



**Sudan University of Science & Technology  
College of Graduate Studies**

**A Review Study of Frameworks Used in  
Developing Web-based Applications Django,  
Ruby on Rails and Cake PHP**

**دراسة استعراضية للاطارات المستخدمة في تطوير تطبيقات الويب  
الأساسية**

*Thesis Submitted as Partial Fulfilment for the Requirements of MSc  
Degree in Computer science*

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# **Acknowledgements**

I have tried my best to grasp, analyse and put together here the spirit of the endless productive conversations that we have had on the frameworks used in developing web-based applications to explore, evaluate and help users and experts to use and develop frameworks.

I want to express my deepest appreciation to my family for their support and understanding and all my colleagues who have contributed, either directly or indirectly, to this thesis. I believe I could not have got better ingredients for it. I hope the results will serve our common goal of enhancing frameworks used in developing web-based applications.

Special thanks to Dr. Abdallah Akode Osman, my supervisor, for his help and guidance along the way. I am glad to have had the opportunity to work with him.

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# Abstract

Due to the large on line services, there are a lot of different frameworks used to develop web applications. The process of selecting proper framework that fulfil the purpose for which applications to be the most suitable was considered. Hence before developing the application the user must go through a lot of steps mainly his ability to deal with framework and the programming language used to develop the framework. The main objective of this research is to perform a comprehensive review and a comparison on the most popular frameworks used to develop web application specifically Django, Ruby on Rails and Cake PHP in order to help the user to select a proper framework that suits the scope of the required applications. The selection methodology is based on software engineering criteria, namely: documentation, lines of code, community and validation. The results show that the best framework based on the four criteria is Ruby on Rails. For more comparison and review the results of the questionnaire show that the Ruby on Rails is the best framework. The study recommends more evaluation studies based on other software engineering criterion such as user interference, etc, must be done on the Django, Ruby on Rails and Cake PHP frameworks.

## الخلاصة

نتيجة لتعدد خدمات الإنترنت هنالك عدد من الإطارات المختلفة التي تستخدم في تطوير تطبيقات الويب لكن العملية التي يتم بها إختيار أفضل الإطارات التي تناسب الغرض من تصميم التطبيق تعتبر من أصعب المهام لذا قبل تطوير التطبيق يجب على المستخدم أن يمر بعدد من الخطوات أهمها قدرته على التعامل مع اللغة المستخدمة في تصميم الإطار. الغرض الرئيسي من هذه الدراسة هو كيفية إختيار أفضل إطار يتناسب مع تصميم تطبيق الويب ومن أشهر الإطارات المستخدمة في هذه الدراسة والتي تساعد المستخدم في إختيار أفضل (Django, Ruby on Rails, and Cake php) يناسب تطبيقه وطريقة الإختيار في هذه الدراسة تعتمد على معايير هندسة البرمجيات (التوثيق, عدد أسطر الشفرة, المجتمع المستخدم, تاكد من صحة الكود). ومن النتائج التي توصلت لها هذه الدراسة هي أن أفضل الإطارات في تطبيق المعايير المستخدمة في هذه الدراسة هو (Ruby on Rails) ومن خلال تحليل الإستبانة التي تم توزيعها إتضح أيضا أن (Ruby on Rails) هو افضل الأطارات من توصيات الدراسة أن هنالك عدد من معايير هندسة البرمجيات التي يمكن التحقق منها علي الاطارات (Django, Ruby on Rails, and Cake php)

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## Table of Abbreviations

Ch2	
PHP	Personal Home Page
CGI	Common Gateway Interface
ASP	Active Server Pages
MVC	Model-View-Control
API	Application programming Interface
DOM	Document Object Model
UI	user interfaces
Ios	Internet Operating system
UX	user experience
SEO	Search Engine Optimisation
CMS	content management system
J2EE	Java 2 Platform, Enterprise Edition
RDBMS	relational database management system
OO	Object-oriented
O/R	Object-relational
OJB	Object-relational Bridge
GL	Graphics Library
DTD	Document Type Definition
HTML	Hyper text markup language
Css	Cascading style sheet
Xml	<b>Extensible markup language</b>
CRUD	create, retrieve, update, delete
ORM	object relational mapping
IDE	integrated development environment
HTTP	Hyper Text Transfer Protocol
CMS	content management system



Ch3	
MVC	Model-View-Control
HTML	Hyper text markup language
Css	Cascading style sheet
Xml	<b>Extensible markup language</b>
CRUD	create, retrieve, update, delete
ORM	object relational mapping
IDE	integrated development environment
HTTP	HyperText Transfer Protocol
JSON	JavaScript Object Notation

Ch4	
MVC	Model-View-Control
HTML	Hyper text markup language
CRUD	create, retrieve, update, delete
ORM	object relational mapping

# **CHAPTER ONE**

## **1. INTRODUCTION**

## **2.1 Introduction**

At present there are a lot of different frameworks divided over different programming languages, despite the fact that most of them were based on PHP and Java languages, while each of them declares that it is the best and possesses most capabilities. But in usage, this could not be the reality, therefore why should there be a need for continuous development and evaluation of the frameworks? To find out which one virtually support the criteria needed by the user and the usage environment (Spencer et.al. 2007).

Despite the services that the framework offers to web application, still there are challenges that face the use of frameworks. The most important one is how to build the application on the framework and integrate them without contraction or difficulty in dealing with the language used in building the framework. Concentrating on the language has become one of the most important parts that contribute and help in selecting the framework. Also dealing with the language is easy and helps the user to avoid using the codes whenever the framework is often used.

## **2.2 Research problem**

The process of selecting the proper application at this time is considered the most difficult matter, because there are a large number of frameworks available. Moreover, and the diversity of web applications and the different purposes for which the applications were designed in addition to the difference between the capabilities and skills of the users of these applications make it difficult to deal with the framework and application at the same time. What makes this matter even more difficult is the difference in languages used in the framework design. How the framework is evaluated and selected. Poses the problem, because there should be some criteria by which the framework was selected, and this is the axis of this study, with the help of software engineering conceptions used in this evaluation.

## **2.3 Aims of the study**

- Extrapolation of some criteria on which the framework used in the application is evaluated.
- Helping users who lack experience or with little experience to select the proper framework for their applications.
- Helping experts and the skilful in the process of developing frameworks later on.

## **2.4 Research methodology**

The methodology used in the research could be summarized as follows:

1. Definition of the web applications framework.
2. Evaluation of framework through some criteria that help in developing frameworks and web applications.
3. Using software engineering concepts in the usage process.
4. Using open sources of frameworks available free through the internet, for its common use by several developers or the web.
5. There are four criteria used in the evaluation process (documentation, community, line of code, and validation).
6. Using these results in the developing process of frameworks and web applications and helping the user to select the proper framework for his purpose.
7. Applying a comparison process to three kinds of frame works (open sources) where the application of every criterion of the past criteria is done on the three frameworks.

## **2.5 Contribution of the Research**

- 1- The study contributes to solving problems that face web application users, while using frameworks.
- 2- Criteria of compatibility between the framework, application and their user.
- 3- The availability of clear framework evaluation criteria facilitates the process of framework selection.
- 4- Reflection of the role played by software engineering conceptions in the evaluation process.

## **2.6 Research Organization**

Chapter two contains a background of the web applications origination i.e. what is the framework?, Who is the framework uses?, advantages and

disadvantages of frameworks, previous studies and their relationship with the research. Chapters three is concerned with the comparison between the three frameworks as per evaluation criteria. Chapter four includes the results of the comparison as per the criteria followed in the evaluation process.

## **CHAPTER TWO**

### **2.BACKGROUND and LITERATURE REVIEW**

## **2.1 Introduction:**

Today, websites are complex applications that perform transactions, present real-time data, and provide interactive user experiences. Web based software is becoming as powerful and as important desktop software. Developing web applications that provide advanced functionality is now a complex task that involves multiple developers, evolving tool sets and many options. Web frameworks provide a golden mean between building an application from scratch and using an out-of-the-box content management system (CMS). Using an out-of-the box CMS is like buying a finished house. You can choose the paint and furniture, but ultimately you have to trust that the house was made to suit your needs infinitely. Building from scratch is like going to the store and buy everything starting from nails and finishing with plumbing and wooden panels. Using a web framework lets you choose between different types of walls, different types of wiring, plumbing, and windows that can be pieced together in a way that best suits your needs (Spencer et.al. 2007).

- **Open source continues to gain popularity:**

An open source project often develops rapidly because a large numbers of developers from around the world contribute to it. Since the code is visible to the whole community it is often very clean documented code. Open source tools also avoid vendor lock-in. Companies choosing open source not only own the source code but all the data. Further, open source tools typically have a large support community who can rapidly react to problems and provide assistance.

This report focuses on three leading open source web development frameworks: Django, Ruby on Rails and Cake PHP written in three different languages – Python, Ruby and PHP respectively.



All three frameworks have similar architectures and claim to have similar characteristics, such as greatly enhanced productivity and code re-use.

This report is designed for senior managers and experienced developers considering the development of complex web applications and interested in assessing the feasibility of open source web development frameworks.

The report provides a methodology to evaluate each framework. The methodology, criteria, and weights provided in this report are generic and comprehensive. Each organization should adapt the methodology of this report to its own unique context (Mora-Murguía et.al. ,2014 ).

## **2.2 Background:**

The World Wide Web (often known as the web) was created in 1990 (Spencer et.al. 2007) and in the beginning the web was very static. The user could not interact much with the content, and to update a piece of text (or something else as well) in a published material on the web, the author had to edit the page locally and upload it to the server. To get rid of this manual work the Common Gateway Interface (CGI) standard was created for interfacing external applications with web servers (YALDIZ, 2004). CGI created a new process for each request to the server resulting in heavy load on server side when dealing with a great amount of requests, thereby the demand for something more efficient grew. In 1995-1996 the growth of web pages increased dramatically (Björemo and Trninić,2010) and at the same time e-commerce got about. ColdFusion, PHP and ASP (Active Server Pages) was created during the same period. Today ASP is replaced with ASP.NET, but ColdFusion and PHP are still developed and used. The term "web application" was first introduced in 1999 in

the Servlet Specification version 2.2 for the Java language. Today most web sites are interactive in some way which has made them more complex to develop and the term web application has become generic (Lee, 2012).

## **2.3 What is a Web Framework?**

A framework in context of software development is a set of prewritten code or libraries which provide functionality common to a whole class of applications. The framework can be seen as a base or a skeleton to build upon. In relation to libraries a framework gives a broader span of functionalities. Libraries are often more focused on solving a narrow scope. Typically a framework provides a predefined structure for the application. The purpose of using a framework is basically to speed up development by not having to rewrite features and structure that are commonly used in most web applications. Instead of inventing the wheel over and over again the developer has many wheels (functions/features etc) that are already tested and working properly. Most (web) frameworks today are free to use (under license from Creative Commons, Apache, etc.) and are open source and anyone can join to contribute in some way. Either, be part of development, propose improvements, code review/inspection or just gain experience by using the framework and thus being able to help others. Most of the frameworks today have quite many contributors and users (developers) inspecting the source code for security risks and evil pieces of code.

### **2.3.1 Advantages of using a framework**

This list is trying to pinpoint the major benefits of using a framework:

- Reuse of working code that has already been built, tested, and used by other developers increases reliability and reduces developing time. Time is major cost in software development and by decreasing time one can cut costs.
- Get (free) help from others. By letting others (the framework) take care of common issues, like security, internationalization, localization, etc., one will get (free) "outsourcing" from skilled developers. If a developer starts from scratch with a project the developer will have to think of everything. And, if the developer knows how to solve everything; why do it once more? There is just risk of bugs and security leaks.
- A framework can help the developer to use a specific architecture or design pattern, often Model-View-Control (MVC), and general best practices. This will make it easier for incoming developer to understand the code and quicker start working with it.
- Framework can support "high level" of programming, by code modularity. Basic tasks, like login, and database handling, can be in the framework and separated in another layers is business logic.
- By upgrading one's framework it might give extra features without extra implementation. Take an example if an e-commerce is using a framework and the team behind the framework releases a new version it might give new ways of payment methods.
- It helps new inexperienced developers to easier adopt design patterns and understand the thinking behind following a design pattern. A framework can help beginners to have a steeper learning-curve (Spencer et.al. 2007).

### **2.3.2 Disadvantages of Using a Framework**

Not everything with a framework is on the positive side. Here are some of the most common negative aspects:

- To be able to use the framework at its best, it often requires significant education and experience, in other words long learning curve. But on the other hand if one has great experience from one framework the learning curve for the second one is much steeper. (Assuming that the framework is about the same size.)
- Performance might be suffering from common code that is built to handle as much as possible, and is not optimized for a specific task.
- If a bug or a security risk in the framework is found it will be in all applications using the framework. If an intruder finds out about this weakness the intruder might be able to use this for evil purposes on all applications using this framework. If the weakness is discovered in someone else's application then one's application might be at risk even though none has ever tried to hack it before.
- Some frameworks are very stiff and do not give the developer enough flexibility needed for some applications. Good frameworks provide utility and structure while still leaving enough flexibility to not require the developer to do work around. It is not necessarily the framework's fault; the framework might be intended for some other use than one have in mind. Choosing the right framework is crucial if time will be saved or lost.
- Building from scratch often gives a feeling of more productive which can make the developer more peaceful and less feeling of being stuck and thereby more creative and less bored. However, this is just a feeling, not a fact.
- If using a design pattern, like MVC, it might compartmentalize towards a fault, since it may use six or seven files for showing a simple page (Spencer et.al. 2007).

### **2.3.3 Degrees of Activeness Web Frameworks**

Results from this evaluation showed that the frameworks have different degrees of activeness under and after installation. See more under Results chapter.

- "Passive" framework - are frameworks that are just a bunch of files to start working from. Unpack and one is ready to create a project from it. Some frameworks support to be located apart from the project files, so the framework files can be reused by several other projects. This setup might require some extra configuration.
- "Semi-active" framework - are frameworks that can generate code from one's existing code by a command from the developer. Some of these frameworks can also create whole new projects from the developers command, with or without options.
- "Active" framework - are frameworks which got what semi-active frameworks got and also are working in the background by writing/creating/generating code automatically without any command from the developer (Spencer et.al. 2007).

### **2.3.4 Who Should Use a Framework?**

- Different frameworks might aim for different goals, but in general they all aim for supporting developers in their work of creating an application with as little effort and little hinder once as possible.
- A framework can be used for many purposes, not only serve common functionalities; it can also help learning a design pattern. Therefore new developers, who know some programming but do not know so much about design patterns and best practice, can benefit from a framework by gaining understanding and programming skills. A beginner will not feel that the framework is getting in the way as much as an experienced developer. An experienced developer already knows the basics and how everything functions and the various parts are related to each other and might, therefore, see hinders instead of possibilities. Experienced developers are also more likely work on more advanced projects where a framework might not be suitable due to the broad use of the application and greater demand for high performance.

The advantages of using a framework should be greater than the disadvantages, otherwise it would, obviously, not be any point of using a framework (Spencer et.al. 2007).

## **2.4 Literature Review:**

1. Quality in Qualitative Evaluation: A framework for assessing research evidence (Spencer et.al. 2003): This paper presents a framework for appraising the quality of qualitative evaluations. It was developed with particular reference to evaluations concerned with the development and

implementation of social policy, programmers and practice. The framework was devised as part of programmer of research conducted on behalf of the Cabinet Office (Björemo and Trninić,2010).

2. Evaluation of Web Application Development. Sunay YALDIZ in 16.02.2004 Web application development frameworks makes life easier for web development teams.

The existing frameworks Struts, Cocoon and OXF have been analyzed and evaluated in the work. As a result of the analysis, Struts-OXF integration framework was chosen. Struts is an MVC-based framework, the model, view and controller in Struts are components easy to understand.

The documentation and very large user base and efficiency of Struts make it a very suitable framework for most web development projects.

OXF is an XML content-based J2EE application development framework. OXF has very useful concepts like XML pipelines. The company offering OXF also offers an OXF-Struts integration framework. In this integration framework Struts functionalities as well as main OXF functionalities are provided to the application programmer.

The concept of XML pipelines and view creation by applying XSL transformations to XML documents are introduced to Struts. In pure Struts, the views are JSPs. By OXF a new view creation concept is introduced.

Object-relational mappers ease the mapping of business objects to RDBMS. This task is not a simple one, because of the different views on data structures in both worlds. Object-oriented design and languages have concepts like inheritance, polymorphism, classes which do not exist in relational tables. There are many existing patterns to map the OO classes to relational tables.

The analysed O/R mapper frameworks in this student project work are Hibernate, OJB (Object-relational Bridge) and Castor JDO. After analysis, Hibernate is chosen for O/R mapping. Hibernate is a high-performance O/R mapper for Java with very large user base, very nice documentation. Hibernate has many features enabling flexible mapping of classes to relational tables. But it can be said that Hibernate is mostly suitable for mapping existing Java classes to relational tables. Hibernate provides tools to create the relational tables from the mapping files of the Java classes.

GL Fleet Online web application which provides online facilities for GL customers is prototypically implemented with chosen web development framework and O/R mapper. GL Fleet Online application provides ship owners to inspect the various data about their ships.

The ships should have surveys in specified times. The online application mainly provides the functionality to view the fleet status and survey request details. For the domain model persistence, Hibernate has been used (SCADA,2015).

### 3. Evaluation of web application frameworks with regards to rapid development By: (Björemo and Trninić,2010)

This report focuses on evaluating several web application frameworks for use in rapid development. As there is a need for the possibility to deploy new applications in a short period of time there is also a need for a framework, which facilitates those demands. Creating an application from scratch would most likely be also time consuming and not very rapid. Thus the report will look closer at some of the application frameworks (Cake PHP, Grails, Ruby on Rails, Stripes, Spring Roo and Wicket) to see what they have to offer and how they do it. The frameworks are evaluated based on six criteria (documentation and learning, convention over configuration, integrated development environment, internationalization (localization), user



data input validation and testing) and one promising is chosen to be used to implement a web application. The conclusions of this evaluation are that there is no superior framework and one should not learn a new programming language just for using a recommended web framework.

And also, one should choose framework wisely based on the size of one's application and the scope of the application (YALDIZ, 2004).

4. Generic SCADA Risk Management Framework Author: Saltbush group in March 2012 SCADA systems have traditionally been viewed as being isolated and therefore 'safe' and less exposed to remote cyber attacks. Risk assessment and management methodologies, correspondingly, have largely been directed at legacy SCADA systems in which underlying protocols were designed without modern security requirements in mind.

Business drivers for SCADA integration with enterprise management systems, load management and smart grid environments has meant that SCADA systems have become interconnected with corporate business networks, customer premises and directly or indirectly with the Internet. This, together with the rapid advancement of technology, shifting threat landscape and the changing business environment, is increasing the exposure of SCADA systems to network vulnerabilities and Internet security threats.

Recent incidents such as Aurora and Subnet demonstrate that a directed cyber attack can cause physical harm to critical infrastructure. Traditional threat sources have evolved to now include focused foreign nation cyber intrusions and industrial espionage capabilities.

Such changes and attitudes require a new all hazards approach to risk management one that takes into account Industrial Control Systems, IT, Communications, physical security, supply chains and services and the

interconnection of SCADA systems with corporate, partner and service provider networks and the Internet. Organizations are encouraged to foster a culture of security for SCADA system management, operations and procedures (Björemo and Trninić,2010).

5. Design and Analysis of Web Application Frame-works (Schwarz, 2013)  
numerous web application frameworks have been developed in recent years. These frameworks enable programmers to reuse common components and to avoid typical pitfalls in web application development. Although such frameworks help the programmer to avoid many common errors, we find that there are important, common errors that remain unhandled by web application frameworks.

Guided by a survey of common web application errors and of web application frameworks, we identify the need for techniques to help the programmer avoid HTML invalidity and security vulnerabilities, in particular client-state manipulation vulnerabilities. The hypothesis of this dissertation is that we can design frameworks and static analyses that aid the programmer to avoid such errors.

First, we present the JWIG web application framework for writing secure and maintainable web applications. We discuss how this framework solves some of the common errors through an API that is designed to be safe by default.

Second, we present a novel technique for checking HTML validity for output that is generated by web applications. Through string analysis, we approximate the output of web applications as context-free grammars. We model the HTML validation algorithm and the DTD language, and we generalize the validation algorithm to work for context-free grammars.

Third, we present a novel technique for identifying client-state manipulation vulnerabilities. The technique uses a combination of output analysis and information flow analysis to detect flow in the web application that might be exploited by malicious clients. implement and evaluate the techniques to study their usefulness in practice. find that Jwig is useful for implementing large web applications. We furthermore evaluate the static analyses techniques and find that they are able to detect real bugs with few false positives in open-source applications (YALDIZ, 2004).

#### 6. Practical Comparison of Agile Web Frameworks (Clavijo, et.al. 2014).

It has been a practical approach to the problem. Although the definition of the test is strict and precise, the comparison still lacks objectivity: programmer background and the order in development influenced in the results 125 hours spent in each web framework does not allow to measure productivity A longer time project is useless due to the appearance of new versions A feature-rank comparison, as Villamor and Raible, would have been theoretical and made by someone who had not real experience This approach has taken the advantage of an inexperienced programmer to measure the ease of learning of these frameworks, and an overview of the main features has been made (Clavijo, et.al. 2014).

#### 7. MVC FRAMEWORKS IN WEB DEVELOPMENT (Kolu,2012).

With the increased demand for complex, well-scalable and maintainable web applications, the MVC architecture is increasing in popularity and frameworks (whether they utilize the MVC architecture or not) are quickly becoming de facto –standard in web development. This Bachelor’s Thesis introduces the use of MVC architecture in web development and how several

web application frameworks make use of it. This research introduces the concepts of both the MVC architecture and web application frameworks but does not go into the basics of web development. Three examples of web application frameworks that utilize the MVC architecture are introduced. Due to the constraints provided by the size of this research, this paper does not have a thorough comparison between the three frameworks. Instead, it focuses on finding out how each framework provides answer to certain complexity often required in today's modern Web 2.0 applications.

#### 8. Best Practices for Web Development using Grails and Django (Mora-Murguía et.al. ,2014 )

A best practice is a technique or an important aspect that helps to develop Web applications more efficiently. Best practices on Web frameworks reduce the development time and effort, saving money, increasing the quality of code, enabling to create friendly and interactive applications. This paper is focused on identifying and providing according to the experiences and requirements of the users, the best practices for Web development by using Grails and Django Web frameworks. With these best practices, developers can develop more interactive and efficient Web applications, integrating features of Web 2.0 technologies with less effort as well as exploiting the framework benefits. As proof of concept we have developed a set of Web applications by using best practices as HTML5, Comet support, AJAX, ORM, extensibility, among others(Mora-Murguía et.al. ,2014 ).

#### 9. Evaluation of Web Frameworks By Matthew Elliston 2005/2006

Online applications are becoming more complex in what they can achieve. As a result programming in the more traditional languages such as Perl

may not be the best way to develop them. There are many tasks in web development that are repetitive yet if languages such as Perl are used the developer still has to program them into the application.

More software engineers are realising this fact and as a result new web frameworks are being released that aim to strip away the repetitive processes from the developer allowing them to concentrate the business logic. There are many ways in which these frameworks can achieve this which will be discussed in later on.

The aim of this project was to evaluate a selection of web frameworks and see if they do provide a better platform for applications to be developed. This was achieved by creating a testing application evaluating the process of development.[22 ]

#### 10. Evaluation of web application frameworks with regards to rapid development (Björemo and Trninić,2010).

This report focuses on evaluating several web application frameworks for use in rapid development. As there is a need for the possibility to deploy new applications in a short period of time there is also a need for a framework, which facilitates those demands. Creating an application from scratch would most likely be too time consuming and not very rapid. Thus the report will look closer at some of the application frameworks (CakePHP, Grails, Ruby on Rails, Stripes, Spring Roo and Wicket) to see what they have to offer and how they do it. The frameworks are evaluated based on six criteria (documentation and learning, convention over configuration, integrated development environment, internationalization (localization), user data input validation and testing) and one promising is chosen to be used to implement a web application. The conclusions of this evaluation are that there is no superior framework and one should not learn a new programming language just for using a recommended web

framework. And also, one should choose framework wisely based on the size of one's application and the scope of the application (Björemo and Trninić,2010).

#### 11. Performance Evaluation of PHP Frameworks CakePHP and CodeIgniter Ali RazaFayyaz&MadihaMunir (2013)

Information technology is playing an important role in creating innovation in business. Due to increase in demand of information technology, web development has become an important field. PHP is an open source language, which is widely used in web development. PHP is used to develop dynamic web pages and it has the ability to connect with database. PHP has some good features i.e. cross platform compatibility, scalability, efficient execution and is an open source technology. These features make it a good choice for developers to choose PHP for web development. The maintenance of an application becomes difficult and performance being considerably reduced, if PHP is to be used without using its frameworks. To resolve these issues, different frameworks have been introduced by web development communities on the internet. These frameworks are based on Model, View, Controller design pattern. These frameworks provide, different common functionalities and classes in the form of helpers, components, and plug-in to reduce the development time. Due to these features like robustness, scalability, maintainability and performance, these frameworks are mostly used for web development in PHP, with performance being considered the most important factor (Fayyaz, 2013).

#### 12. An Evaluation Model for Application Development Frameworks for Web Applications by (Lee, 2012)

Web frameworks and web-based content management systems (WCMS) are emerging as the growth of the Internet has continued and its role has

increased in the daily life of its users. When choosing a web framework or a WCMS on which to build an application, web application developers usually decide on a framework or a WCMS based on their prior web development expertise, the quality of the available documentation about the framework, or the popularity of the web framework, regardless of its ability to meet the non-functional and functional requirements of the application to be built. The problem is that there are many choices with respect to web frameworks and WCMS for a web developer to select from and the goals must be to select the best framework for the job.

When choosing a framework or WCMS, web application developers must consider the overall effect of the design decisions within the framework, the inherent tradeoffs between quality attributes (such as performance and security), and the tradeoffs required to address user, system, and business requirements. However, the process necessary to find the best framework for an application's requirements is not well described.

There is only limited research on the evaluation of web application frameworks; this makes it hard for developers to choose the right web framework or WCMS (Lee, 2012).

### 13. The play! Framework by (Kolbe,2012)

Web Development has grown tremendously during the last decade. Enabling the possibility to create and deploy web applications in a more convenient way, frameworks like Ruby On Rails, Grails, Django or CakePHP have arisen. The concept of rapid web development has not been available for the java world until Zenexity released its framework play!. This paper will demonstrate the key concepts of play! and compare it to the present state of the art in rapid web development (Kolbe,2012).

14. Evaluating Web Development Frameworks: Rails and Django by Jonathan S. LinowesParkerhill Technology Group LLC February 26, 2007

First, you might want the programming language to be the deciding factor in choosing a web development framework. If you're already experienced in a programming language, and want to stick with it, then your decision is easier. If you are a Pythonista, then by all means, stick with Python. In that case you may still be doing a framework evaluation, as there are several competing ones in Python including Django, TurboGears and Pylons. Similarly, if you are a Rubyist and love it, then stick with Ruby and use Rails, or consider one of the competing frameworks in Ruby. If you are programming language agnostic, or don't mind learning a new one, then take the time to get to know the language syntax, communities and available resources. What are your friends, colleagues or employees using? That could be a factor too. Second, do you like being an early adopter or are you more of a conventional buyer? While all MVC

Evaluating Web Development Frameworks: Rails and Django

Frameworks are relatively new and early, Django might appeal more to early adopters at its current stage. Third, are you more comfortable relying on user contributions, or do you generally prefer to roll your own? Rails has a much larger body of plug-ins and other resources than Django. And finally, do you like the efficiency of having things packaged together for you, or do you prefer the freedom of making your own choices? Rails is more “opinionated” and does more packaging. Django, in its Pythonic way, leaves more choices up to you (Plekhanova, 2009).

15. A Practical Comparison of Agile Web Frameworks Cayetano Guerra Artal  
2014



Web application frameworks are defined as a set of classes that make up a reusable design for an application or, more commonly, one tier of one application. This specialization in tiers (persistence, web flow, ...) has led to their classification due to their proliferation. Agile web frameworks are defined as full stack web frameworks for developing an application. In contrast with web application frameworks, they are not specialized in one layer, but offer the full stack.

Agile web frameworks started with Ruby on Rails, which defined a new approach to web development, based on a single web framework. Ruby on Rails follows the principle so convention over configuration and don't repeat yourself, providing an agile web development framework that simplifies the development process and increases productivity for prototyping web applications.

When a subject, a programmer or a business, is beginning to develop a web project, it is a hard decision which agile web framework to choose. Learning how to use a full stack web framework is a high time consuming task, it can take two months to get started and one year to have some level of expertise. Therefore, experienced programmers can wonder if it is worthy to migrate from a known framework to a new one and inexperienced programmers or start-ups do not know which one to choose, neither they have tools to choose the right one.

This project tries to analyze the existing web agile frameworks, to choose, compare and review a set of them to facilitate stakeholders the selection of the most suitable for each case (Clavijo et.al. , 2014).

## 16. A WEB INTERFACE FOR NATURAL LANGUAGE PROCESSING DRIVEN FAQ WEBSITE by (Sriprada,2012)

This thesis is about creating a simple user friendly Frequently Asked Questions website using natural language processing algorithms. Shashin Patel

has explained these algorithms in a thesis entitled “Natural language techniques for web language driven interface”. The application has the facility to upload a text file. The text file is processed and the text is broken into text chunks using Text tagging and chunking algorithm which is mentioned in the thesis. When the user enters a question, the keywords from the question are collected. The frequency of the keywords is calculated and that keyword frequency helps in determining if the question is in the Question Answer table. If the question exists, the application generates the corresponding answer. If the application is not able to find the question in the table, it uses the text chunk table to find the most similar texts using most likelihood estimation algorithm and answer it.

#### 17. Implementation Generation for WSDM using Web Applications Framework By (Van Wilder, 2009)

In this dissertation, we present the research and implementation of a code generation tool for the Web Site Design Method. Two avenues of website generation are examined.

On the one side, we investigate various web frameworks such as Django, Ruby on Rails and CakePHP to provide us with insights about the requirements for generating towards these web frameworks. We then implement a code generation tool which reads in the WSDM description of a web site and automatically generates the web site using the Django web framework.

On the other side, we investigate various other methodologies such as OOH, OOHD, UWE and WebML along with their respective tools for generating websites.

A case study and various commonalities between other code generation tools validate choices made during the development.

#### 18. Comparison of Web Frameworks Across Languages by (Will, 2013)

This paper discusses the roles of the basic components in a web framework and provides an overview of leading frameworks from four popular languages: Ruby on Rails, Django, CakePHP, and Spring Roo. It provides a high level introduction to web framework architectures by evaluating similarities and differences across four popular frameworks with a focus development efficiency and maintainability.

#### 19. Metrics for Web Programming Frameworks by Daniel Walker and Ali Orooji

Many languages and techniques exist under the umbrella of programming. Web development comprises a small subset of the whole. Without JavaScript, CSS, HTML, Databases like MySQL, and several server side languages such as PHP, the internet would be far less user friendly. Since a vast amount of code is duplicated between projects, web application frameworks were born. Some of these frameworks are basic and others are very feature-rich. This paper provides some metrics for evaluating the MVC (model-view-controller) based frameworks. More specifically, four frameworks are examined: CakePHP, Django, Ruby on Rails, and ASP.NET MVC.

#### 20. An Empirical Analysis of XSS Sanitization in Web Application Frameworks By (Weinberger et.al., 2011)

Filtering or sanitization is the predominant mechanism in today's applications to defend against cross-site scripting (XSS) attacks. XSS sanitization can be difficult to get right as it ties in closely with the parsing behaviour of the browser. This paper explains some of the subtleties of ensuring

correct sanitization, as well as common pitfalls. We studied several emerging web application frameworks including those presently used for the development of commercial web applications. We evaluate how effective these frameworks are in guarding against the common pitfalls of sanitization. We find that while some web frameworks safeguard against the empirically relevant use cases, most of them do not. In addition, some of the security features in present web frameworks provided a false sense of security.

## **2.5 Summary**

Previous researches with framework from several aspects such as: Analysis, design and development have addressed these points in general without a particular framework security, risk and attack risk assessment methodologies, management, and how to avoid the risk. Several web applications frameworks have been evaluated without refereeing to a specific type of frame work similarity between frameworks and the security services.

Services provided between the Microsoft .NET and J2EE frameworks and the difference. This research is about a review and study of specific frameworks, namely, (Django), (Ruby on Rails), and (Cake PHP) which are used in web applications based on software engineering conceptions.

These are the selected ones but the total reviewed studies amount to 30 and sub studies

## **2.6 Overview of Django, Rubyon Rails, and CakePHP**

a. Django is based on Python, which is a very popular programming language often compared with Ruby, and Java. It is a dynamic object-oriented language. Python offers strong support for integration with other languages and

tools and comes with extensive standard libraries (SCADA,2015). Large firms such as NASA, Google, YouTube, Yahoo!, and Apple use Python for their applications. The language is easy to learn and follows the principles of simplicity, readability, expressiveness, and modularity.

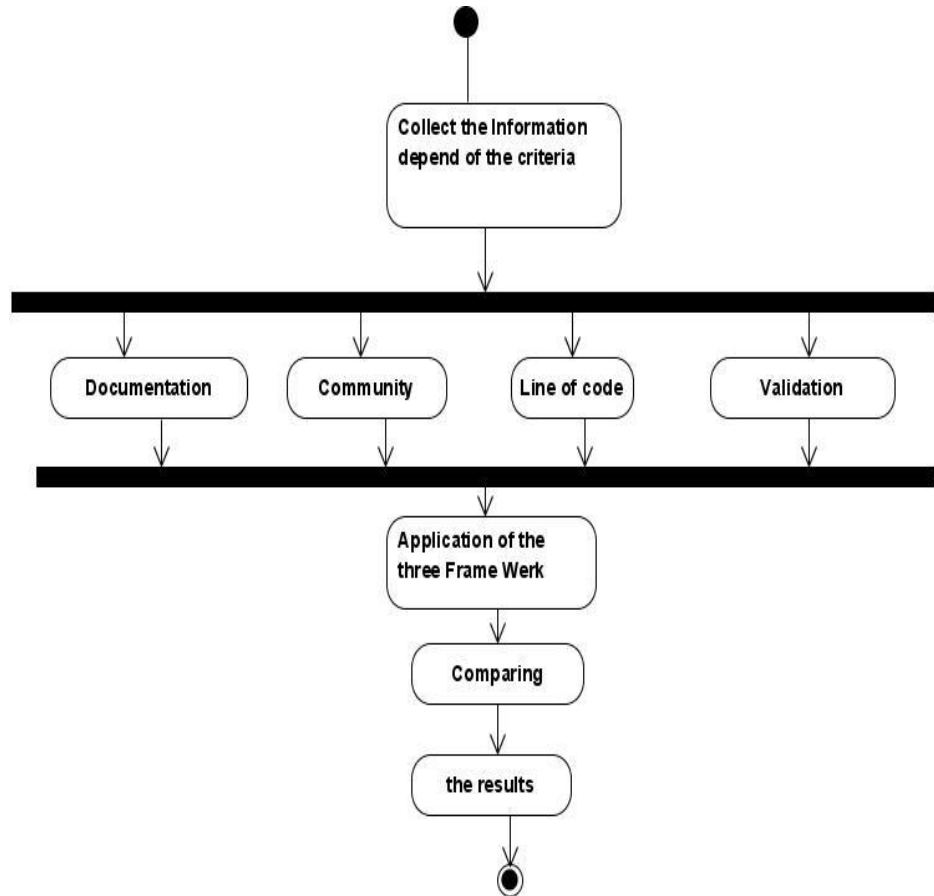
b.Ruby is a “dynamic, open source programming language with a focus on simplicity and productivity. It has an elegant syntax that is natural to read and easy to write” (Elliston, 2006). Ruby is used by NASA Langley Research Center, Motorola, Lucent and other major firms. Ruby got its popularity from the Rails framework.

c.CakePHP “CakePHP is a rapid development framework for PHP that provides an extensible architecture for developing, maintaining, and deploying applications” (Björemo and Trninić,2010). CakePHP was developed in 2005, when Ruby on Rails was gaining popularity. The goal of CakePHP is to enable users to rapidly develop robust and well-structured web applications .CakePHP is based on PHP, a general-purpose scripting language that is especially suited for web Programming, There is an extensive support for this language and hundreds of web application examples. The language is easy to learn and understand, and many programmers write in PHP. The main principles behind PHP are robustness and simplicity.

# **CHAPTER THREE**

## **3.METHODOLOGY**

This chapter illustrates the method used to review and to compare between the three frame works Django, Ruby on Rails, and CaKePHP. A comprehensive literalism which focuses on the documentation, community, line of code and validation software engineering criteria was reviewed.



**Figure 3.1:** demonstrates the research methodology.

The figure above illustrates the research methodology used to compare between the three frameworks. The data was collected according to the following criteria:

- 1-previous research
- 2- Publication paper
- 3- Website
- 4- conference paper

### **3.7 Documentation**

Good documentation is the most important aspect of a good framework. Most of the popular frameworks out there have two types of documentation.

1-formal documentation which includes the API and all its related documents put forward by the framework developers.

2- informal documentation, such as mailing list logs or forum archives, are solutions to problems asked(and answered )by the community members and fellow framework users.

### **3.8 Lines of Code**

On completion of the applications comparisons on how many lines of code it had taken to develop the applications were done.

Because the applications were developed by only one person there should be no difference in coding styles.



This could have been a problem if different developers were working on the applications as different people can code in different styles.

## **3.9 Community**

This measure focuses on the community and support for each framework, and how easy it is to get answers to the questions that a developer might have. In other words, it shows how mature a framework is in terms of support, community, and documentation.

In the open source world where there is no official technical assistance, documentation and community support become crucial sources for developers. A well-supported framework is a big advantage.

The community is the backbone of a popular framework and encourages growth for the framework while maintaining standards.

Documentation helps to build a stronger community, promotes discussion and improvement, and helps create momentum that leads to further popularity of the framework. Unfortunately, open source projects often lack well-structured documentation.

## **3.10 Validation**

For applications that rely on human interaction handling input will play a large role in the application. It will also be something that has to be done repeatedly, which is why support for checking the validity of the input and give

the user feedback in case of error is a valuable feature. This can be especially useful when the application uses its own database for storage of data as it aids in keeping the integrity of the data in the database.

## **CHAPTER FOUR**

### **4.RESULTS AND RECOMMENDATIONS**

After a deep survey and previous studies which reached the 30 scientific studies and sub-studies, we arrived at the following results regarding the three Frameworks along the criteria mentioned below:

## 4.1 Documentation

This measure which focuses on documentation depends on available sources to learn about framework.

The good framework depends on big sources available to framework

**Table 4.1: Dcomntiaion**

<b>Django</b>	<b>Ruby on Rails</b>	<b>CakePHP</b>
<b>544.000</b>	<b>678.000</b>	<b>386.000</b>

The above table shows that the Ruby on Rails is the best framework.

## 4.2 Community

This measure focuses on the community and supports for each framework, and shows how easy it is to get answers to questions that a developer might have. In other words, it shows how mature a framework is in terms of support, community, and documentation.

**Table 4.2:community**

<b>Ruby on Rails</b>	<b>CakePHP</b>	<b>Django</b>
<b>6858</b>	<b>13,134</b>	<b>No</b>
<b>113,000</b>	<b>14.4k=14,400</b>	<b>40.7=40,700</b>
<b>119,858</b>	<b>27,534</b>	<b>40,700</b>

The above table shows that the Ruby on Rails is the best framework.

## 4.3 Lines of Code

The total number of lines of code written gives an indication of how long it will take to create an application. The more lines of code the programmer has to write the longer it will take to develop.

Below is the table of how many lines of code it took to develop the application in the varying frameworks.

**Table 4.3:line of code**

<b>Django</b>	<b>Ruby on Rails</b>	<b>CakePHP</b>
42	41	47

The above table shows that the Ruby on Rails is the best framework.

## **4.4 Validation**

Almost all frameworks utilize MVC architecture and therefore solve validation in like manner.

The input page sends the user data input to a controller, which in turn calls the domain models validate function. If it was correct, the controller then uses the input data, and most likely store it in a database. If the input data was not correct, it would return a list of fields that was incorrect. The controller sends user's input data and whichever fields that were incorrect back to the input page. The input page fills in the user's input data, and fields containing corrupt data are marked, in some way.

**Table 4.4:validation**

<b>Django</b>	<b>Ruby on Rails</b>	<b>CakePHP</b>
<b>Complex</b>	Simple	simple

The above table shows that the Ruby on Rails and CakePHP is the best framework.

## 4.5 Questionnaire Result

Criterion	Django			Ruby on Rails			Cake php		
	pass	good	Excellent	pass	good	excellent	pass	Good	excellent
Documentation	33%	6%	21%	0%	34%	66%	7%	50%	4%
lines of code	20%	3%	7%	0%	37%	63%	12%	43%	3%
Commun ity	53%	0%	7%	0%	30%	70%	10%	30%	0%
Validatio n	3%	6%	0%	7%	9%	4%	6%	7%	7%

The above table reflects the results of the questionnaire (see appendix, A) for developing basic web application frameworks (Django, Ruby on Rails and Cake php) which were distributed to the Msc students in the University of Gezira faculties of computer science and computer engineering.

Thirty forms have been distributed and after the analysis the results have shown that, the Ruby on Rails is the best one as far as the mentioned criteria in the above table are concerned.

## **4.6 Conclusion**

There are no ideal frameworks recommend for use as every framework has its particular problems. To reduce these problems and increase its quality, the three frameworks have been assessed along the time four criteria. The results of this assessment showed that every framework is pre-eminent in some aspects through all in all Ruby and Rail is the best one.

Finally, it seems to me that the four assessment criteria which have been used in this study are not enough for the developing frameworks satisfactorily. Therefore, some more different criteria are called for.

## **4.7 Recommendations**

Evaluation is a continuous process to keep up with changes in frameworks used for web applications.

- 1- Evaluation must handle the sides that were not tackled by the study.
- 2- All developers should follow up the evaluation process to detect the failure aspects.
- 3- Framework users must determine the framework specifications relating to applications.



- 4- To make the updating process successful, there must be full understanding of software engineering concepts.
- 5- Market needs must be known when designing the frameworks.

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