# Agile in Public Administration: Oxymoron or reality? An experience report

C.J. Torrecilla-Salinas[1], J. Sedeño[1,2], M.J.Escalona[1] and M. Mejías[1]

[1]Department of Computer Languages and Systems. University of Seville
{carlos.torrecilla,jorge.sedeno}@iwt2.org
{mjescalona,risoto}@us.es
[2]Agencia Andaluza de Instituciones Culturales
jorge.sedeno@juntadeandalucia.es

**Abstract.** In the last 10 years, Agile methods and practices have emerged as an alternative for software development. Different "flavors" of Agile have appeared ranging from project management to tests organization. These approaches have being gaining popularity and involve now a solid option for organizations developing software, but what about Public Administrations? Is Agile a suitable option for developing software in Public Administrations? Even if Public Administrations have been traditionally regarded as change-resistant, Agile approach can also provide them with the benefits of quick adaptation and frequent value delivery.

This paper presents the results of two different projects, which use an Agile framework based on Scrum, developed by a Spanish Public Administration. Additionally, after considering the obtained results, it takes out some relevant learned lessons on the suitability of applying Agile approaches to Public Administration environments.

**Keywords:** Agile methodologies, Scrum, e-Government, Public Administration

## 1    Introduction

The appearance of methodologies like Scrum [1] or eXtreme Programming [2] during the nineties, with their iterative and incremental approach to software development, represented an enormous change in the way systems were developed. Some years before their appearance, a group of the most recognized practitioners of these methodologies published what was known as "Agile manifesto" [3], pointing to the main values of Agile: working software over documentation, collaboration over contract negotiation, response to change over following plans and people and individuals over tools. Based on these guidelines, the basic principles of Agile include, among others: early delivery of value; quick response to change, even on late phases of development; close collaboration between the development team and the business representatives or periodic revision of the development process.

Agile can be conceived as a label where several methodologies and techniques, sharing its principles, can be included. Some of them are Scrum [1], eXtreme

Programming [2], Crystal [4], Lean Software Development [5] or Feature Driven Development (FDD) [6]. From the set of Agile techniques, the most popular is Scrum [7], an incremental and iterative framework for product development proposed by Ken Schwabber and Jeff Sutherland [8] and inspired by the work of Takeuchi and Nonaka [9]. Using Agile methodologies is being popular in the last years [10] [11], becoming a solid alternative for systems development, especially for those which demand early delivery of value and quick-response to changes. Nevertheless, despite Public Administrations have been traditionally conceived as change-resistant organizations, the challenges they have to face up in the actual interconnected and global economy make them need faster adaptation to the changing citizens' requirements.

Based on the foregoing, this work presents the results of applying an Agile framework, based on Scrum, to two different projects developed by a Spanish Public Administration, with the following objectives:

- Evaluating the possibilities of applying Agile methodologies to a high regulated environment.
- Taking out, comparing the results of both projects, the relevant lessons learned and the future lines of research.

This paper is organized into the following sections: After this introduction, Section 2 describes the environment where the projects were developed and Section 3 overviews the proposed Agile framework. Then, section 4 analyzes and compares the results obtained from both projects and, finally, Section 5 states the main conclusions and lessons learned.

## 2 The environment

Projects presented in this work were developed by the Ministry of Culture and Sports of the regional government of Andalusia, the largest autonomous region in Spain. The autonomous government of Andalusia is called Junta de Andalucía and it is organized into eleven ministries, being the Ministry of Culture and Sports one of them. It develops policies in the cultural area, such as the management of public libraries, museums and archives, and supports the practice of sport in the region. In addition, it promotes and supports regional cultural and sports industries. The ICT (Information and Communication Technologies) department, within the Ministry, is responsible for developing the projects described in the present paper. It encourages all technological projects and policies within the Ministry, including both the development of new software systems and the maintenance of ICT infrastructure.

The ICT department, in liaison with the IWT2 research group, created a Project Management Office (PMO) [12] in order to improve the project management capabilities, optimize the way projects are managed and reduce costs and effort by implementing a scale economy. Some of PMO's tasks entail improving the way projects were managed as well as the research on new project management methodologies. Thus, it was proposed to start with pilot projects using an Agile

framework based on Scrum, to test its suitability and feasibility, so that it can be generally applied in the Ministry. The two selected projects were:

- **eBOJA:** It deals with adapting and integrating the Ministry systems to using the new electronic official journal of the regional government of Andalusia. It included, among others points, the design of the administrative procedure, the deployment of the two Web applications within the Ministry's infrastructure, the development of some software APIs to protect the internal systems of the Ministry, the interconnection of the applications with the general infrastructure and all the aspects related to change and users' expectations management.

- **TOPOS:** This was an infrastructure project which gathered the following objectives: Reorganizing the environments where the Ministry's systems were deployed; standardizing the software products used to support the systems (operative systems, databases or application servers, for example); updating the versions of some homemade software products; cleaning and decommissioning some obsolete systems and getting high-availability configuration of all e-Government services.

eBOJA was a development and integration project carried out by a team of four members, under a strict and short deadline fixed by a law approved by the regional government. It involves several internal and external stakeholders. Despite the development team had long experience working together, it was the first time they worked with some of the technology concerned. TOPOS, in contrast, was an infrastructure project, with a flexible deadline and requirements, and an indirect business impact. The team in charge of carrying it out comprised five members, with less team dynamics than eBOJA's team, and, in this case, they were very familiar with the technology.

Both projects were developed with internal staff, being the first experience with Agile techniques for almost all participants. These projects were developed in 2012; eBOJA lasted almost 4 month and TOPOS almost a year.


## 3      The Agile framework

An Agile framework composed of several techniques was used to develop and manage both projects. The main techniques are listed below:

- **Scrum:** The Scrum lifecycle was the basis of the project management methodology. The development process was divided into time-boxed iterations (lasting from 3 to 4 weeks, depending on the project). A Product Backlog, including all the features of the project, was created for each project in order to guide such process. Each Sprint included a Sprint planning meeting, a Sprint review, a Sprint retrospective, using Agile retrospective techniques [13] and a "Product Backlog grooming" [14] meeting. As in both cases the teams were located in different places, they were not able to organize Daily Scrum meetings. Consequently, tools like IM message, chats and ticketing systems were used to cope with this point.

- **Agile estimating and planning techniques:** User stories [2] [15], story points [16] and value points [17] were used to estimate and plan the features of each project. Each Sprint the project plan was reviewed, creating a dynamic project plan, which was able to include new users' needs that could appear during the development process.
- **Agile EVM:** An Agile approach to Earned Value Management techniques was used [18] to control the costs, effort and planned schedule of the projects, without losing the ability to change. This approach is based on the use of two indexes, the *Cost Performance Index (CPI)* and the *Schedule Performance Index (CSPI)*. The CPI is the result of dividing the Earned Value of the project, calculated as the monetary cost of the finished story points in a certain Sprint, by the Actual Cost, calculated as the monetary cost of the real working hours in a certain Sprint. The CSPI is the result of dividing the Earned Value of the project, calculated as the monetary cost of the finished story points in a certain Sprint, by the Planned Value, calculated as the monetary cost of the planned story points for a certain Sprint. Decisions were made attending to these values with the aim of improving the way the project was conducted.
- **Agile productivity metrics:** A set of productivity metrics, proposed by Downey and Sutherland [19], were used to help the team improve through the Sprints. These metrics allowed knowing, among other things, how much of the team's work is really delivering a value to the customer, how much the team is improving through the Sprints of a project and how good or bad are the estimations.

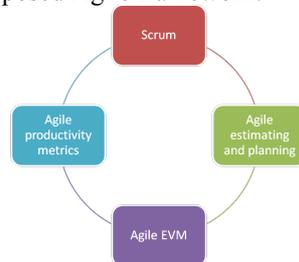Figure 1 summarizes the proposed Agile framework:



**Fig. 1.** Proposed Agile framework.

## 4 Results of the projects

In this section, we will list the results of both projects in order to be able to compare them. Using Agile estimating and planning techniques, an initial plan, including, according to McConnell's uncertainty cone [20], an uncertainty of 25% was developed and approved. Table 1 shows the initial plan of each project against the real results. Regarding the presented data, it has to be mentioned that, as both projects were developed using internal resources, no real expenditures were performed. All economic data offered are only assumed estimations to better manage the projects.

**Table 1.** Results against estimates in both projects

| Magnitude | TOPOS Project | | eBOJA project | |
|---|---|---|---|---|
| | Initial forecast | Final value | Initial forecast | Final value |
| Total story points | 70±18 | 64 | 56±14 | 56 |
| Velocity | 7±2 | 5,8 | 11±3 | 11.20 |
| Number of iterations | 10±3 | 11 | 5±1 | 5 |
| Sprint length (week) | 4 | 4 | 3 | between 3 and 4 |
| Project length | 40±12 weeks | 53 weeks | 15±3 weeks | 16 weeks |
| Hours per Sprint | 137±34 | 67,72 | 150±38 | 111.8 |
| Hours per Project | 1,370±340 | 744,94 | 764±191 | 559 |
| Average cost per Hour | € 25,90 | N/A | € 24,62 | N/A |
| Cost per iteration | € 3,584.30 ± 887.01 | € 1,777.74 | € 3,694.24±€ 923.59 | € 2,752.52 |
| Total project cost | € 35,843.00 ± 8,870.10 | € 19,293.95 | € 18,807.55±€ 4,701.89 | € 13,762.58 |

It can be observed that in both cases, most of the estimations are in-line with the real data (except for the case of the expected hours and cost of TOPOS Project), being eBOJA's estimations more precise. It can be explained by the fact that the team working in eBOJA had some previous experience working together as a team. Also the fact that eBOJA lasted less than TOPOS, can explain the better estimations. In both cases, effort and cost estimations were higher than the real values, probably due to the teams' lack of experience and a self-protection tendency to get enough time to finish the tasks. It has to be mentioned that these initial estimations were reviewed and corrected at the end of each Sprint, according to the result. Moreover, the CPI index measures the difference between estimated and real costs, in our case, at the Sprint level. Figure 2 shows the evolution of CPI for TOPOS project and Figure 3 represents the evolution of CPI for eBOJA project:
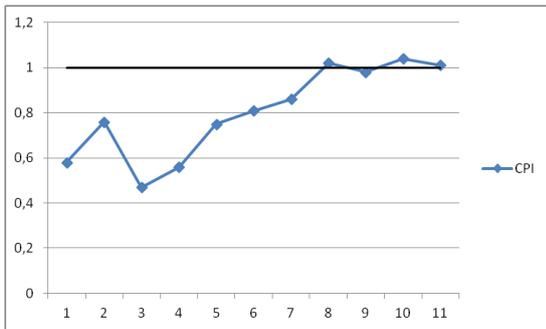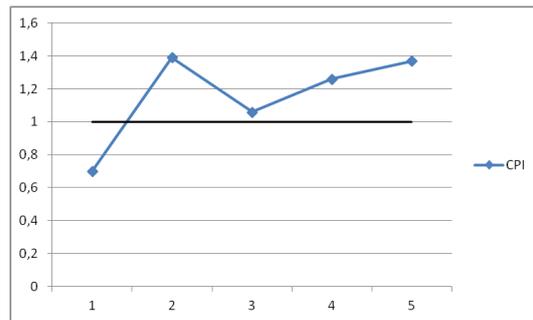


**Fig. 2.** TOPOS' CPI evolution.



**Fig. 3.** eBOJA' CPI evolution.

As it can be observed, both CPI indexes started below 1, meaning that the cost was higher than the earned value. However, they were increasing through the Sprints in both projects. In the case of TOPOS project, it increased and stabilized around 1, probably due to the learning process of the team during the project. In contrast, in eBOJA, the estimations were mainly above 1, probably because of a certain tendency

to self-protection. The fact that TOPOS be a longer project also helped this team to gradually learn, but it did not happen in eBOJA because of its duration. Moreover, the CSPI index measures the relation between the estimated schedule and the real one, in our case, at a Sprint level. Figure 4 shows the evolution of CSPI for TOPOS project and Figure 5 represents the evolution of CSPI for eBOJA project:
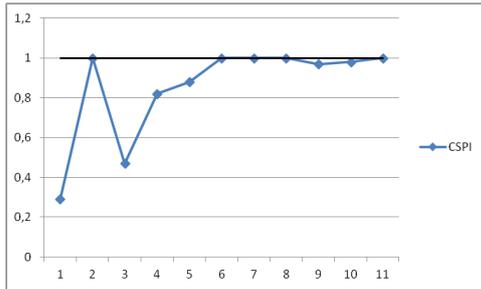


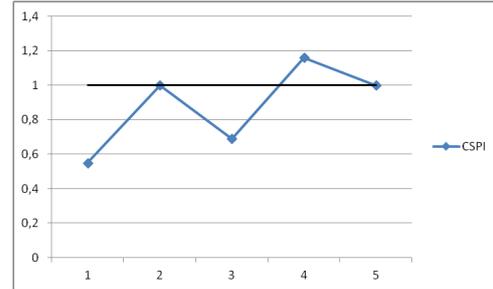**Fig. 4.** TOPOS' CSPI evolution.



**Fig. 5.** eBOJA' CSPI evolution.

In both cases, CSPI started below 1 and evolved to be around 1 in the end of the project. The learning process can be observed in both cases, resulting it quicker in the eBOJA project, probably due to the previous experience already mentioned and some legal constraints to deliver the project. The slow evolution of TOPOS team could be also caused by external factors (as this was an infrastructure project, not a business project and sometimes it was affected by the priorities of other projects) and by its longer duration. Lastly, Table 2 shows the average results of the selected productivity metrics for each of the projects:

**Table** 2. Global comparative productivity metrics between TOPOS and EBOJA

| Metric | TOPOS | EBOJA |
|---|---|---|
| Sprints | 11 | 5 |
| Average Velocity | 5,8 | 11,2 |
| Average Hours per Story Points | 11,73 | 9,96 |
| Average Velocity in Hours | 87,65 | 126,27 |
| Average Work Capacity | 65,51 | 111,5 |
| Average Focus Factor | 133,80% | 113,25% |
| Average % of Accepted Work | 56,59% | 85,95% |
| Average TVI+ | 118,62% | 119,82% |

Table 2 shows that eBOJA team spent more hours per Sprint (its average Velocity in Hours and its average Work Capacity are higher), and also its percentage of accepted work is higher (a higher number of the dedicated hours was used to deliver real value to the user). This means that eBOJA team was more productive than TOPOS team, they had a higher work capacity and they delivered more value. This responds to the fact that they had more experience working together and also to the urgency of their project. Both teams were able to improve through Sprints, as it can be observed in

their average TVI+, which is very similar for both projects. Therefore, both teams were able to better deliver at the end of the project than at the beginning. It seems to have sense, for at the end of the project they better knew both, the methodology and their colleagues. Focusing on estimations, both teams tended to overestimate, as they show a focus factor over 100% in both cases. As it was said, this fact can be caused by a tendency to self-protection.

## 5    Lessons learned and future work

This paper has presented the results of applying an Agile framework for project management in two projects developed by a Public Administration. We have realized that the approach allowed the teams to develop an initial project plan that can drive the project, and also to correct it in terms of the results, using the values CPI and CSPI indexes as guidance. Besides, the approach provides a relevant view on the status of the project, which becomes very useful, both for the team and for its management. It can also be regarded as a learning process, in which the team is improving its estimation skills. Additionally, the framework transforms the estimation and planning effort into continuous and participative processes involving the whole team, instead of being an initial phase of the project. The techniques used seem to be also very useful too, particularly to compare the performance of different teams, which will be very beneficial for organizations dealing with several projects. Lastly, the methodology seems to be transversal and may be applied to different kind of projects (development, integration or infrastructure, for example). Nevertheless, in the case of the analyzed projects, the fact that the team was not co-located is considered an impediment to improve communication and collaboration. Furthermore, both teams tended to overestimate their work, maybe with self-protection intentions and because this was their first Agile experience. Besides, as a conclusion, the approach works better in shorter projects and with more experienced teams.

A main conclusion is that Agile can be a suitable approach for certain projects in Public Administration. In the context of the research group, we worked with the Ministry of Culture and Sport during the last years in Web Engineering projects. However, previous experiences were not developed with Agile solutions. This experience opens a new research line to look for an approach to develop a Web Engineering approach in Agile context. Generalizing and formalizing this approach could be useful to face up short projects with changing requirements and needs of early deliver of value.

## Acknowledgements.

# References.

1. Schwaber, K. "Scrum Development Process". Oct. 1995. *In proceedings of the 10th Annual ACM Conference on Object Oriented Programming Systems, Languages and Applications* (Austin, TX, USA 15-19 Oct. 1995). OOPSLA '95. ACM.
2. Beck, K. "Extreme Programming Explained: Embrace Change". Boston: Addison-Wesley. 1999.
3. Beck, K. et al. Manifesto for Agile Software Development. 2001. From http://www.agilemanifesto.org. Last accessed 01-04-2013.
4. Cockburn, A. "Crystal Clear: A Human-Powered Methodology for Small Teams". Boston: Addison-Wesley. 2004.
5. Poppendieck, M.; Poppendieck, T. "Lean Software Development. An Agile Toolkit". Boston: Addison-Wesley. 2003.
6. Palmer, S. R. "A Practical Guide to Feature-Driven Development". NJ: Prentice-Hall. 2002.
7. Pikkarainen, M. et al. "The Impact of Agile Practices on Communication in Software Development". Empirical Software Engineering, Springer, pp 303-337. May. 2008.
8. Sutherland, J.; Schwaber, K. "The Scrum Guide: The Definitive Guide to Scrum: The Rules of the Game". 2011. From http://www.scrum.org/Scrum-Guides. Last accessed 01-04-2013.
9. Takeuchi, H.; Nonaka I. "The New Product Development Game". Harvard Business Review 64(1): 137-146. Jan.-Feb. 1986.
10. Ambler, S.W. "Lessons in Agility from Internet-based Development." IEEE Software, pp. 66-73. Mar-Apr, 2002
11. Begel, A.; Nagappan, N. "Usage and Perceptions of Agile Software Development in an Industrial Context: An Exploratory Study. *In proceedings of the 1st International Symposium on Empirical Software Engineering and Measurement* (Madrid, Spain, September 21-27 2007) ESEM '07, IEEE.
12. IWT2. 2013. From http://www.iwt2.org. Last accessed 01-04-2013.
13. Derby, E.; Larsen, D. "Agile Retrospectives. Making Good Teams Great". Dallas: The Pragmatic Bookshelf. 2006.
14. Cohn, M. "Succeeding with Agile Using Scrum". Boston: Addison-Wesley.  2009.
15. Cohn, M. "User Stories Applied: For Agile Software Development". Boston: Addison-Wesley. 2004.
16. Cohn, M. "Agile Estimating and Planning". NJ: Addison-Wesley. 2005.
17. Highsmith, J. "Agile Project Management: Creating Innovative Products, Second Edition". NJ: Addison-Wesley. 2009.
18. Sulaiman, T. "AgileEVM: Measuring Cost Efficiency Across the Product Lifecycle". 2007. From http://www.infoq.com/articles/agile-evm. Last accessed 01-04-2013.
19. Downey, S.; Sutherland J. "Scrum Metrics for Hyperproductive Teams: How They Fly like Fighter Aircraft". *In proceedings of the 45th Hawaii International Conference on System Science*. 2012. (Maui, Hawaii, USA, January 4-7 2012) HICSS 2012.
20. McConnell, S. Software Projects Survival Guide. Redmond: Microsoft Press. 2009.