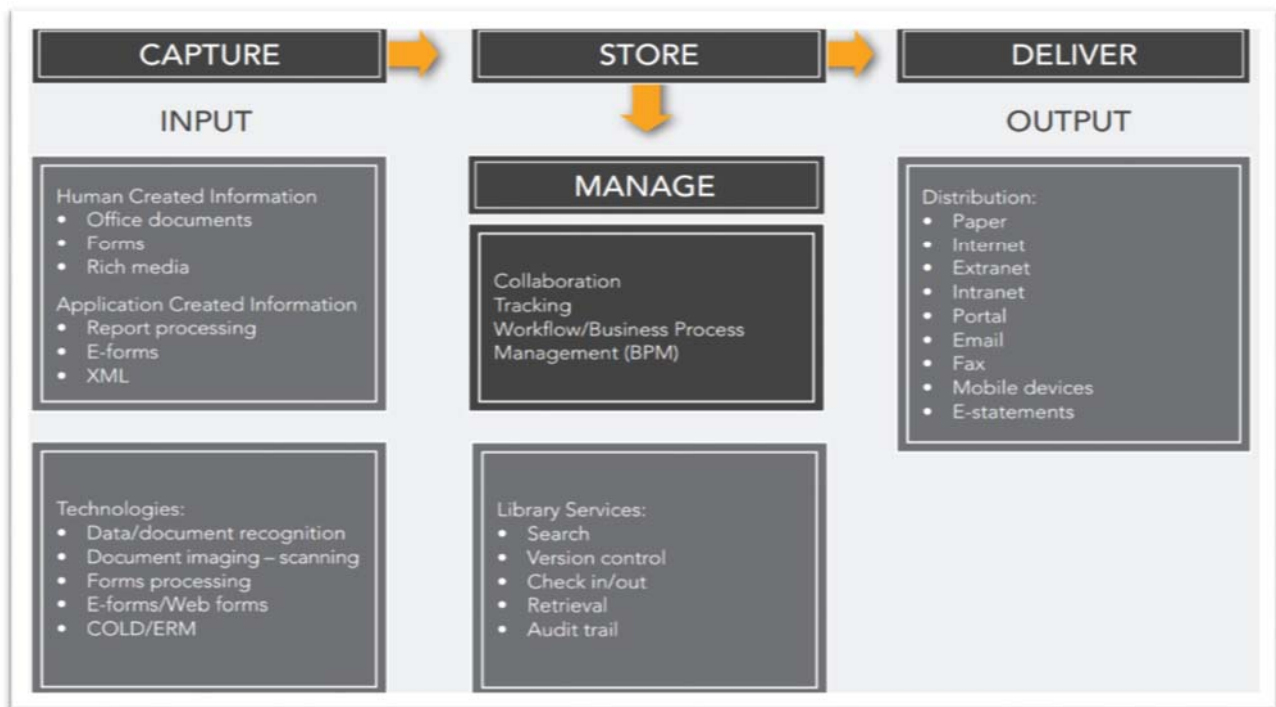
Figure 5 - Phases of Enterprise Content Management

2.1   Components

2.1.1   Capture

Managing an organization's content begins with the capture and importing of information into a secure digital repository. This can be any kind of document that is created, captured, stored,

shared or archived, including invoices from vendors, resumes from job applicants, contracts, research reports etc.

A few methods of capturing these documents include:

- Making the data or document digital at the time of creation itself. Documents still in paper form to be scanned and made digital.

- Management of the existing digital data by grouping, categorizing and linking those which are found dependent.

- The prior method of capturing the essential data in paper needed more investments in terms of man power and effort. But digitizing the whole process through the above methods totally removes these problems such as: distribution speed, sorting, finding duplicates, logistics etc. There are many technologies that make the Data capture process simple and efficient such as Data/Document recognizing technology, Document imaging/scanning technology, Forms processing technology etc.

Figure 6 - Enterprise Content Management Development Structure

2.1.2 Manage

With ECM solutions the data storage for the organizations has become conveniently easy and booming. Rather than just keeping metadata and location information about the data, ECM promises more profits to the organization by reducing time and contributing to the overall document management cycle. The solutions being provided by ECM vendors mainly aims at meeting the primary principle which is a Digital Repository which helps the organizations in the following areas: better structural organizing of the data, accessing mechanism with edit features, better grouping of the data which also specifies the metadata associated with each component. Data Management comprises of some of the following major steps:

- **Collaboration**

ECM systems run on the basic principle of providing the data to multiple users and promote multitasking. The processing methods used by ECM makes this easier even though users are simultaneously attempting to edit/alter the same content.

- **Web Content Management**

Web Content Management Tools are one of the extra additions to the ECM architecture family. Most vendors mainly concentrate on WCM tools as a separate entity, which internally made the data management abilities prominent itself in WCM systems provide by them. WCM systems internally uses most of the data management techniques like versioning, workflows, access controls etc.

- **Workflow**

Workflow mainly defines the stages of the document component that it passes through which are categorize into:

a. **Production Workflow**

It is a set of predefined sequences mostly generated by the system itself for guiding the entire data life cycle.

b. **Ad-Hoc Workflow**

It is a type of workflow where the user himself decides the workflow of a particular data component.

2.1.3 Store

The Storage department mainly handles keeping track of the information that are not required, desired / required information and the data which meets the criteria for long term depository or preservation. The Store components can be categorized into:

- **Repositories:**

The physical storage locations. There exists a variety of physical storage repositories which can be used in combination for implementing ECM.

a. **Databases:**

One of the easiest and basic entity for data storage and management.

b. **Data Warehouses:**

These represents more complex solution whose formation is based on multiple databases. It is considered as the accumulating common repository of a combination of data from different sources.

c. **Content Management Systems**:

It is basically a whole new system of data management and repository which comprises databases and a variety of management tools. Considered as a complex mechanism as a whole capable of management of large data components.

- **Library Services:**

Manages components of the repository. Library Services in ECM context acts as the one of the main authoritative component which manages the access control mechanisms in the architecture. It is responsible for the manipulation of the processed information from the capture and manage department of the process. The main responsibilities of Library Services include:

- Categorize the results and manage the dynamic storage methods and locations.
- Connect with the data management department such as the repository and provide methods which supports proper functionalities for search and retrieval.
- Helps to connect the backend database containing the original data component as it is unaware of the original physical location.
- Provide proper search functionalities.
- Versioning and Check-in Check-out services.

2.1.4 Preserve:

This phase involves the permanent storage mechanisms and backing up unchanging and static data. It helps to adhere with the government and industry regulations and is achieved with the help of record management features of an ECMS.

2.1.5 Deliver:

It is the final result of the phases going to be delivered. ECM delivery concentrates on providing the gathered and sorted out data or information to the proper access enabled users. This phase does the delivery securely, collaborating all the functionalities, and taking care of the proper version via version control.

2.2 Advantages of ECM over Traditional Document Management Systems

- In traditional DMS, it's not certain that the document retrieved is the latest one. But ECM always access most up-to-date version.

- Limited Permission settings for individual documents in DMS. ECM has the capability of restricting who can read, edit, or delete a document.

- In DMS the search for a particular document is based on a limited set of properties. Where as in ECM search is based on a descriptive information of a particular criteria.

- DMS does not support Workflows and routing techniques. But ECM has a built in process for routing maintained specially for approvals.

- Increase in work efficiency: One of the main reasons for the organizations to implement

  ECM is the increase in work efficiency. The task performing methods improvises a lot with

  ECM because there is always a scope of content re-use during the development which in-

  turn increases the efficiency of the whole process.

- Reduces risk of damage: ECM always came with good management techniques for the

  content that also is in a protective nature for the enterprise. With its capability of better

  access protocols these secret data are having a very low risk of falling into wrong hands.

CHAPTER 3

ECM ARCHITECHTURE, TOOLS AND COMPONENTS USED IN XYZ

3.1   Architecture Overview

The experience that I underwent is with the products, services and solutions provided by the market leader in ECM solutions, IBM. This chapter discusses some of the extensive product line-up that IBM provides for ECM implementation which were also a part of my experience.

Figure 7 shows the architectural overview of the ECM structure that was followed in XYZ, which is also considered as the base for the IBM structure and implementation techniques.
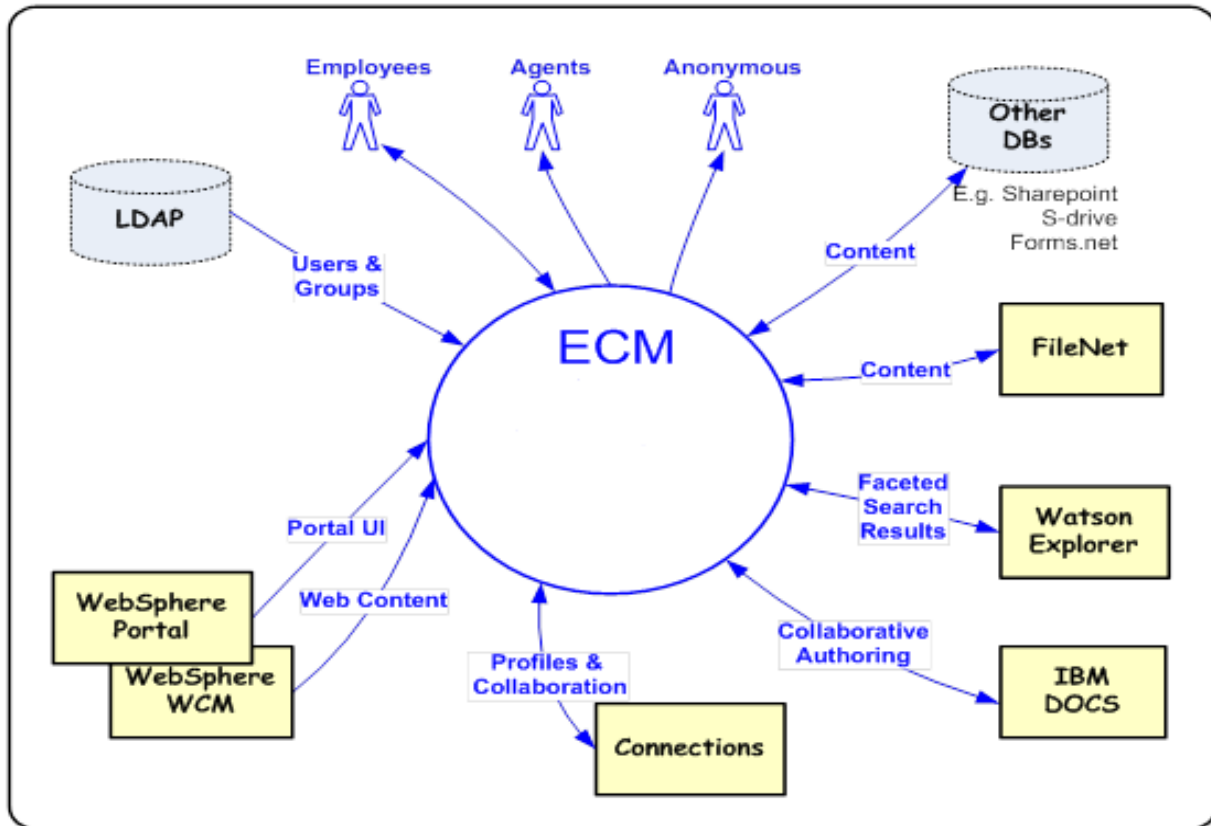
Figure 7 - Project Interaction Diagram

3.1.1 LDAP

LDAP stands for Lightweight Directory Access Protocol is an IETF (Internet Engineering Task Force) standard mainly used for directory services in a network. A normal TCP/IP network such as the Internet uses the DNS (Domain Name System) as the directory system for connecting to different locations through IP addresses.

LDAP is used internally for organizational needs mainly to connect different enterprise divisions, departments etc. It can be distributed in multiple servers which individually will contain the small version of the total directory structure which are updated periodically. LDAP servers are known as Directory System Agent (DSA).

A DSA fully takes control and responsibility of an incoming request and transmits it to the other intended DSAs. It also ensures a combines single response which the actual user wanted. One of the main reason for adapting LDAP is its capability of defining user permissions. The LDAP permission methodology allows the administrator to grant access only to the most needed and denying the same for the rest. It concatenates the security of data and search requests along with proving group permissions that were widely used during our program.

3.1.2 Primary Software Components

The following is a summary of the primary software components being leveraged in the ECM Program which I experienced during my internship.

Product	Version used
IBM File-Net P8 Content Process Engine	5.2.1
Watson Explorer Enterprise Edition	11.0.0
IBM WebSphere Portal	8.5.5.5
IBM WebSphere Content Manager	8.5.5.5
IBM Connections	5.5

Table 2 - ECM Primary Software Components in XYZ

1. **IBM File-Net P8 Content Process Engine**

Component	IBM File-Net P8 Content Process Engine
Description	This Content Engine (CE) component provides a Central Repository within an enterprise to in-take, store and manage the document assets. This Content Engine is where the Enterprise Taxonomy will be defined and applied to the data/documents and also manages security and access control (ACL) rules are defined and enforced on enterprise documents.
Functions	This component provides the following key functions: • Enterprise Document Management • Taxonomy and Metadata tagging • Data Source for New Search Platform • Governance Business Process and Workflow Services

Table 3 - IBM File-Net P8 Content Process Engine

2. Watson Explorer (WEX)

Component	Watson Explorer Enterprise Edition (WEX)
Description	WEX is the enterprise search component and can crawl and index data sources both inside and outside of the enterprise. The WEX search collections are used in the ECM application to provide both faceted and keyword search capabilities. As part of the WEX installation, the following components are also installed and managed as a self-contained solution: WebSphere Liberty (this Web Application Server instance is bundled into the WEX install) WEX Engine Watson Connector for File-Net WEX Application Builder
Functions	This component provides the following key functions: Enterprise Search Faceted Search Keyword Search Federated Search
Relationship(s)	This component interacts with the following solution components: File-Net P8 Content Process Engine (CPE) IBM Connections IBM WebSphere Portal IBM WebSphere Content Manager

Sample WEX Architecture	
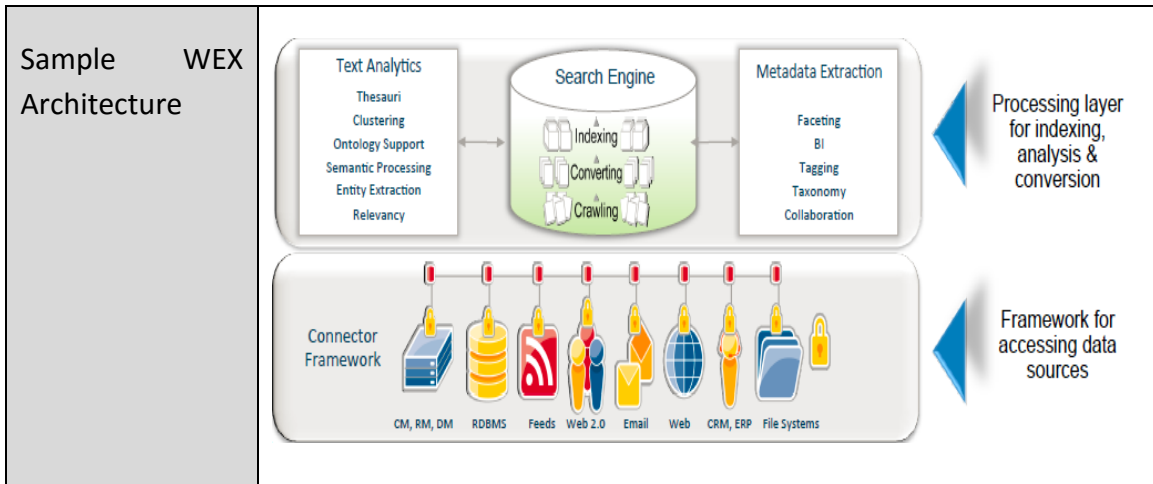
<p align="center">**Table 4 - Watson Explorer Enterprise Edition (WEX)**</p>

3. IBM WebSphere Portal

Component	IBM WebSphere Portal
Description	The WebSphere Portal component is the platform on which the ECM Portal will be hosted, configured and deployed.
Functions	This component provides the following key functions: The ECM application itself The Front End of the Application User interaction mechanism Interdependency with other application components
Relationships	This component interacts with the following solution components: File-Net P8 Content Process Engine (CPE) IBM Connections IBM Watson Explorer

	IBM WebSphere Content Manager
Common Topology	The following figure shows a common topology for integrating WebSphere Portal v8 with IBM Connections.
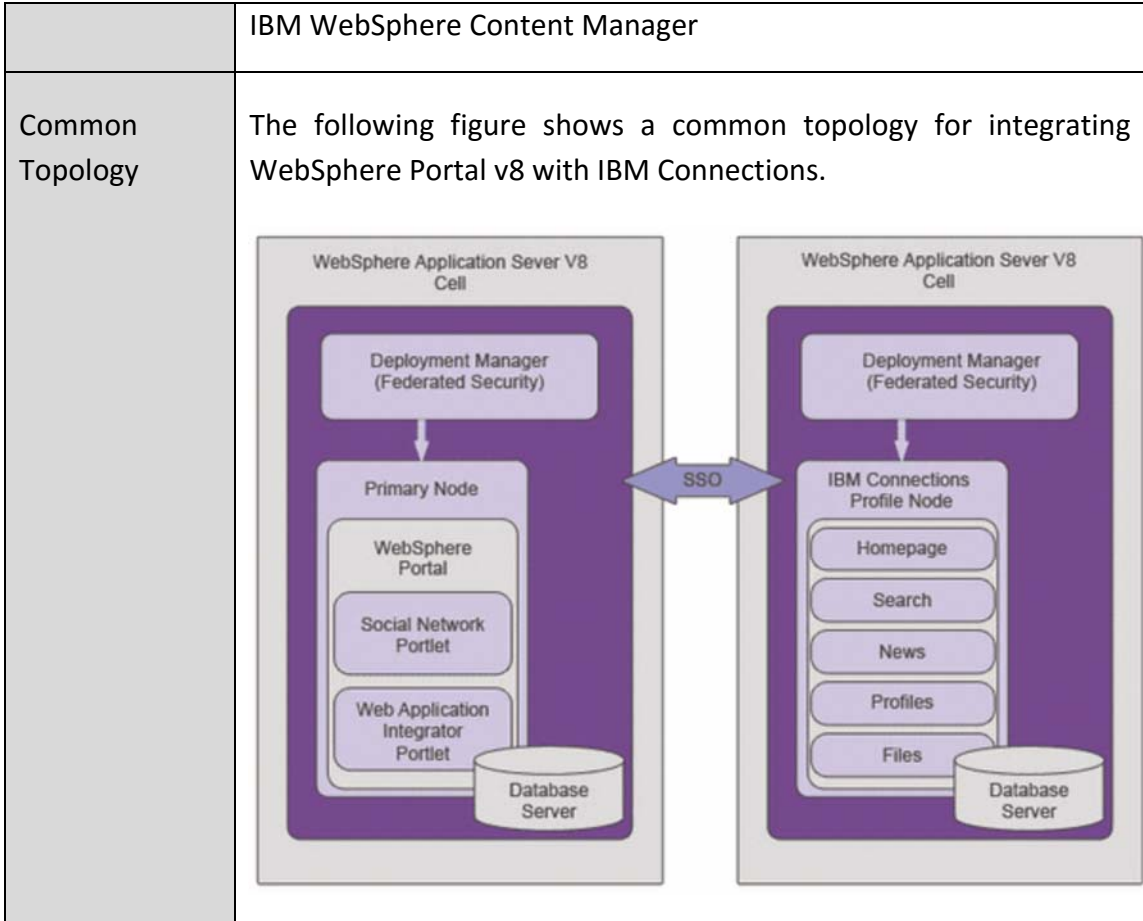
<div align="center">**Table 5 - IBM WebSphere Portal**</div>

4. IBM WebSphere Content Manager (WCM)

Component	IBM WebSphere Content Manager (WCM)
Description	The WCM component is included with IBM WebSphere Portal and will be used to manage ECM web assets which is a complete different entity installed over WebSphere portal which acts as a library.
Functions	This component provides the following key functions: Web Content Management Taxonomy and Metadata tagging

Relationship(s)	This component interacts with the following solution components: File-Net P8 Content Process Engine (CPE) IBM WebSphere Portal

Table 6 - IBM WebSphere Content Manager (WCM)

5. **IBM Connections**

Component	IBM Connections
Description	IBM Connections is the component that will enable social networking and collaboration functionality. IBM Connections consists of Activities, Blogs, Bookmarks, Communities, Files, Forums, Home page, Profiles, and Wikis.
Functions	Deployment Manager Connections Enterprise Content Edition (CECE) manages File-Net integration Employee Profile Management Collaboration with other Web Applications
Relationship(s)	This component provides the following key functions: File-Net P8 Content Process Engine (CPE) IBM WebSphere Portal Watson Explorer

Table 7 - IBM Connections

6. IBM Connections DOCS

Component	IBM Connections Docs
Description	IBM Connections Docs extends IBM Connections, offering real-time, co-editing support designed to help users collaborate on documents together. This also includes the following components as a bundled install: Document Engine, Conversion Engine, and Viewer Server.
Functions	This component provides the following key functions: Facilitates co-editing of documents and content real-time. Provides thin client browser interface, simplifying deployment and support
Relationship(s)	IBM Connections

Table 8 - IBM Connections Docs

3.2 ECM VENDORS

There are many vendors who are claiming and providing the best ECM solutions.

Some of them are:

- IBM
- MICROSOFT
- OPENTEXT
- ORACLE
- LEXMARK
- EMC
- LEXMARK
- LASERFICHE

These vendors are claim a one stop agreement in providing the whole set of products and solutions line-up for an organization. Each of these vendors maintain a full portfolio of the total needs for implementing ECM. The enterprises also look forward to go for the vendors who provides the full suite for avoiding the interdependency issues.

The Advantages of ECM implementation via these top vendors include:

- Clients are able to get rid of the confusion of which toll to be used in each section as they provide the whole suite at a single point, getting more value for the money invested.

- Removes the discrepancies across the architectural design along with the management tools which will be useful throughout the whole list of products provided.

Disadvantages:

- Clients are forced to follow the implementation techniques of a single vendor.

- Vendors will be updating their products to meet the rising requirements of the market which will also affect the current development methods and implementations. The Clients will have no other choice other than adhering to the need of the vendor.

Below image shows the current trend of the Leaders who provides the whole ECM Package.

Figure 8 - ECM vendor leaders (Gartner Magic Quadrant for ECM)

CHAPTER 4

AGILE METHODOLOGY

4.1 Agile Methodology

Agile is one of the evolving Software project management methodology. It is one of the method that relate directly to the software development process which is considered totally different from the common software development lifecycle models such as the Waterfall model. Agile was introduced to meet the increasing requirements of the current software development sector as the old models were not strong enough to conceive the demands of the evolving flexibility and agility needs of this sector.

More flexible models were needed which lead to the starting point of inventing a robust methodology known as Agile. Nowadays, the term Agile is used as a common name for all of the different sub-models which actually comes under this software development methodology.

Agile development methodology focuses mainly on an accumulative, iterative approach. It doesn't prompt for a full-fledged planning of the entire process in the begging stages, but it is known for the commitment made to the changing requirements throughout the development iterations. A team in Agile is bound to receive continuous changes in requirements and functionalities from the client as the development progresses. Agile mainly concentrates in bringing together multiple teams working on the development iterations which adjusts to the changing requirements as the business changes their needs. The main reason for the popularity

of Agile is this main feature that the clients can change their view of the product and the team is bound to deliver the same even though there will be a chance to change the deadline.

Each Agile development cycle or iteration produces a working demo for the clients to have a look upon. Agile Software development methodology was introduced for getting past the development processes that always followed a specific plan throughout the whole cycle. It made the customers happy by allowing changes in the functionality requirements over the phases of the product development and also to provide agility for an enterprise in order to respond to the frequency of changing market needs. Many evolving organizations have implemented Agile Scrum in their existing distributed environments. The implementation may not seem satisfactory as they all required huge amount of time and sources just to manage work during the implementation.

Agile was first published in February 2001, when a group of software developers met in order to have a discussion on Lightweight Development methods. A Manifesto was released as a part of this discussion which became the entry level fundamentals of Agile Development methodology. The manifesto aimed at better ways of software development which included 12 main principles. The Agile Manifest is one of the main part of the PMBOK (Project Manager's Body of Knowledge) guide and standards.

4.1.1   12 Principles of Agile Methodology

The Agile Manifesto lists 12 principles to guide teams on how to execute with agility. These are the principles:

- Our highest priority is to satisfy the customer through early and continuous delivery of valuable software.

- Welcome changing requirements, even late in development. Agile processes harness change for the customer's competitive advantage.

- Deliver working software frequently, from a couple of weeks to a couple of months, with preference to the shorter timescale.

- Business people and developers must work together daily throughout the project.

- Build projects around motivated individuals. Give them the environment and support they need, and trust them to get the job done.

- The most efficient and effective method of conveying information to and within a development team is face-to-face conversation.

- Working software is the primary measure of progress.

- Agile processes promote sustainable development. The sponsors, developers, and users should be able to maintain a constant pace indefinitely.

- Continuous attention to technical excellence and good design enhances agility.

- Simplicity -- the art of maximizing the amount of work not done -- is essential.

- The best architectures, requirements, and designs emerge from self-organizing teams.

- At regular intervals, the team reflects on how to become more effective, then tunes and adjusts its behavior accordingly.

Agile is a result of continuous monitoring and integration of multiple light weight development approaches put forward by project managers who have experience in the inflexible Waterfall

model. Agile mainly focuses on speed, flexibility and endless improvement. Some of the main advantages of adopting to Agile methodology are mention below.

- **Acceptable changes:** the chance of change at any time in the development process can be executed without any discontinuity. This is possible because of the shorter iterations and the daily involvement ad interaction of the client team directly.

- **Final Product is unknown:** The small iterations and continuous changes make way to the successful development of a product even though the final client requirements are not fixed. The Product owner or Business owner can keep working on the required final product while the development process is on track and can go for a better end line after getting a better understanding of the ongoing partially developed product.

- **Guaranteed Faster delivery:** The fragmentation of the whole project life cycle prompts each team member to concentrate on specific modules and deliver a better functionality or feature. This fragmentation also gives way to better defect fixing since each iteration has the testing team working along with the development team.

- **Less Communication Gaps:** This is one of the main advantages of Agile is that, it improves the communication between the team members. Agile methodology has very frequent Team meetings and daily stand up meetings which makes the team to work in sync and take responsibility for their own modules.

- **Client is aware:** The client is always aware of the development and testing progresses and can interfere with the same if he/she finds any need for change. This interference will directly have a real impact on the final product which the team is to deliver. The client also gains an ownership sense via these continuous interactions.

- **Frequent improvements:** Agile also encourages the suggestions and feedbacks from the whole team throughout the phase. Each suggestion and feedback is taken into consideration and tried to be implemented in future iterations.

4.2   Fundamentals of Agile Methodologies

Software Development methods has been in stepping stones to any project life cycle. Since late 1990's there has been a big leap into the software development sector by having changes in programming approaches like OOPS, Structured Programming, Aspect oriented Programming, Extreme Programming. All these changes made way for the research for strengthening the software development methodologies to a higher level. For the efficient usage of these research outcomes, it was necessary follow a defined process.

Agile strategies were first developed to impact the observed and arising weaknesses of traditional Software Engineering. Agile doesn't make itself compatible to all the existing situations, existing projects, developed products etc. Introducing Agile need ample alterations to employee's work habits. This is as a result of the conditions and strategies that Agile requires which is an uncompromising shift from the traditional development methodologies which were followed. Agile methodologies are heavily used in most of the organizations today. Some of them are

- Extreme Programming
- Adaptive Software Development (ASD)
- Scrum
- Cristal

Agile is considered as a framework and consist of different basic concepts which are further divided into sub categories. The whole agile movement has different flavors. One of which is SCRUM methodology. In this report, I will be concentrating on SCRUM Agile methodology as I have been a part of SCRUM and undergone a live-project development under Scrum Methodology.

4.3   SCRUM

Scrum has been one of the main frameworks for implementing Agile. It is an iterative software development model that strictly adheres with a specific set of responsibilities, rolls and strategies which makes the whole development lifecycle flexible. It is one of the most evolved Agile methodology which is widely used throughout the industry leading organizations. Introducing Scrum Has benefitted most of the Clients via better quality, increase in productivity, faster product delivery and many more. Scrum is an Agile method which is considered to an iterative, incremental and practical software development model. I would like to point out some of the main concepts and terminologies related to SCRUM Agile methodology.
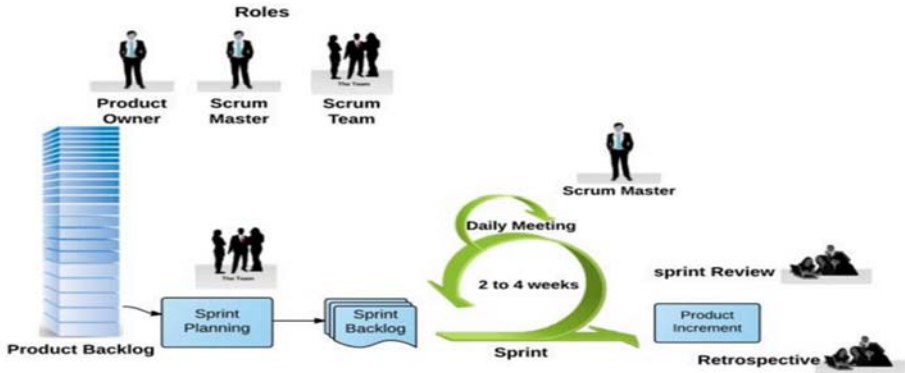
Figure 9 - SCRUM Architecture

Some of the concepts and terminologies involved in SCRUM are as follows:

- **Sprint**: Sprint is the name given the iteration cycle for Scrum. A sprint has a duration of at least 2 weeks depending upon the complexity of the undergoing project. A Sprint is considered as the time period when a specific set of requirements is decided to be completed and also the iteration cycle. A sprint starts with a sprint planning meeting which is the arena for the product owner to lay down the features and functionality requirements in front of the scrum development team. The product owner and the development team together then decides the work to be done in the current sprint. A sprint ends with a sprint review meeting followed by a sprint retrospective meeting.

- **Story**: A task assigned by the Product owner and accepted by the development team is known as a story. Each story will be having a specified meta-data assigned for identification.

- **Sprint Backlog**: It defines the set of work or tasks which is going to be worked on for a specific sprint. This is also a set of propositions decided in the sprint meeting at the start of each sprint which bounds with a set of goals along with the tasks assigned which is to be met at the end of the sprint.

- **Sprint planning meeting:** It is the base of each sprint and as mentioned earlier it is the first meeting held at the start of each sprint. It is considered to be an agreement between the Product owner and the development team about the work to be done in the ongoing sprint. Both the team and Product owner decides on a set of goals to conclude the items to be taken from the sprint backlog for commitment in the current sprint. The duration of this meeting may vary upon the quantity and complexity of the tasks retrieved from

the sprint backlog. The development team decides on the delivery strategies and the fixes on a specific deadline for each task and also lets the product owner know about the tasks which cannot be taken up in the current sprint. The product owner either negotiates with the team for the same or tries to move the odd tasks out to be included in the forthcoming sprints.

- **Sprint Review meeting:** The sprint review meeting is the one which is held on the last day of the sprint. This meeting concludes the perfect review of all the tasks, features, functionalities and overview of the product part in which development was done in the current sprint. The product owner approves the stories by going through each one of them while it is being put forward by one of the development team members.

- **Sprint Retrospective meeting:** The spring retrospective meeting also occurs at the last day of each sprint after the sprint review meeting. This is the arena for the Scrum master to discuss the following:

    a. What went well in the current sprint.

    b. What to improve in future sprints.

    c. Observations of the current sprint.

This meeting is an integral part of Scrum since it is the place where the scrum master makes points for the whole team and tries to input all the necessary ingredients for strengthening and improve the team for future.

4.4   Roles in Scrum
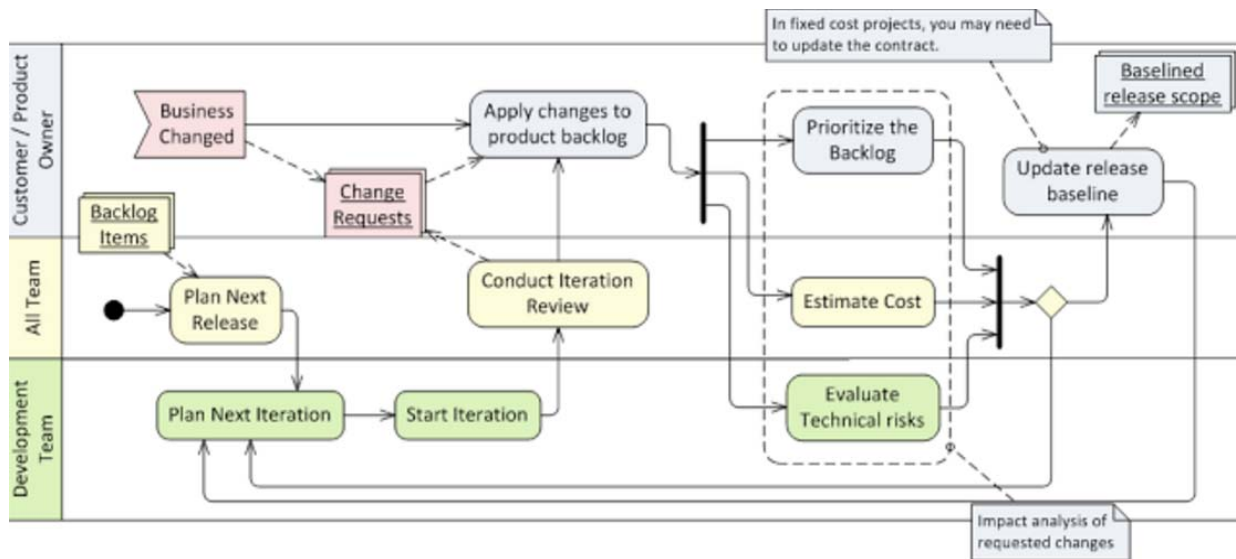
Figure 10 - SCRUM cycle with respect to Roles

- **Product Owner**

As the name suggests the product owner is the client representative who will own the final product during and after the delivery of the final product. Product owner has the final vision of what the original product should be and conveys it to the development team. The product owner is the direct connection of the development team with the client. The major responsibilities of Product owner are:

a. Creating and managing Product backlogs.

b. Prioritizes the functionalities and features to be delivered in each sprint.

c. Connects with the development team and other stakeholders for making everyone in sync with the product development status and strategies.

d. Motivate the whole team with a vision.

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- **Scrum Master**

Scrum master is considered as the main motivator of the whole team. He/ She is coaches the team for giving out their best performances and works with Product owner for making sure that everything is ready for the upcoming sprint such as the product log. The Scrum master doesn't have any authority to command the team what to do, but always exercise the power over the whole process. He can give possible suggestions keeping in view the successful delivery of the product. More than a leader, a Scrum master acts like a guide to the whole team. Some of other major responsibilities are:

a. Organize and control all the sprint meetings including the daily stand-ups.

b. Be responsible and solve existing and possible roadblocks and impediments.

c. Be responsible for the team to adhere with the Scrum methodology rules and regulations.

- **Scrum Team**

A Scrum team normally ranges from 5 to 15 according to the complexity of the project. The Scrum team works together to meet the delivery of the product. They are characterized as a team who helps each other, self-esteemed and who are multi capable. The responsibility of actual development of the product is under the Scrum team. They are also responsible to answer for specific tasks assigned during each sprint.

CHAPTER 5

AGILE-SCRUM DEVELOPMENT

5.1 Agile-SCRUM development flow summary in XYZ

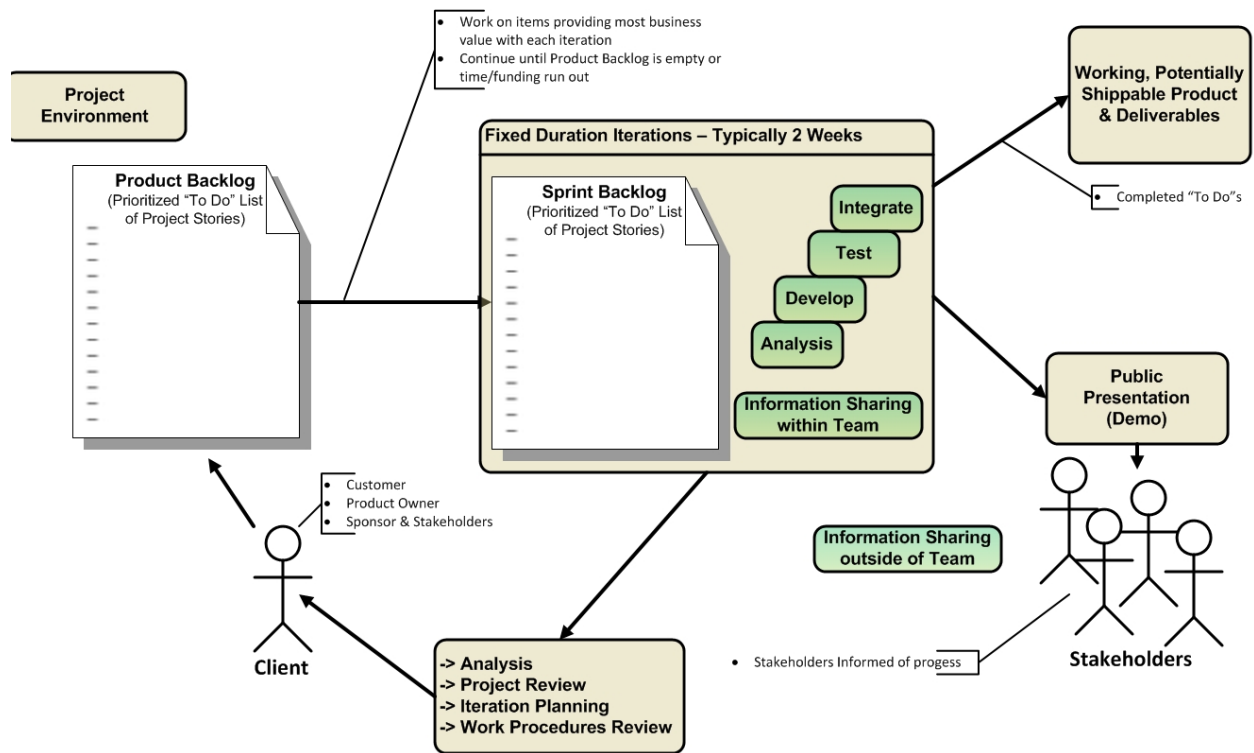Here I explain the development process that I underwent in Agile:

Figure 11 - SCRUM Development Flow

5.1.1 Initial Planning Phase:

The initial stage is the planning stage. There was a sprint meeting held up on the first day of the sprint cycle. The meeting included the Product Owner, Business Analysts, Delivery Manager, Project Manager, the development team and their leads, Test Leads and the Scrum Master.

The product owner puts forward a set of requirements, which is reviewed thoroughly by the whole team via Agile management tools which in our case was Version-One. The main tasks performed during this spring meeting are:

- Sorting out the requirements in perfect accordance with the priority needed by the product owner.

- Investigate if the requirements can be achieved or not. This task is a combined effort of the Project Manager and the Development team.

- Leaving out the requirements which cannot be met in the current spring. This process includes the approval of the product owner so that he/she is ready with the team delivering the specified requirement in the coming sprints.

5.1.2 Requirement analysis:

The Requirement analysis phase is also included in the first sprint meeting with all the members and mainly revolves around the idea of analyzing the sorted out requirements put forward by the product owner. Here the Business Analysts come into picture.

- The BA analyses the final requirements sorted out by the whole team and compares it with the business needs. They can suggest minor changes related to the requirements with the product owners concern.

- Next, the Scrum Master lists out each requirement and divides it into stories. The description of each story is done while in discussion with both the product owner and the development team to which the story is to be assigned.

- These stories were assigned to different development teams with respect to the different skillsets they have.

- Each story is assigned a Story point according to the complexity of the requirement it is concerned with. This process is also the outcome of the discussions between the development team members and the product owner.

- All the stories which are entered as it is discussed in the meeting to Version One by the Scrum master. These stories which are entered in Version One are assigned to each team member and are given completion hours as discussed in the meeting.

5.1.3 Designing Phase:

The design and Implementation techniques are discussed among the development team members and the specific team leads and meant to be informed of each and every step taken to fulfill the tasks. Steps taken as follows:

- The Team holds meetings internally for discussing the approach to meet the requirements of each story assigned to them.

- After completing the Design and approach, the team comes up with a tentative strategy to complete the stories within the sprint.

- Each Team Lead is entitled to enter the details of the implementation strategy in Version One as they proceed with the development process.

5.1.4 Implementation, coding or development Phase:

In this phase the actual development of the given story and testing happens. Steps as follows

- The Development team members implements the stories assigned to them and updates the details in version one along with burning out their corresponding hours.

- This phase also includes the testing of the features or requirements mentioned in each story. The testing happens along with the development with accordance with the updates made by each developer in version one.

- Each day there will be a stand-up meeting which will include the development and the testing team along with the scrum master in order to discuss about the progress and issues faced by the team and to mark the details in version one.

- The blocks and impediments faced by the development and testing team will be discussed in the daily stand up meetings. It's the job of the scrum master to make a note of all the issues faced by the team and resolve any dependencies with other development teams.

- During the development, the team will be facing many issues which will be related to the following:

    a. Dependencies related to the story which needs immediate approval from BA and the product owners and product owner.

    b. Dependencies with other third party vendors providing services which the development team uses.

    c. Environment related dependencies.

    d. Deployments to the development environments for testing a specific functionality may fail due to many issues.

- The issues which are discussed in these meetings will be closely monitored and their resolution will be tracked by the scrum master.

- The issues which are unlikely to be solved before the current spring will be taken into upper management like the delivery managers and also will be notified to the product owner.

5.1.5 Testing:

The general behavior of the testing team is to test the code and features only after it is developed completely. But in Agile strategy, a daily development target is maintained so that the testing team gets at least a small functionality to test. These small testing phases that occurs along with the development process ensures the whole team that the features and functionalities which are being developed are in perfect accordance with the client requirements and meets the business needs.

5.1.6 Deployment:

The initial deployment occurs during the development phase itself since some part of the functionality should be delivered to the testing team during the sprint. The deployment normally occurs step by step according to the environments eligible for testing and development.

- After passing all the test cases created by the testing team, each functionality moves to a higher environment for integration with the main modules developed.

- The deployment in the early development environments will a major step to cover since it deals with integration with the main framework modules.

- As each functionality moves forward to higher environments, the testing and bug fixing process also goes along with and the functionality is made perfect as to adhere to client requirements.

- The product residing in the highest environment which is fully tested and approved by the testing team is delivered to the customers for their use.

- Although the complete delivery to the highest environment is done, it's not a confirmation that every functionality delivered is accepted as a full proof component of the original product need by the customer. There will arise situations where the customers will run into new issues during the long use of a functionality. When such situations arise the development team is responsible to look into the customer's intensions and make accurate call of redesigning, if necessary.

CHAPTER 6

SHORTCOMINGS

6.1 Shortcomings of current ECM implementation techniques

Rather than the most advantageous part of using ECM as a method for managing the unstructured enterprise data, ECM is also made into good use for marketing purposes and presenting the strategies, product features of an enterprise. The experience which I had was mostly in developing a web application that purely depicted the marketing strategies of XYZ insurance firm. The main purpose of the application was the present the features of the products offered by xyz to the public using ECM systems.

Some of the major flaws that I experienced during ECM implementation are as follows:

6.1.1 Increased chances of breaking the application

The content of the application is managed and authored by the client themselves as they need to independently change it as per their marketing strategies. As a development team, we only can provide a framework skeleton to the client. The content authoring is the responsibility of the client and any inability to provide the specific content types matching the elements of the skeleton will cause major design issues to the application. Some of the instances include inappropriate images and image sizes, inappropriate style guide references etc. This mainly puts up a questionable situation to the application consistency.

Solution: Proper content authors should be in place who also has the application development knowledge in first place. The most effective method will be to retain at least

some of the development team members who will directly assist and train the client content authors for the proper use of the authoring techniques.

6.1.2 Migration is almost impossible

Once implemented, ECM becomes the integral part of the whole data management vision of an enterprise. Implementation costs requires them to follow the same stream as long as possible. The implementation techniques of ECM rebuilds the entire root of every enterprises data management procedures and makes migration almost impossible. The wide variety of vendor agreements also plays a very important reason of making migration a tough task. Due to the huge changes in the basic principles of data management methodologies which comes along with ECM implementation, there exists a variety of bounding reasons for an ECM vendor to be a part of an organization, which in-turn makes a bond of compliance between a vendor and a client. The agreements between an ECM vendor and a client will be so strong that migration will not only be a tough chance but also a time taking process. These reasons require a client to be held up with the current ECM implementation rather than shifting to other methodologies.

6.1.3 Resource unavailability to RUN THE BUSSINESS/Application support

The content authoring part continues even after delivering the product as per client's requirement. Here resources don't mean the development team who were involved before the final delivery of the product. Client side content authoring will always require some set of eyes constantly watching for any type of support. Other than the authoring support, ECM applications normally doesn't need pure developers for application support. With this view in mind the

management never allocates major resources. But there arises situations where major enhancements will be needed and resources will never be available for involvement.

6.1.4 Initial adoption

Although ECM existed to provide more control over the enterprise information, they lacked fast adoption over the organization structure. ECM always need special skilled programmers and management people at the initial implementation stages who were also either representing or directly working under the vendor for making ECM stable for the enterprise.

6.2 Issues caused by ECM Vendors

As the main vendor for ECM implementation at XYZ was IBM, I would like to also keep some points to the issues faced by the client because of the product line of IBM.

- IBM has a wide variety of product line which provides the complete ECM solution experience which attracts a lot of enterprises. IBM is the top vendor providing a total ECM solution. As such, the complete solution comes at a very high cost and every enterprise makes a huge investment in getting this product line-up.
- This product solution line-up exists as the base of the content management in the enterprise but has some overlapping capabilities. This recurring capabilities of vendor products causes a wide confusion among the clients who evaluates these products. Solution: Clients should be able to categorize and evaluate ECM vendor products based on the areas where integration might become easier.

- Many clients including XYZ have always reported unsatisfactory responses from the customer service, product support, upgrade support experiences. Solution: Clients should be able comply with the vendor for providing dedicated employees or partners to support.

- The products which were expired and waiting for updates often faced extended rollout time intervals which causes a lot of issues with the clients waiting for specific project delivery dates. Solution: There should be frequent updates about the rollout and updates confirmation dates which also should be made aware to the project development team from the client side.

6.3   Agile Shortcomings and Recommendations

Agile is still evolving, many organizations are planning to migrate the software development into Agile from tradition models. There are still areas in this development technique which needs some tweaking.

- Since it is new to the developers involved, the lack of knowledge about Agile always comes up during the implementation phase.

- The first phase of understanding the requirements and business needs is given low priority and the team runs behind understanding the Agile process. The development methodology of Agile should be made familiar separately at first before the actual implementation takes place.

- Agile presents the wide view of what each developer's skillset is, through its thorough indulgence with daily standups and immediate action course. This in turn makes a fear

factor in the mind of the new developers who are still in a learning phase of their skill sets. The senior experienced members should consider these situations and take it easy on such developers.

- Agile enforces all its team members to be a "master of all trades" to meet the requirements as expected. This is not at all a feasible solution to make the development process steady. If all the developers concentrate on multi-tasking, the whole development will be in jeopardy.

- Agile always requires a special set of skills which has an in-built implication of speeding up each and every process weather it is development or testing. This automatically is an area where only high experience plays its role. Looking at the requirements that Agile enforces, there is very less scope of evolution through by bringing forward new candidates. A prompt solution to this to incorporate Agile specific recruitments and appropriate training sessions to the already existing employees.

- Along with the development process, Agile gets the trust of the client by involving the direct representatives like the Product Owner into the development meetings. It is considered healthy for accordance with the client as they have an eye on the whole process and gets a perfect idea on what the final product to be delivered will look like. But there incur situations where the client side is not happy with the view that they see from the development side and this can create problems. They are forced to make changes in the requirements and the team itself which will cause the whole process to go into a black out phase.

- Agile always needs the team members to be in sync for all the immediate development progress that they commit and mention their views in the daily standup meetings. If the team members are located in different geographical locations, the speeding up of the development process will be not done as expected. For example there are on-site and off-shore teams working in Agile who faces this issue and are in need of some kind of solutions. Providing industry standard communication technologies with on live camera/video conferencing facilities which will remove this communication gap. Even though providing these facilities will not clear the problem fully because of the time zone differences. A support team specifically dedicated to the onsite-offshore communication problem should be set up for maintaining a balance.

- Agile boasts of getting the delivery done very quickly and efficiently which is true from a certain extend. The code delivered has the rarest chance of getting reviewed properly in spite of fast delivery. This happens most of the time due to the inappropriate deadlines that were agreed upon. Most of the code delivered will be in a category that complies only with the working features which in in sync with the requirements. The features will be working and good to go, but the code underneath will mostly be junk which can never be reused. This lack in code efficiency may seem irrelevant as the product is being delivered but will effect in the long run. There should be a reviewing team who not only reviews the features and functionalities tested by the testers but also review the code efficiency running in the back ground.

CHAPTER 7

ECM APPLICATION FRONT-END OVERVIEW

7.1 ECM Web-Application Mobile Compatibility

The ECM application in XYZ was an internal application which manages the documents useful for the employees itself. The application mainly allows the users to extract a specific document from the repository by providing specialized search criteria as needed.

The application managed the proper authentication mechanism for each user. My role in the development was to enable compatibility of the application in devices other than Desktops and Laptops. My work completely focused on making the internal web application compatible on mobile and tablet devices. In this chapter I will focus on the methods and procedure that I took in making the application compatible on mobiles and tablets. I will be providing some screenshots and the application and depict the same in smaller devices.

7.1.1 Responsive Login Page

The Application Authentication (Sign-in) page was not responsive and fully broken while viewing from a mobile device.
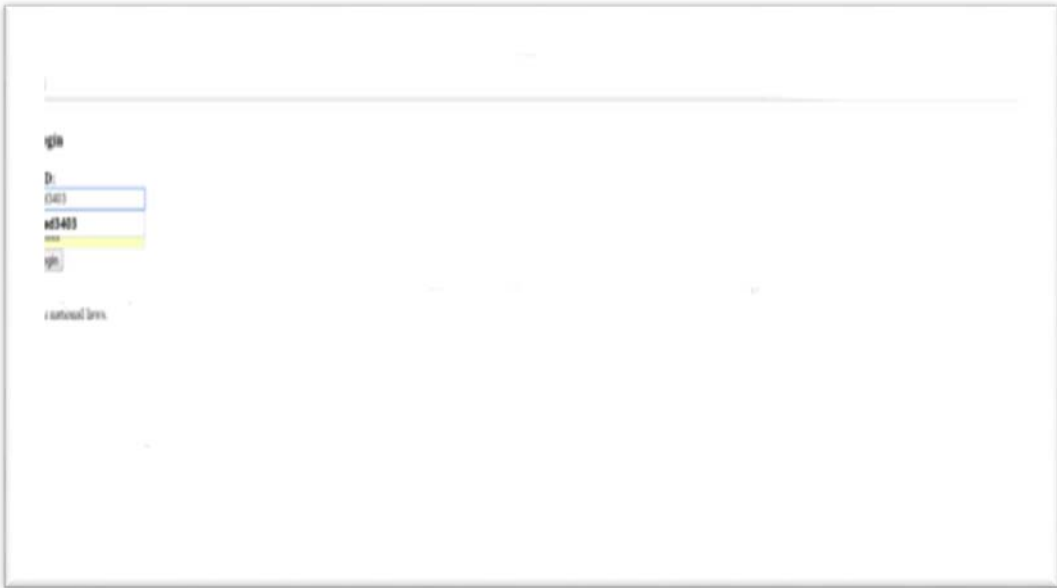
Figure 12 - Application Authentication Page
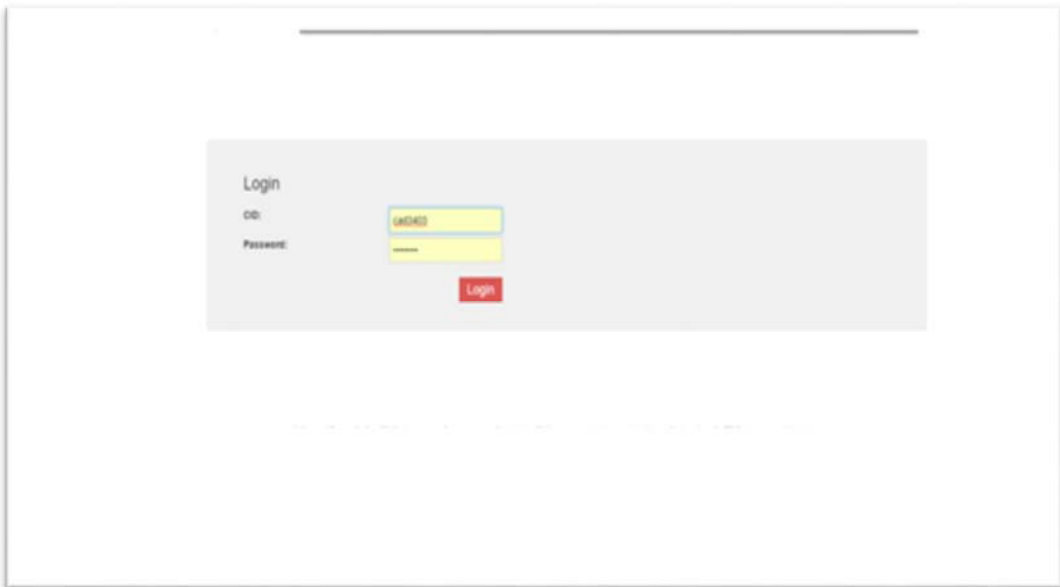
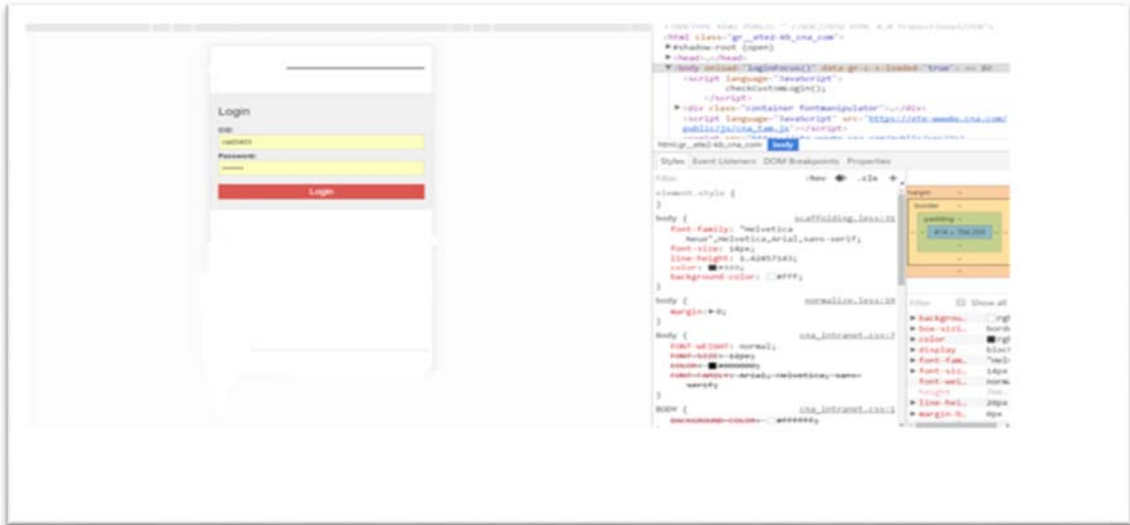**Figure 13 - Application Authentication Page in Tablets and Desktops**

Figure 14 - Application Authentication Responsive Page in Mobile
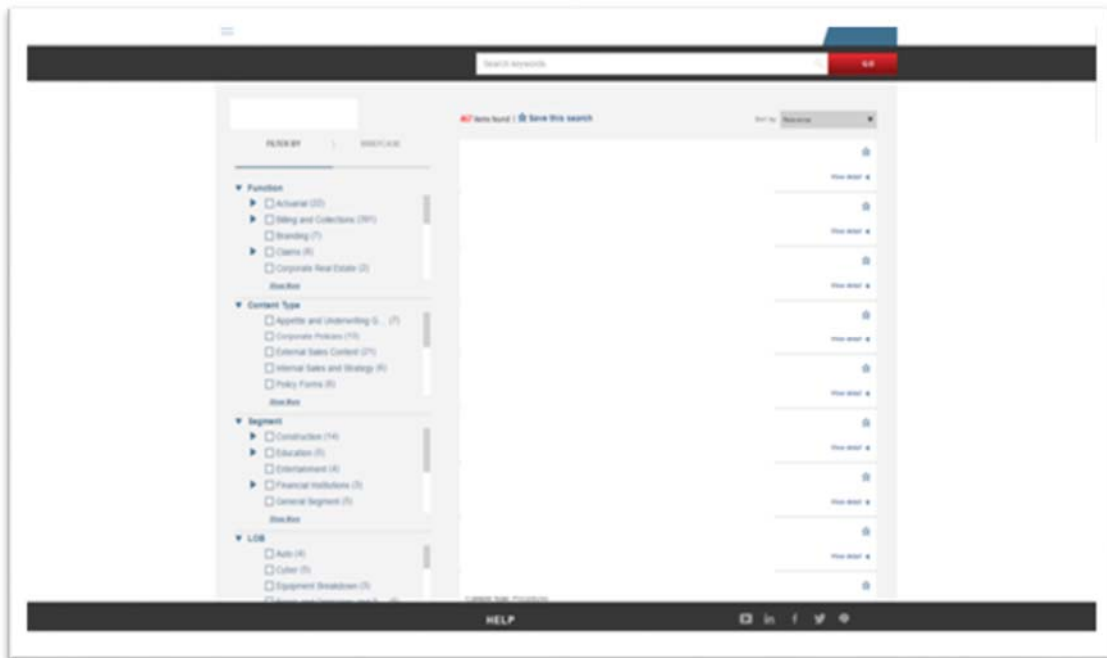
7.1.2   Responsive Application Main Page

Figure 15 - Application Main Page in Tablet

7.1.3 Mobile Compatibility Methods

- **Media queries**

Media queries enable the use of CSS based on orientation, screen size, and other attributes of the device. We have place them on the <link /> element when including CSS or inline directly in the CSS. For this article, we place the queries directly within the CSS to alleviate any extra requests to the server. Using queries is similar to writing if conditions to tell a browser when to enable a certain set of styles.

- **Creating the media queries**

The media queries optimize the theme for different devices. In this example, we focus on two additional devices other than desktop: a smartphone and tablet. In design, when a media query is introduced, that is often called a breakpoint. We can have multiple breakpoints per device we are targeting, but for this example we ignore orientation changes and other minor breakpoints and focus on one breakpoint for each device.

The first query that we will need to add is for a tablet device, so we want to target devices with a screen width less than 800 pixels. Copy the media query below in Listing 1 to the end of master.css.

```
@media screen and (max-width: 800px) {

}
```

Figure 16 - Media Query for screen width less than 800 pixels

With this media query in place, any styles that are placed within the structure will render when the screen size is less than 800 pixels. The second query to add is for a smartphone device, which targets devices with a screen width less than 480 pixels. Copy the media query below in Listing 2 to the end of master.css.

```
@media screen and (max-width: 480px) {

}
```

Figure 17 - Media Query for screen width less than 480 pixels

With this media query in place, any styles that are placed within the structure will render when the screen size is less than 480 pixels. Listing 3 shows the master.css with these two breakpoints in place.

```
. wpthemeMenuAnchor {display: inline-table! important;}. wpthemeMenuBorder {top: -9999px.

@media screen and (max-width: 800px) {

}

@media screen and (max-width: 480px) {

}
```

Figure 18 - Master CSS file with Media Queries

7.1.4   Update the theme structures to become responsive

We now have two structures set up that contain the styles that override the desktop and optimize the theme for a tablet and smartphone. The first step to identifying areas of the theme that need to become responsive is to use Firebug to inspect the DOM and find the structures that have a set width.

To inspect the DOM, select the arrow button on the right side of the Firebug toolbar.
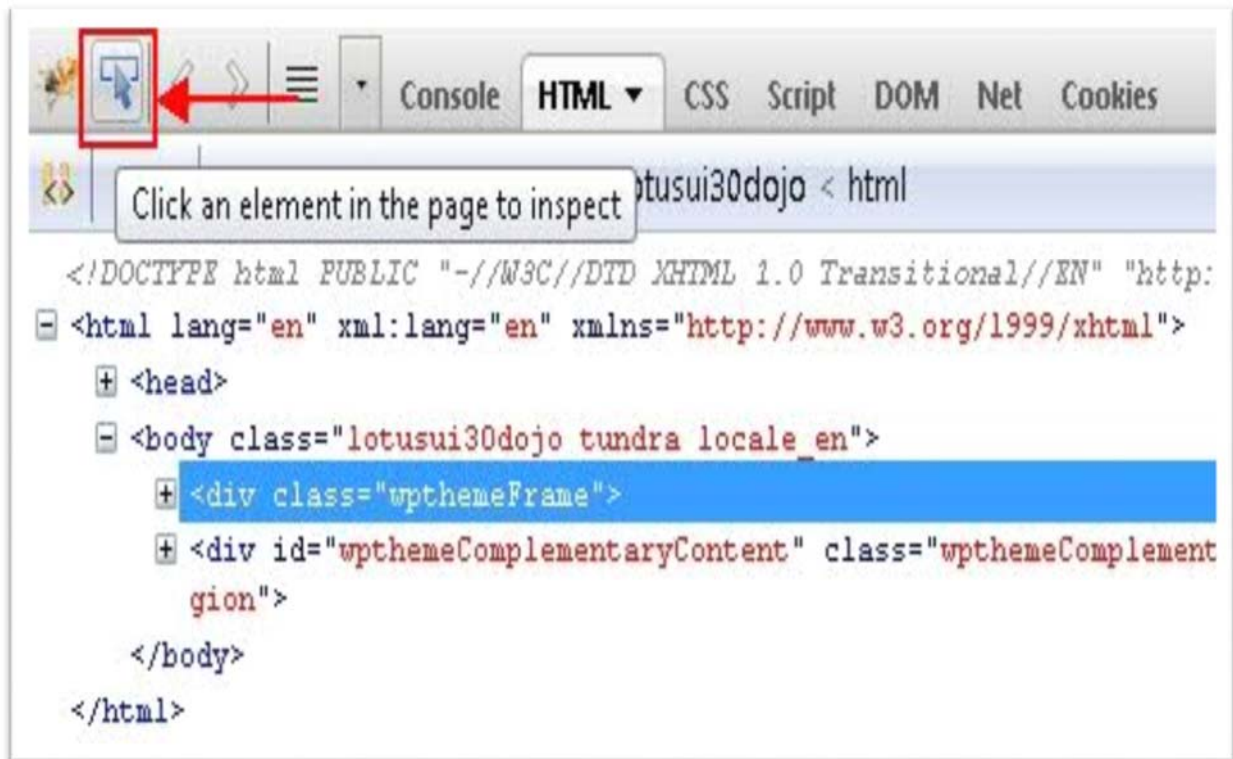
Figure 19 - Fire-Bug Inspector (Firefox Browser plugin)

Using the inspector, we can hover over areas of the page to see the width defined in the styles.

As we start to hover over elements on the page, we will notice there is a page wrapper with the

style class "wpthemeFrame" and within the major areas of the page, such as navigation, main

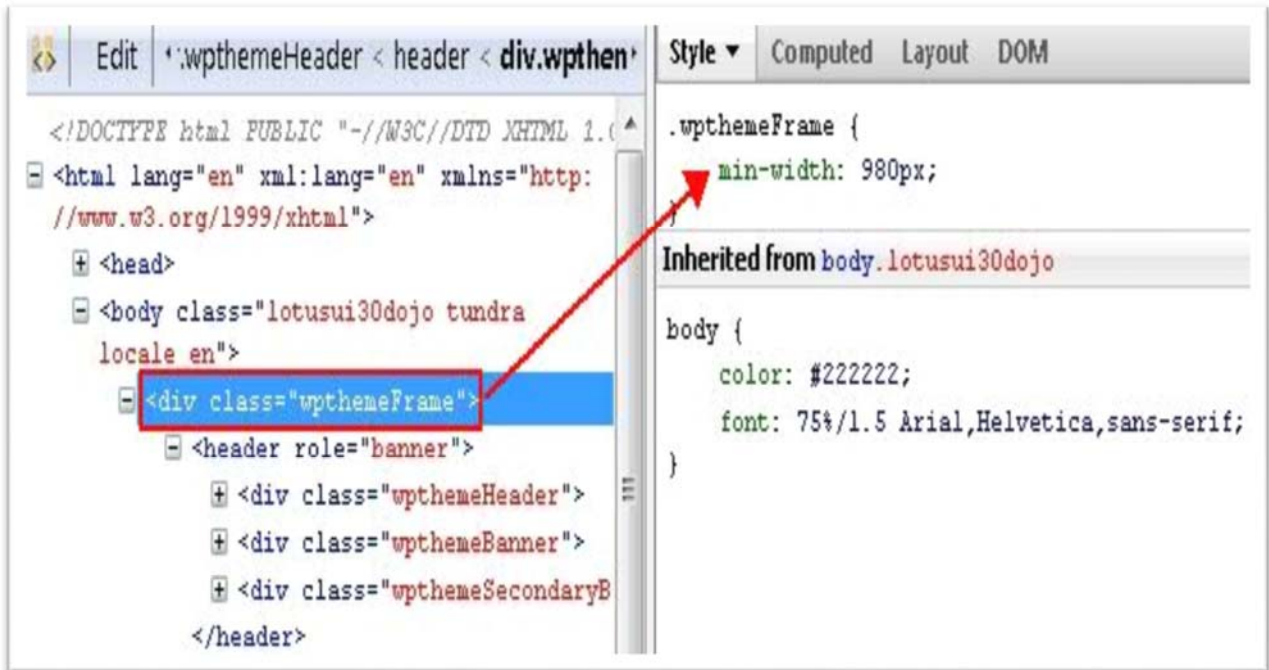content, and footer, there is a structure with the style class of "wpthemeInner"

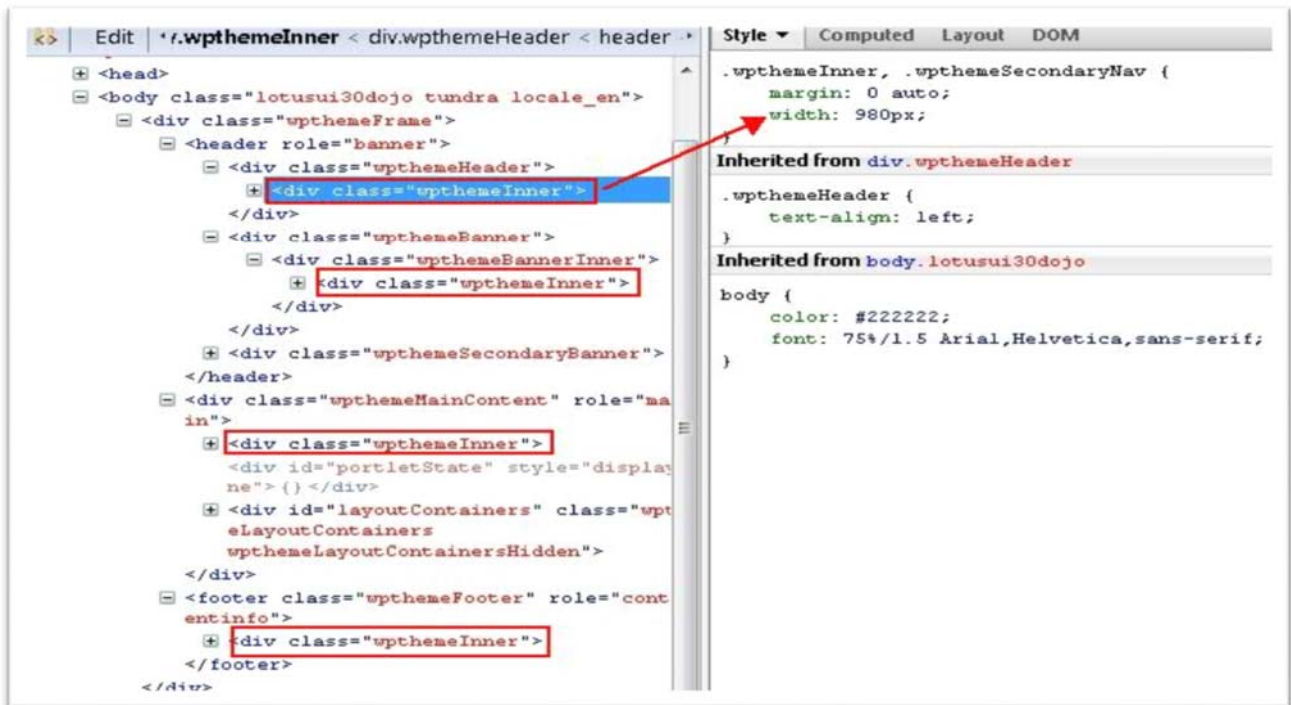**Figure 20 - The Page Wrapper Element**

Figure 21 - Page Inner Structure

These two style classes are defined with static values. We need to change the widths to accurately reflect the device that is targeted and make the structures with the classes defined flexible. To do this, set the min-width on wpthemeFrame to the minimum width we want our responsive design to adapt to (for this sample, it is 320px). Next, make all of the major areas of the page elastic by giving wpthemeInner a percentage width (for this sample, we use 100%). Copy the style definitions for wpthemeFrame and wpthemeInner to the tablet media query defined with a max-width of 800 pixels. Since these styles will be applied to all screen sizes below 800 pixels, it will apply for both tablet and smartphone devices.

7.1.5   Mobile View

The mobile view of the application which I developed was divided mainly into four parts other than the Authentication page as mentioned earlier. The screenshots are the view from Chrome Web Browser Emulator set to IPhone 6 view mode.

- Home page
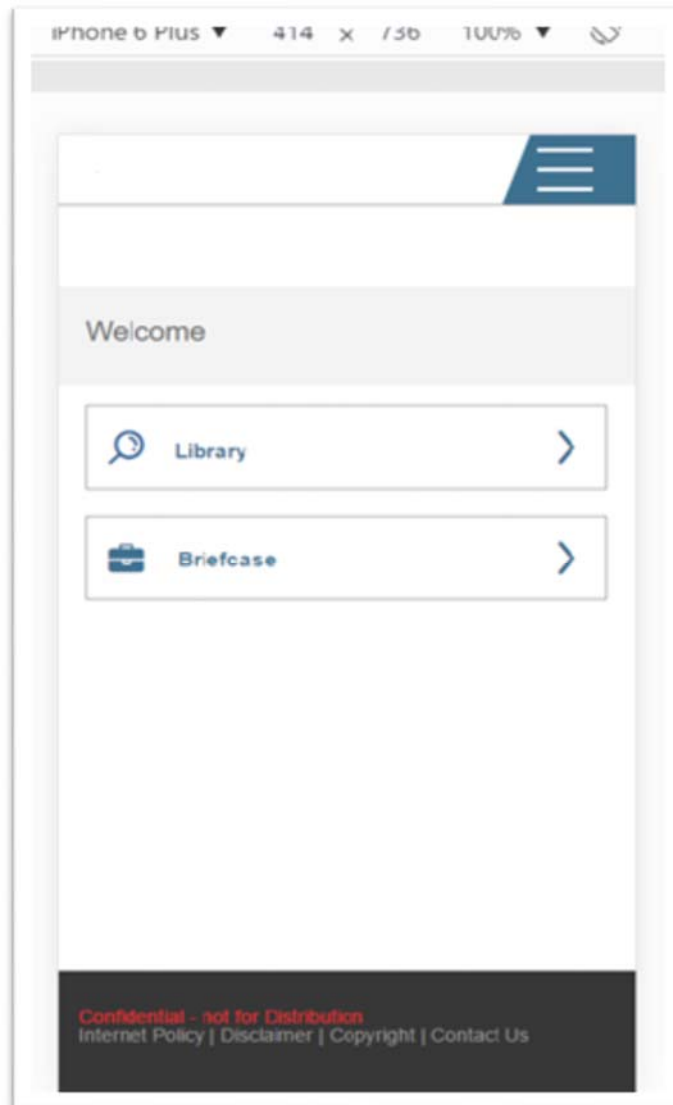
Figure 22 - Mobile Home Page

- Search Page
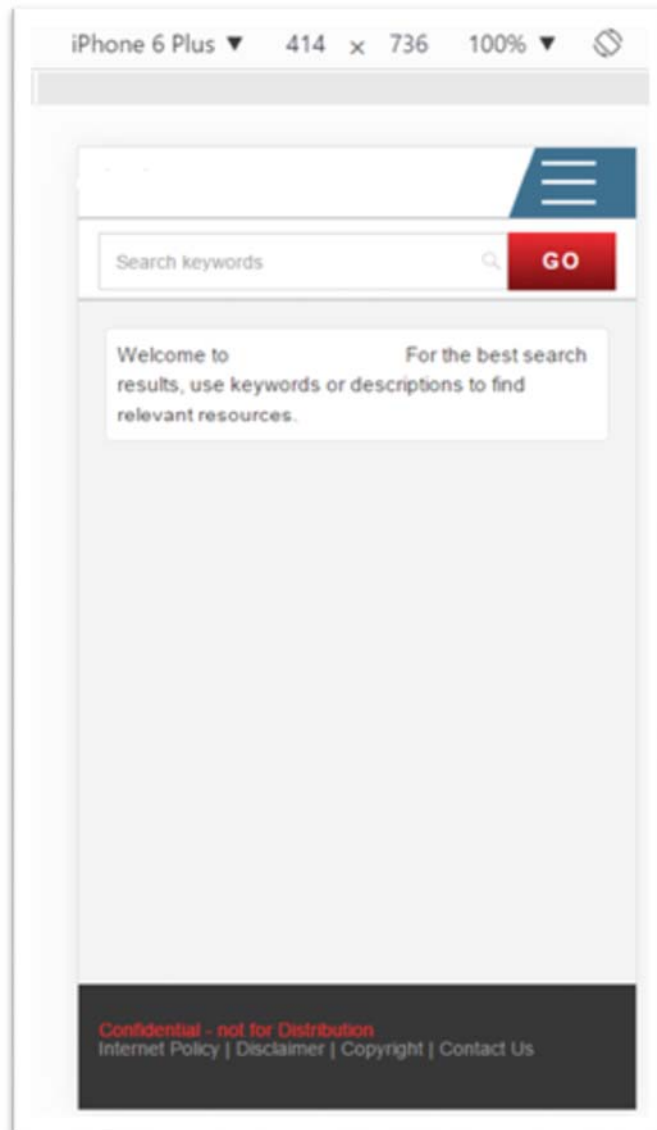
Figure 23 - Mobile Search Page

- Search Main Page

Figure 24 - Mobile Search Main Page

- Bookmark and Briefcase Page

Figure 25 - Mobile Bookmark and Briefcase Page

CHAPTER 8

CONCLUSION

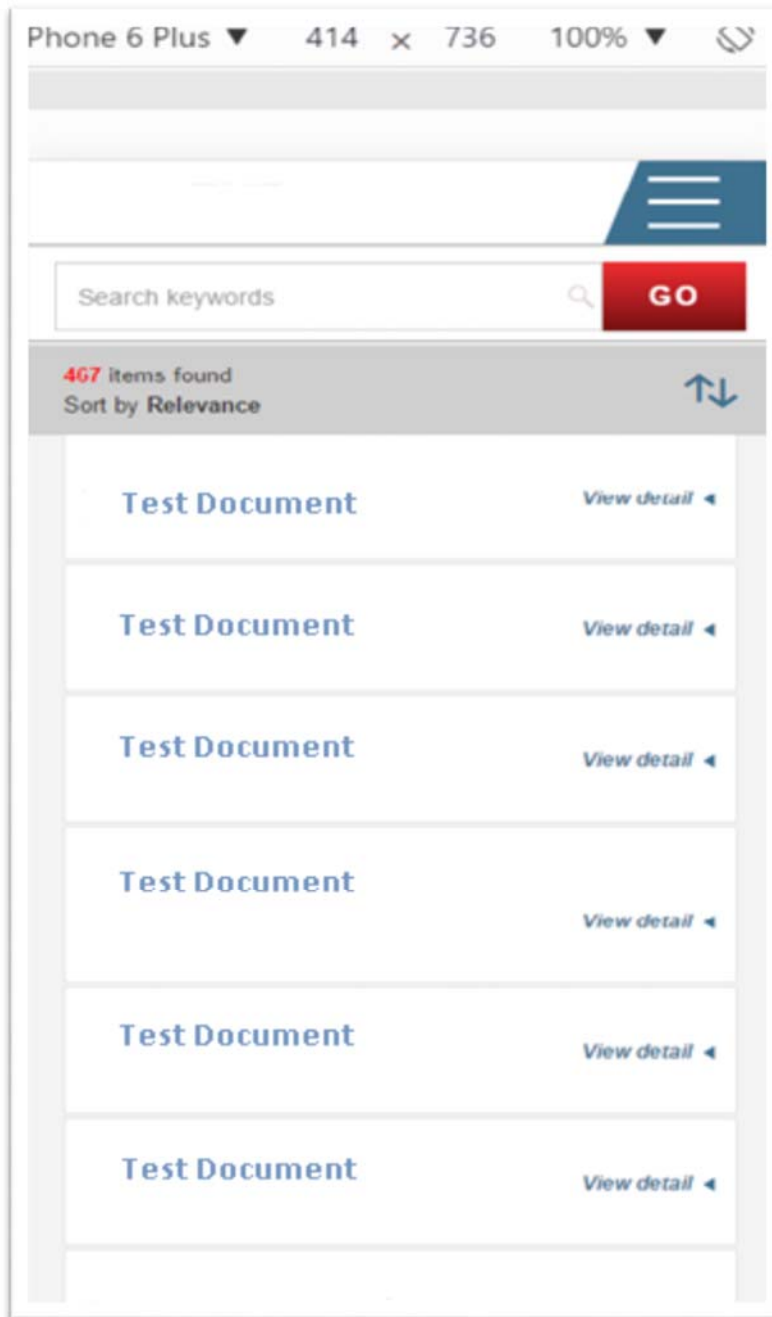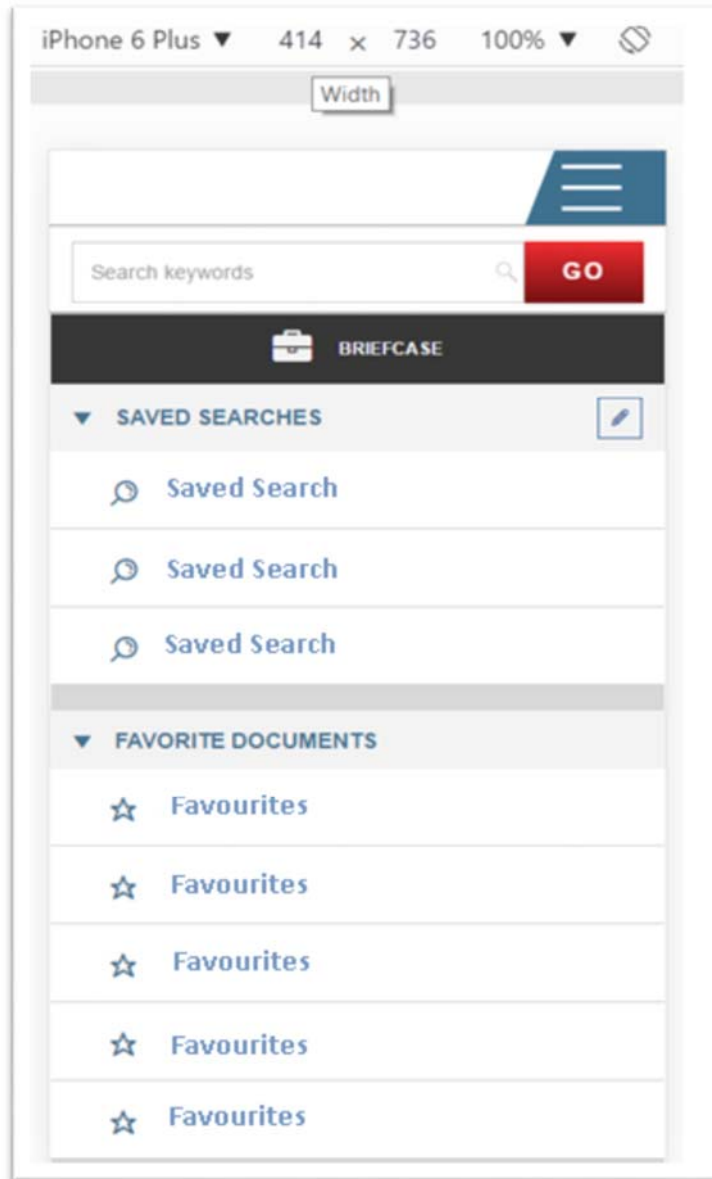This master thesis research investigated the current issues in ECM implementations and the development of ECM applications in an Enterprise with a direct view on the ECM implementation techniques currently ongoing in XYZ enterprise. A different view in this thesis is the depiction of the implementation issues of ECM while in Agile methodology.

This research showed the lack of understanding the concepts of ECM as a main reason for unresolved issues existing in organizations. The organizations are only partly aware of the fact that there still exists a lack of knowledge on the implementation techniques throughout the enterprise structure. This Research also depicted the methodological shortcomings of Agile development and cited out different recommended solutions for the same. If implemented will caution and removing the shortcoming mentioned above, ECM via Agile is one of the best method for controlling the increasing content burden existing in most of the current organizations.

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