# Agile Methodologies in Web Programming: A Survey

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**Abstract.** This paper reports the results from a survey concerning the use of Agile Methodologies (AM), techniques and tools for Web Programming. The survey lasted from October to December 2013, and involved 112 Web application developers from 32 countries. Its main purpose was to assess the usage of AMs, and of specific practices and tools, in the context of Web programming and of related technologies, such as Content Management Systems. The results confirm a broad adoption of AMs among Web developers, and the prevalence of Scrum among AMs.

**Keywords:** Web programming, Agile Methodologies, CMS.

## 1 Introduction

Agile Methodologies is a name referring to a set of practices and processes for software development that were created by experienced practitioners. The principles inspiring AMs were formalized in 2001 in the "Agile Manifesto" [1]. The main goal of AMs is to increase the ability to react and respond to changing customer, business and technological needs at all organizational levels [2]. Several software companies are moving to Agile software development to improve quality and productivity and to reduce delivery times.

AMs are commonly reputed to be useful for driving the development of non-critical systems under vague or changing requirements. This is exactly the context of most Web applications. We call "Web application" a system that makes use of Web browsers – possibly running on mobile devices – to interact with the user. So, a Web application spans from simple or complex Web sites to mobile apps, to custom client-server systems built using this approach.

The goal of this work is the study the extent to which, and how, AMs, Agile practices and Agile tools are used by Web programmers. To achieve this goal we investigated not only the specific AMs and practices used, but also the tools, frameworks, databases and languages most commonly used for this type of application.

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Some surveys on AM usage have already been published, such as ref. [3], or the very detailed survey conducted annually by VersionOne [4]. However, our intent was to create a specific survey to ascertain whether and how AMs are used for Web programming, a sector of software engineering that has become very large in the past years.

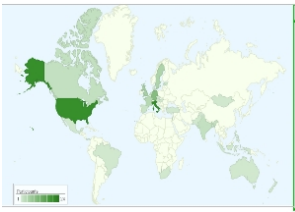
The paper is organized as follows: in Section 2 we present the research method, the gathered data and the results. Section 3 presents a discussion and concludes the paper.

## 2 Research Method and Gathered Data

Our survey includes 12 questions, and it is intended to be answered by personnel involved in Web programming. It gathers information about the type and size of the respondent's company, the possible usage of AMs or Agile practices, and the technologies used during Web application development. It was created with PollDaddy [5] because of its better flexibility compared to similar tools. The data collection lasted for about three months, starting from October 2013 – survey publishing date – to the end of December 2013. The survey was filled on the Web. It was advertised through a call on the main reference sites related to the Agile world and Web programming, through requests directly given at an Italian Agile conference, and through emails sent to fellow researchers, asking them to forward it to the software companies they were in contact with. Clearly, the respondent set cannot be considered an unbiased sample of Web developers.

### 2.1 Main Features of the Sample

The total number of respondents is 112, divided in 78 “Agile” and 34 “non-Agile” persons (6 respondents, 5.4% of the sample, belonging to the Italian Agile Conference). Figure 1 shows with different levels of green the nations where the respondents live and their relative number. As you can see, the survey was answered by people living all over the world (32 countries). The heterogeneity of the sample is in fact a prerequisite for the external validity of the results.



| Country | Nr. | % | Country | Nr. | % | Country | Nr. | % |
|---|---|---|---|---|---|---|---|---|
| United States | 24 | 21.4% | Estonia | 2 | 1.8% | Brazil | 1 | 0.9% |
| Italy | 23 | 20.5% | Panama | 1 | 0.9% | Bangladesh | 1 | 0.9% |
| Germany | 12 | 10.7% | New Zealand | 1 | 0.9% | Australia | 1 | 0.9% |
| United Kingdom | 7 | 6.3% | Mexico | 1 | 0.9% | Austria | 1 | 0.9% |
| Sweden | 6 | 5.4% | Mongolia | 1 | 0.9% | Czech Republic | 1 | 0.9% |
| France | 5 | 4.5% | Philippines | 1 | 0.9% | Denmark | 1 | 0.9% |
| Netherlands | 3 | 2.7% | Pakistan | 1 | 0.9% | Indonesia | 1 | 0.9% |
| India | 3 | 2.7% | South Africa | 1 | 0.9% | Hungary | 1 | 0.9% |
| Canada | 3 | 2.7% | Turkey | 1 | 0.9% | Hong Kong | 1 | 0.9% |
| Israel | 2 | 1.8% | Singapore | 1 | 0.9% | Iran, Islamic Rep. of | 1 | 0.9% |
| Spain | 2 | 1.8% | Moldova, Rep. of | 1 | 0.9% | | | |

**Fig. 1.** Sample distribution

The first questions of the survey identify the user from a business point of view (job role and type of company), together with the perceived use of Agile practices in her/his working activities. Tables 1, 2 and 3 show the main characteristics of our sample, composed for the greatest part of software developers (42%) belonging to

small/medium companies (78%). We compare our results (first column of each figure) to those obtained by the 2013 VersionOne survey [4], where it is possible.

**Table 1.** Role of the respondents

| Q1. What is your job at your company? | % of total | VersionOne [4] |
|---|---|---|
| Developer | 42% | 23% |
| Product/Project manager | 19% | - |
| Consultant | 12% | 33% |
| Other Option | 11% | 14% |
| Develop team leader | 10% | 15% |
| IT staff | 4% | 3% |
| Tester | 4% | - |

**Table 2.** Size of the sample

| Q2. How many people do work in your company? | % of total |
|---|---|
| From 11 to 100 people | 36% |
| From 2 to 10 people | 27% |
| Only one | 15% |
| More than 500 people | 12% |
| From 101 to 500 people | 10% |

**Table 3.** Percentage of Agilists

| Q3. Do you use an Agile approach to software development? | % of total | VersionOne [4] |
|---|---|---|
| Yes | 69% | 88% |
| No | 31% | 12% |

### 2.2 Agile Development Practices, Process and Technologies

Respondents who declared to use AMs (*Agile users*) were asked questions about the specific AM and practices used, reported in Tables 4 and 5, respectively. For completeness, non-Agile respondents were asked a question about the kind of software development process they use, reported in Table 6. Other questions were about what language, CMS, DBMS and other tools were used at a basic use and about having attained or not an Agile certification.

The first question asked to Agile users was "*Which of the following Agile Methodologies do you use the most?*", allowing three answers of decreasing relevance (*most, average, least used*)[1]. The answers confirmed the strong preference in the use of Scrum [6] inside Agile users' projects: we have an overall usage of 65%. In second place there was Extreme Programming [7], with 33% of answers. The respondent had the option to insert other names besides the listed ones, as in most questions of our survey. In this particular case, no further Agile Methodology was reported. The results are shown in Table 4.

[1] In the case a respondent used only one or two technologies, we provided the options "*I use one of them / two only*".

**Table 4.** Diffusion and classification of the Agile Methodologies

| Methodology | Most used | Average used | Least used | VersionOne [4] |
|---|---|---|---|---|
| SCRUM | 23 | 13 | 5 | 55% |
| Extreme Programming | 15 | 6 | 0 | 1% |
| Custom hybrid | 5 | 3 | 2 | 10% |
| Lean | 7 | 4 | 2 | 3% |
| SCRUMBAN | 4 | 5 | 3 | 7% |
| Agile modeling | 6 | 4 | 5 | 1% |
| Lean Kanban | 6 | 5 | 6 | - |
| None | 4 | 18 | 31 | - |

Another question asked to *Agile users* investigated the most used Agile software development practices. To this purpose, each *Agile user* had to specify the usage frequency for each practice, choosing between *sometimes*, *often, always* and *not used*. The answers are shown in Table 5, toghether with the percentage of *always* and *often* answers on the total of Agile respondents, and compared to the VersionOne survey [4]. AM usage within the software development area is quite homogeneous; the three most used practices are: "open work area", "daily standup meetings" and "requirements expressed with user stories/features to be developed independently".

**Table 5.** Agile software development practices

| Q4. Which Agile software development practices do you use? | Always | Often | Some-times | Always or Often perc. | VersionOne [4] |
|---|---|---|---|---|---|
| Daily standup meetings | 31 | 9 | 16 | 51% | 85% |
| Open work area | 31 | 12 | 9 | 55% | 44% |
| Requirements expressed with user stories/ features to be developed independently | 29 | 18 | 16 | 60% | - |
| Digital taskboard | 27 | 14 | 12 | 53% | 45% |
| Feature - driven, time boxed iterations | 27 | 22 | 10 | 63% | - |
| Unit testing | 26 | 17 | 13 | 55% | 72% |
| Continuous integration | 25 | 16 | 13 | 53% | 58% |
| Iteration Planning meetings | 25 | 19 | 11 | 56% | 75% |
| Team based estimation | 24 | 21 | 18 | 58% | 69% |
| Refactoring | 21 | 23 | 14 | 56% | 47% |
| Analog taskboard | 19 | 14 | 20 | 42% | 22% |
| Burndown chart | 19 | 10 | 22 | 37% | 69% |
| Collective code ownership | 19 | 21 | 15 | 51% | 29% |
| Continuous customer involvement | 17 | 24 | 23 | 53% | - |
| Continuous Deployment | 15 | 19 | 17 | 44% | 25% |
| Test driven development (automated) | 15 | 18 | 18 | 42% | 38% |
| Cumulative flow diagram (Kanban) | 11 | 9 | 25 | 26% | 39% |
| Work in progress (WIP) limits/kanban board | 11 | 11 | 24 | 28% | 39% |
| Automated acceptance testing | 8 | 8 | 31 | 21% | 22% |
| Pair programming | 6 | 15 | 31 | 27% | 30% |

**Table 6.** Software development process used

| Q5.Which software development process do you use? | Count | Percentage |
|---|---|---|
| In house process | 14 | 30% |
| Waterfall | 8 | 17% |
| None | 6 | 13% |
| Iterative/Incremental | 6 | 13% |
| RUP | 5 | 11% |
| Spiral | 4 | 9% |
| In house certified process (ISO 9000 or CMMI) | 3 | 6% |
| Other Option | 1 | 2% |

We then focused our attention on the usage of Agile tools. The development of a Web project using AM is usually made with the help of one or more tools to plan and develop in a right way. For that reason we proposed the question: "*Which of the following Agile tools do you use the most?"*. There are a number of tools for Agile business planning and we chose those that we thought were the most representative in the category. Table 7 shows that Jira [8] is the most used tool by respondents; the reasons are explained by its ductility and dissemination. In addition, Jira is suitable for Scrum and Lean-Kanban development, and there are many additions that make it a very Agile product. Another tool that is quite used is Bugzilla, which we included in the survey despite it being a bug-tracking tool commonly used also in non-Agile projects. We received some answers about some Agile tools that are not on the list. More than one respondent indicated the following tools: "Excel", "Google Docs", "RedMine" and "Pivotal Tracker". Note also the high number of respondents who answered "None", an answer in line with the opinion of hard-core agilists that it is way better to use tangible artefacts such as cards and boards rather than electronic tools.

**Table 7.** Diffusion and classification of Agile tools

| Tool | Most used | Average used | Least used | VersionOne [4] |
|---|---|---|---|---|
| Jira | 22 | 7 | 3 | 36% |
| Bugzilla | 9 | 1 | 4 | 21% |
| None | 8 | 23 | 30 | - |
| MS TFS | 5 | 1 | 1 | 26% |
| Extreme planner | 3 | 5 | 1 | 4% |
| HP | 2 | 0 | 0 | 26% |
| Xplanner | 2 | 1 | 2 | - |
| CA | 1 | 1 | 0 | 1% |
| IBM Rational | 0 | 1 | 2 | 6% |
| Scrumworks | 0 | 0 | 2 | - |
| Version One | 0 | 0 | 2 | 41% |

Finally, we tried to understand what is the most used language in Web programming (server side) by asking the question: "Which of the following languages/technologies for Web programming do you use the most?".

The results are clear and show the predominance of Java and JSP technology over all others (Table 8). More than 50% of the respondents are using one of two technologies among those listed. The result is not surprising, because Java and JSP technologies are known to be the most used in the Web programming world. We also noticed a moderate spread of ASP and ASP.net, in addition to using Php.

**Table 8.** Diffusion and classification of the programming languages

| Language | Most used | Average used | Least used |
|---|---|---|---|
| Java | 25 | 9 | 10 |
| JSP | 14 | 13 | 3 |
| ASP.NET | 13 | 4 | 2 |
| PHP | 8 | 11 | 6 |
| None | 5 | 15 | 14 |
| Ruby | 5 | 4 | 5 |
| ASP | 4 | 2 | 2 |
| Phyton | 2 | 1 | 7 |
| Perl | 1 | 2 | 3 |
| CGI | 0 | 0 | 1 |

Another question, whose results we do not report in full for the sake of brevity, was: "*Which language framework (like Spring, Rails, Django, etc) do you use?"*. The results show a supremacy of Spring and a great fragmentation of the other framework. Rails, Jsf and Django achieved good results, though. We asked also the question: "*Have you got, or has anyone in your team got, an Agile certification?"*, whose results are reported in Table 9.

**Table 9.** Agile certification

| Language | Count | Percentage |
|---|---|---|
| None | 78 | 70% |
| Certified Scrum Master (CSM) | 26 | 23% |
| Others | 8 | 7% |
| Kanban Certified Professional (KCP) | 0 | 0 |

### 2.3 Use of CMS and Database

A question about the use of Content Management Systems (CMS): "Which CMS Framework, if any, do you use for Web application development?" was directed to the whole sample of respondents. A CMS greatly eases the management of website content, and modern CMS allow also to integrate custom functionalities. The respondents could choose more than one tool among eight, and could report others not included in the list. The three most used CMS are Drupal, Joomla! and Wordpress. We found also that 40% of respondents do not use any CMS. The results are summarized in Table 10.

Table 11 shows the same results, highlighting the kind of user (Agile, non-Agile). Note that only 24% of non-Agile users do not use a CMS in their work, against a 49% of Agile users (Table 11). The most popular CMS among Agile users is Drupal, while

for non-Agile users we found Joomla! and Wordpress. In addition, four non-Agile users said they use “Concrete5”.

**Table 10.** Use of CMS

| CMS | Number of replies |
|---|---|
| None | 47 |
| Drupal | 25 |
| Joomla! | 22 |
| Word Press | 20 |
| Other Option | 16 |
| OpenCms | 13 |
| FrontPage | 6 |
| WebMatrix | 5 |
| Plone | 4 |

**Table 11.** Use of CMS: comparison between *Agile* and *non-Agile* users

| | *Agile users* | | *non-Agile users* | |
|---|---|---|---|---|
| CMS | Number of replies | Percentage | Number of replies | Percentage |
| None | 39 | 49% | 8 | 24% |
| Drupal | 20 | 25% | 5 | 15% |
| Joomla! | 13 | 16% | 9 | 27% |
| WordPress | 11 | 14% | 9 | 27% |
| Other options | 6 | 8% | 10 | 30% |
| OpenCms | 5 | 6% | 8 | 24% |
| WebMatrix | 4 | 5% | 1 | 3% |
| FrontPage | 3 | 4% | 3 | 9% |
| Plone | 2 | 3% | 2 | 6% |

Finally, we investigated also what are the most used DBMS. Respondents could choose one or more among the 15 designated DBMS. As seen in Table 12, the most used DBMS are MySQL, Oracle and PostgreSQL Server. In this case, there is no significant difference in the responses provided by *Agile* and *non-Agile* users. MySQL is the most used by both categories, and only 3 on 112 respondents answered that they do not use any Database.

**Table 12.** Use of Databases

| Database | Number of replies |
|---|---|
| MySQL | 64 |
| Oracle | 39 |
| PostgreSQL | 35 |
| Microsoft SQL Server | 33 |
| SQLite | 17 |
| MS Access | 16 |
| MongoDB | 13 |
| Other Option | 9 |
| DB2 (IBM proprietary) | 6 |
| Sybase | 3 |
| None | 3 |

## 3 Results and Conclusions

Cross-referencing the answers makes it possible to get some interesting results. Here we just highlight some among the most interesting.

The majority of respondents that declare to use Scrum as the most widely used methodology (60%), prefers to use Jira project management tool. Scrum users also show a large span of preferences regarding the languages used, much broader than for other respondents. Respondents who declared to use Extreme Programming and Lean development tend to adopt technologies in a heterogeneous way, with no particular correlation.

Also the DBMS used by respondents does not seem to be particularly correlated to specific methodologies or tools.

Referring to Jira tool, it is used by 11 "Certified Scrum Masters (CSM)" (on a total of 26). This makes Jira the preferred tool of CSM, with 43% of CSM respondents using it. The use of the other very popular tool, Bugzilla, is not particularly correlated to methodologies or certification. There are other correlations between using a specific methodology in relation to a tool, but their significance level is not enough to be presented here. This is due both to the size of the sample and to the heterogeneity of the answers.

In conclusion, we presented a survey gathering many data about how Web applications are actually developed, from the perspectives of process management, programming language and frameworks, databases, use of Content Management Systems, tools. These data were studied performing correlations between the various answers, to assess if and to which extent specific AM and practices are linked to specific technologies and tools.

We are presently working on extending the number of respondents to the survey, to increase the significance level of our findings, and to complete the correlation analysis of the results.

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