Information System for Doping Control

Francisco Medeiros[1], Juliana Medeiros[1], Fausto Ayres[1], Caio Viana[2], Josemary Rocha[3], Victor Viegas[3], Eder Mendes[3] and Ana Santos[4]
[1]*Federal Institute of Education, Science and Technology of Paraíba (IFPB), João Pessoa-PB, Brazil*
[2]*University Center of João Pessoa (UNIPÊ), João Pessoa-PB, Brazil*
[3]*Institute of Higher Education of Paraíba (IESP), João Pessoa-PB, Brazil*
[4]*Integrated College of Patos (FIP), Patos-PB, Brazil*

Keywords: Information System, Doping Control, Knowledge Management, Athletes' Health.

Abstract: It is apparent that regulators, sponsors, athletes and sports organizations have become more and more concerned about doping control. Despite the investments made in the past few years, recent studies show that Brazil´s sports confederations have not systematized the doping control process nor have they yet dealt satisfactorily with problems to do with transparency with regard to disclosing the results of tests. This study puts forward an Information System to support the Confederations in reviewing and implementing anti-doping measures and procedures. It is also hoped that the proposed integrated database of doping tests can help managers to draw up a public policy for this area.

1 INTRODUCTION

Doping control in Sport is a complex challenge. This is a reason for the bodies responsible for its regulation at the national as well as global context to be concerned. We are constantly made aware of news of cases, in various sports, of doping. This is damaging to the notion of the Olympic spirit, harms athletes' health and undermines the values of sport. Many types of investments have been made by the Federal Government of Brazil in order to make progress in this matter. One example was the creation of the Brazilian Anti-Doping Authority (ABCD, in Portuguese) in 2011.

The doping control process in Brazil is undergoing structural changes that will take place prior to the Olympic Games in 2016. Those that stand out are cooperation with overseas laboratories and the re-accreditation of the Brazilian Laboratory for Doping Control (LBCD, in Portuguese) by the World Anti-Doping Agency (WADA, 2015).

However, despite the investments already made, as described in ABCD's Annual Report (ABCD, 2013), a number of actions still need to be implemented to overcome the challenges in this area. One such current problem is the lack of up-to-date information on doping control, which has an adverse impact on drawing up anti-doping public policies. Access to up-to-date and reliable information is a basic condition for decision making.

The Brazilian Olympic Committee (COB in Portuguese) oversees 52 confederations of various sports, including 30 Olympic National Federations, 19 Bound National Federations and 3 Recognised National Federations. Bound and Recognised federations are those that cover sports that are not included as Olympic sports (COB, 2015). However, the transparency of the confederations as to positive cases is not satisfactory and neither is their verdict on these. The main confederations have deficiencies in doping control and in making data public.

In this context, the general objective of this research was to develop an information system for the purpose of supporting the confederations in the doping control process and thereby to provide up-to-date information that might assist decision making and the formation of public policy in Brazil.

2 BACKGROUND

ADAMS (2015) is a WADA system for managing doping tests that stores the tests that have been conducted by accredited laboratories.

Medeiros, F., Medeiros, J., Ayres, F., Viana, C., Rocha, J., Viegas, V., Mendes, E. and Santos, A.
Information System for Doping Control.
DOI: 10.5220/0005817304320437
In *Proceedings of the 9th International Joint Conference on Biomedical Engineering Systems and Technologies (BIOSTEC 2016) - Volume 5: HEALTHINF*, pages 432-437
ISBN: 978-989-758-170-0

Confederations that have an agreement with WADA can access the ADAMS system (view only).

The objective of the Information System developed in this project, called the System for Doping Control (SCDP, in Portuguese), is to support anti-doping measures, thereby complementing ADAMS, by providing functionalities that ADAMS does not have. SCDP sets out to be active throughout the doping control process. These include functionalities to purchase doping kits, to select the athletes to be tested, to complete the doping form, to detail the results, and to initiate hearings and pass sentences when tests are positive. The scope of ADAMS, for the confederations, is restricted to consulting the results of the tests conducted by accredited laboratories.

Currently, when undertaken, doping control is performed independently by each sports organization (confederation, association, etc.) with the support of spreadsheets and documents but there is no database and no support from any software. In addition, there is no standardization between the sports bodies. Thus, the regulators in Brazil do not have a consolidated view of the process used. Nor is there accurate, detailed and up-to-date information about the tests that would enable a thorough analysis of doping, for example, by region, sport, prohibited substance or age group.

The Athlete Scholarship Program of the Brazil (Bolsa Atleta, 2014) lays down the non-violation of anti-doping rules as an additional requirement that candidates for this award must meet and sets out penalties for holders of this award who violate the anti-doping rules. However, due to there being no automated and centralized control, this Program does not hold up-to-date information on positive tests. Therefore, it is dependent on information that it obtains from the press, based on accusations, or from the Confederations. Figure 1 shows the context in which the SCDP project is placed.

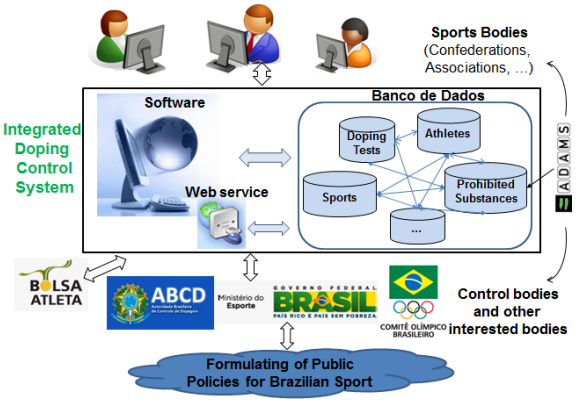

Figure 1: Context of the Doping Control System.

3 METHODOLOGY USED

This section describes the methods and techniques used to conduct this project.

3.1 Mapping the Doping Control of the Sports Bodies

An exploratory study was conducted to answer the following research question: How is doping control currently being carried out by sports bodies? Two university researchers conducted this activity.

Initially the team contacted the Confederations based on contact information provided by COB. E-mails were sent to all confederations. In addition, some confederations were contacted by phone and eight confederations were visited in person. The techniques used for data collection were: i) interviews and ii) analysis of documents. The interviews were conducted at the headquarters of the Confederations with the officials responsible for doping control. The purpose of these interviews was to understand the process that the Confederations used and the difficulties they face. During the interviews, documents were collected such as forms, and test results. In addition, other documents available on the Confederations' websites were analyzed. These included sentences passed at hearings of athletes who were caught by the doping tests. The analysis of the information collected at this stage guided the next step, the purpose of which was to develop the system to support the Confederations as to doping control.

ABCD helped in this process by providing information about the actions that it was conducting with regard to doping control and to formalizing the researchers' role with the sports Confederations. Several confederations were examined in this process. However, since the Brazilian Athletics Confederation (CBAT, in Portuguese) is the exemplar model for Doping Control in Brazil, it was used as the main source of information and to validate the functionalities of the SCDP system.

3.2 Development Process

The Information System is being developed using Scrum (Schwaber, 1995), and follows PMBOK (Project Management Body of Knowledge) practices (PMI, 2013). An interactive and incremental development process, called Business Requirement Agile Process (BRAP) was used (Medeiros, 2015). The process is divided into four sub-processes that are repeated in each monthly cycle of development

(Sprint), as illustrated in Figure 2: Backlog Management, Refinement of the Requirements, Coding (Development) and Conclusion. Each sprint includes a subset of functionalities (requirements) of the backlog of the project.

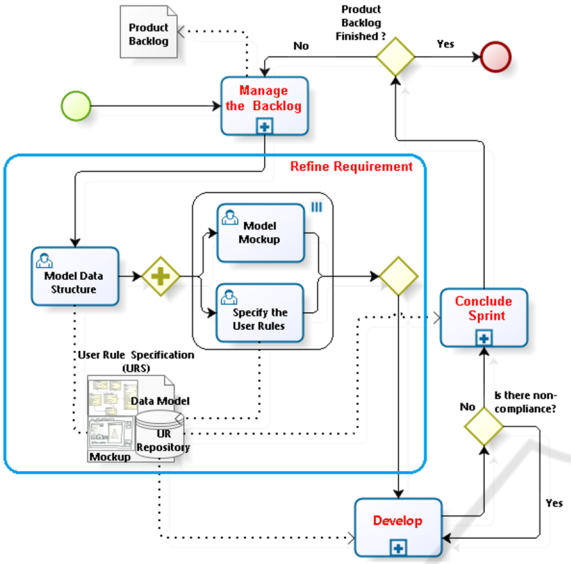

Figure 2: Development process used.

To date, 14 people have been involved in the project: 1 coordinator, 2 researchers, 1 analyst, 4 programmers and 6 trainee students. However, not all staff worked throughout the project. The project coordinator is responsible for executive management, details what activities are to be done and monitors their implementation. Moreover, she is responsible for reporting information on the progress of the project to the project partners, whenever requested.

3.2.1 Managing the Backlog

Based on the face-to-face interviews in the confederations, the initial Product Backlog (PB) of the project was drafted. After validating the PB with CBAT, planning was conducted during which the requirements were distributed in Sprints in accordance with the priorities established by CBAT and ABCD. The project uses the Redmine tool to support management, thus controlling the demands allocated to the team.

3.2.2 Refining the Requirements

At the start of each Sprint, the structure of the database is modeled and includes all the requirements of the Sprint. Then, for each requirement, the mockups (prototypes of the interface with the user) are drawn up and the related rules are specified. These activities are conducted simultaneously by the analyst with the support of the CBAT users and the supervision of the researchers. When the refinement of a requirement is finalized, it is immediately made available for encoding.

The requirements are specified using the template defined in BRAP which links the user's rules, and the mockups and data structure with each other. The document is prepared in MS Word. The mockups are built on the Pencil tool and the data model is designed in the Astah tool.

3.2.3 Coding

This step is performed by the programmers and trainees. One of the programmers plays the role of a software architect and is also responsible for carrying out the weekly deploys. The programming language chosen to develop the software was Java, version 7, on the EE (Enterprise Edition) platform.

The software has a 3-layer architecture, following the Model-View-Controller (MVC) standard (Fowler, 2003) of software architecture that separates the business logic from the interface with the user, as shown in Figure 3.

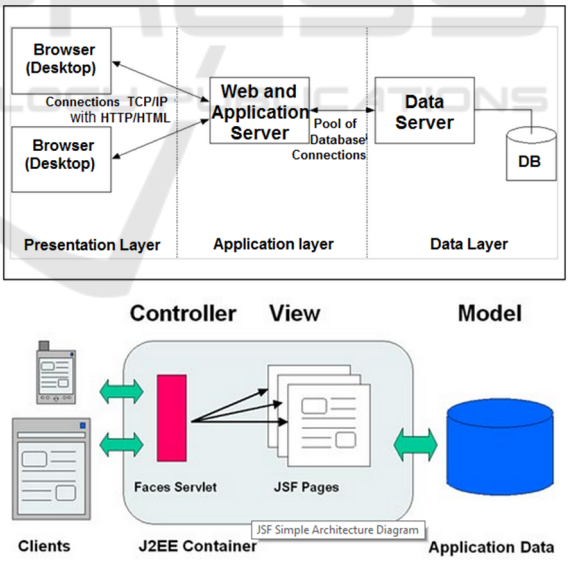

Figure 3: Architecture of the application.

Within the Java EE platform, Java Server Faces (JSF) technology was used. The PrimeFaces library was chosen as an extension of components and resources for JSF. In the Java persistence API (JPA) layer, the Hibernate 3.5 framework was chosen in order to reduce the complexity of communication

with the PostGreSQL 9 database that was used in the project.

Spring Security 3 was used as a security alternative of the Java EE specification, thus offering an authentication and authorization mechanism for the web application. When the project was being developed, the testing team used the JUnit framework, which supports automated tests in Java. The management of project dependencies was carried out with Maven 3. By doing so, it was possible to manage the builds, standardize the development environment, and to simplify the creation and distribution of the project. For the control version of the source code of the application, the development team used the Apache Subversion (aka svn). The project runs on an Apache Tomcat 7 web server.

3.2.4 Conclusion of Each Sprint

Every week, whenever a new version of the application is made available with new functionalities, acceptance tests are conducted. The non-conformities found are reported in Redmine and sent for correction in the specification or software. At the end of each Sprint, the application is made available for validation. Some functionalities have already been validated with CBAT and others with ABCD.

4 EVALUATION OF THE RESULTS

4.1 Current Situation of Doping Control in Brazil

The doping control process currently carried out by the confederations was analyzed as was the level of transparency with regard to the disclosure of doping cases. In addition to the interviews with those responsible for doping control in eight Olympic federations, the sites of the Confederations were also checked to analyze the doping tests that were sent to the Upper Court for Sports Justice (STJD, in Portuguese) of the Confederations. These data were synthesized so as to make it possible to answer the research question of this study.

Of the 30 Olympic federations, 23 have information on the STJD, on their websites. Nonetheless, the absolute figures on the transparency of doping cases held in Brazil are alarming: among the fifty-two confederations analyzed, only eight make data available on their site that can be consulted efficiently. On the large majority of these sites, there is no access to case hearings held nor any mention of any control carried out in relation to doping.

During the survey conducted on the site of the Confederations, no information was found on any of these sites as to the number of tests carried out nor to negative results. The sites only held information on positive tests which had been sent on to the STJD. Even so, only 7 Confederations (all Olympic ones) held such information on their sites, a total of 116 cases, namely: the Brazilian Confederation of Cycling (35), followed by the Athletics Confederation (33), Football (21) and Equestrianism (21). Canoeing appears with 4 cases disclosed and Basketball and Shooting with just one each, as shown in Table 1. None of the other confederations showed any information on doping cases referred to the STJD on their sites at the time of the survey (until February/2015).

Table 1: Doping tests sent on to the Sports Tribunal (up to February/2015).

	2008	2009	2010	2011	2012	2013	2014	SUM
Athletics		6	5	2	5	6	9	33
Basketball					1			1
Canoeing						1	3	4
Cycling	2	9	3	5	10	1	5	35
Equestrianism		4	3		5	7	2	21
Football					2	12	7	21
Shooting						1		1
								116

The WADA anti-doping code sets organizations responsible for doping control deadlines by which to disclose the results that must be made public. However, the results of the analysis carried out on the site of the Confederations demonstrate the need to improve the transparency of this information. The identity of the athlete who violated a rule can only be revealed after the test result has been confirmed and the athlete's defense has been heard. Nevertheless, it was noted that the confederations do not even provide quantitative information on the tests.

It should be pointed out that there are cases of Confederations that did not have records on their websites of cases on which sentences have been passed and reported in the mainstream media. These include the Confederations of Jiu-jitsu, Water Sports, Gymnastics and Motoring. This group includes sports that receive federal incentive programs such as the Athlete scholarship.

Besides few confederations making information available, there are also limitations as to the quality

of information. Data are very often incomplete and disorganized, with decisions and legal remedies not being shown together, for example. In most of the Confederations, there are not enough details about the hearings. Very often there is not even access given to the report of the defense offered by the accused. Moreover, we identified that some Confederations do not disclose the substances found in the tests but only the final decision and the penalty. Some Confederations claim that the high costs involved make it impossible to conduct and control doping tests.

In all the confederations analyzed, the absence of an information system to support the professionals involved was noted. Except for CBAT, there is an alarming need to systematize the doping control process. Another challenge identified is the need to improve the transparency of reporting the legal hearings and outcomes of doping tests.

In order to validate the understanding of the doping control process, a flow chart has been drawn up to describe the activities involved throughout this process (SCDP, 2015). This flow chart is one of the contributions of this article. It is hoped that it will serve to guide the Confederations as to how to systematize their procedures on doping control. CBAT has validated this flow chart.

4.2 Functionalities Made Available by the Information System

Figure 4 illustrates the 7 modules (Administrative, Configuration, Access Control, Doping, Statistics, Sports Justice and General Use) that make up the system and the Webservice which is being developed to make the confirmed doping tests available. To date, the Product Backlog (PB) has 133 functionalities including registrations, queries and reports.

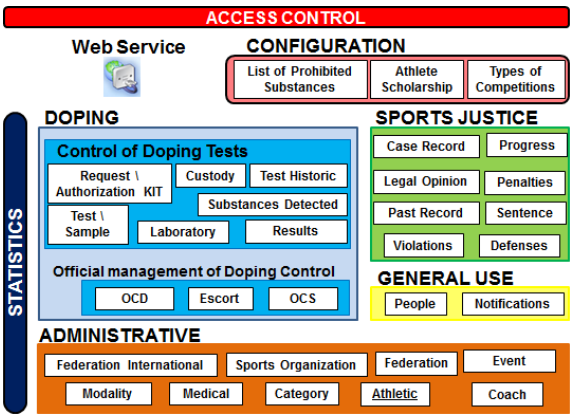

Figure 4: Modules of the System.

The web service being developed will enable integration with other programs, for example, the Athlete Scholarship, thereby ensuring not only that the award is not granted to athletes who are under suspension due to doping but also that it is cancelled immediately after the final confirmation of a positive test.

Some examples of actions that can be taken with the help of the data analysis provided by the Integrated System are:

- Increasing the conduct of anti-doping tests in the sports in which the number of tests conducted is low;
- Investigating the good practices that are being applied with regard to anti-doping control of the sports in which the rates of testing are high;
- Investigating the reasons for the high incidence of positive tests in certain prohibited substances;
- Investigating what the age groups, gender, categories, cities, regions of the country are that need tighter awareness-raising monitoring.

Table 2 shows the current number of functionalities by module and by status.

Table 2: Functionalities by Module and by Status.

Module	Functionalities
ADMINISTRATIVE	30
DOPING	42
SPORTS JUSTICE	20
GENERAL USE	10
CONFIGURATION	15
ACCESS CONTROL	6
STATISTICS	10
TOTAL	133

Status	Functionalities
Concluded	71
Being tested	8
Being implemented	10
Being corrected	14
Allocated to the next Sprints	30

5 CONCLUSIONS

This research involved designing an information system that can support the confederations to implement doping controls with regard to their athletes by feeding a database with integrated information, which hitherto has not been done in Brazil.

With this information, managers of sports organizations will be better prepared to make

strategic decisions and to formulate public policies aimed at improving anti-doping measures in Brazil. It is hoped that the system will contribute to raising athletes' awareness of the harm that doping can cause to their health. A relevant study in this area was conducted by Lipicer (2014), who examined the impact of global anti-doping initiatives on the Republic of Slovenia, sports policies and the role of wider national political and legal frameworks.

This project also served as a case study to validate and optimize a new process created to specify requirements in agile projects. As to future research, we plan to evaluate the possibility of integrating this system with ADAMS. In addition, it is intended to provide a game for mobile devices that can in a fun way to help athletes to know the prohibited substances.

ACKNOWLEDGEMENTS

This research was supported by CNPq (The National Council for Development, Science and Technology) by Notice 91/2013, nº 487777/2013-1, to whom we are grateful for making it possible for us to have the resources needed to carry out this project.

We thank the Brazilian Confederation of Equestrianism for being our partner for the submission of the project; the Brazilian Athletics Confederation for providing information and validating some functionalities of the system; the Confederations of Baseball, Boxing, Canoeing, Snow Sports, Fencing, Rugby and Taekwondo who took part in face-to-face interviews; and finally, the Brazilian Anti-Doping Authority (ABCD) for the institutional support needed to conduct this project.

REFERENCES

ABCD. 2013. Activities Report 2012/2013. Available at: http://www.esporte.gov.br/arquivos/ascom/publicacoes/RelatorioABCDAtividades2012-2013PortuguesIngles.pdf.

Adams. 2015. Anti-Doping Administration & Management System, Release 4.0. Available at: https://www.wada-ama.org/en/what-we-do/adams.

Bolsa Atleta. 2014. Lei nº 13051 que inclui a não violação de regras anti-doping para o Programa Bolsa Atleta do Governo Federal do Brasil. Available at: http://www2.esporte.gov.br/arquivos/snear/bolsaAtleta/leiN13051.pdf.

COB. Brazilian Olympic Committee. 2015. Olympic, Bound and Recognised National Federations. Available at: http://www.cob.org.br/pt/Confederacoes.

Fowler, M. 2003. Padrões de Arquitetura de Aplicações Corporativas. Editora Bookman.

Medeiros, J.D.R.V., Vasconcelos, A.M.L. and Silva, C. 2015. Integration of Agile Practices: An approach to improve the quality of software specifications. *XVIII CIBSE Ibero-American Conference on Software Engineering – Doctoral Symposium*. Lima, Peru. Pp.859.865.

Lipicer, S. K. and McArdle, D. (2014) National law, domestic governance and global policy: a case study of anti-doping policy in Slovenia, *International Journal of Sport Policy and Politics*, 6 (1), pp. 71-87.

PMI. 2013. A Guide to the Project Management Body of Knowledge (PMBOK® Guide). *Project Management Institute*. Fifth Edition. ISBN13: 9781935589679.

Schwaber, K. 1995. SCRUM Development Process. *OOPSLA'95 Workshop on Business Object Design and Implementation*. Austin, Texas, USA: Springer-Verlag.

SCDP. 2015. Flow Chart – Doping Control Process. Available at: Available at: https://drive.google.com/open?id=0B-Nlp0nCynhJdGFBOE9Kal9PZTQ.

WADA. 2015. The World Anti-Doping Code - Prohibited list. https://www.wada-ama.org/en/resources/science-medicine/prohibited-list.